



A Doctoral Thesis submitted to the
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Faculty of Design, Architecture and Building

On the
**Evaluation of Key Drivers in the Development
Performance of City Structures**

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Evaluation of Key Drivers in the Development Performance of City Structures

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Certificate of Original Authorship

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

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Michelle Leong Glastris

28 February 2014



The Sydney Harbour Bridge, Opera House and Sydney CBD Skyline from Blues Point Reserve, New South Wales, Australia

Source: Kyle Willimott

"When a city begins to grow and spread outward, from the edges, the centre which was once its glory is in a sense abandoned to time. Then the buildings grow dark and a kind of decay sets in; poorer people move in as the rents fall, and small fringe businesses take the place of once flowering establishments. The district is still too good to tear down and too outmoded to be desirable. Besides, all the energy has flowed out to the new developments, to the semi rural supermarkets, the outdoor movies, new houses with wide lawns and stucco schools where children are confirmed in their illiteracy. The old port with narrow streets and cobbled surfaces, smoke-grimed, goes into a period of desolation inhabited at night by the vague ruins of men, the lotus eaters who struggle daily toward unconsciousness by way of raw alcohol. Nearly every city I know has such a dying mother of violence and despair where at night the brightness of the street lamps is sucked away and policemen walk in pairs. And then one day perhaps the city returns and rips out the sore and builds a monument to its past."

(Steinbeck 2000: *"Travels with Charley in Search of America"*: 138-139)

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I accept sole responsibility for any errors, oversights and eccentricities that may follow.

For Kyle - We look to you, your cohorts and future generations to continue the remarkable evolution of our cities.

Abstract

Cities as a structural institution, are perceived to have little capacity to control their destiny. The thesis presents a different definition of city structure and contends there are a set of key drivers that can be consistently used to evaluate and guide city structure development performance. Whilst major events and structural changes may not be controlled directly, these key drivers can be used to navigate city structures, mitigate adverse risks and orchestrate change to improve a city structure's future capacity and responsiveness. Key protagonists impact these drivers and can affect changes in a city structure's development performance.

This research examines the key drivers that shape the evolution of city structures and their development performance. City structures have evolved in four key phases and it is the current "knowledge based development" phase that provides the impetus for this research. A "**City Structure** is an evolutionary process determined by its network of functional activities; relationships; capital and knowledge flows" and undergoes various development stages with different rates of growth. The thesis posits key governance, economic, social and environment indicators and the compositional aspects of city structure population can collectively explain the development performance of city structures.

The purpose of the thesis is to develop an integrated, multidisciplinary approach and research methodology; construct and test an evaluative framework, toolkit and analyses to assess city structure development. This approach enables a comparison across 31 city structures in different development stages and geographic regions using 25 critical indicators and 11 derived trajectory indicators. The analyses were typically over a 20-60 year timeframe and capture a number of structural changes, macro and location specific events.

City structure population and GDP were identified as the key drivers of city structure development. The analysis adopted a rate of change approach for four critical indicators and their trajectory determinants (velocity, acceleration and resilience) which informed the evaluation of development trajectories and trends.

The thesis delves into an emerging field where research approaches, methodologies and evaluation processes are still evolving. In spite of the exploratory and multi-disciplined nature of the thesis' research focus and the paucity of city level data, at this early stage it is difficult (nor is it the thesis purpose) to definitively ascertain all aspects of city

structure development performance. However in light of the assumptions, limitations and methodology identified, the predictive variables are robust - the evaluative platform has been validated as a proof of concept and withstood an acceptable level of rigorous analysis.

Collectively the knowledge gained from this research proved the hypothesis valid; offers useful insights on the key drivers that shape city structure development; the historical and projected development performance of city structures; and makes contributions to theory, methodology, policy and practice.

Publication During Candidature

During this candidature, a conference paper was presented at the 2013 State of Australian Cities Conference and later published as part of the conference proceedings (Leong Glastris 2013a).

A condensed/edited version of the same conference paper will be published in the Australia and New Zealand Property Journal in March 2014 and the full version will be available online (Leong Glastris 2014).

Details of the conference paper and journal article are listed below:

➤Leong Glastris, M. 2013a, "**GDP and City Population in the Development Performance of City Structures**", paper presented to the State of Australian Cities Conference 2013, Shangri-La Hotel, Sydney Australia, 26-29 November 2013.

➤Leong Glastris, M. 2014, "**GDP and City Population in the Development Performance of City Structures**", *Australia and New Zealand Property Journal*, Vol. 5, No. 1, pp 21-28.

Glossary of Key Terms and Abbreviations

A glossary of key terms and abbreviations is presented below. For definitions of all the Universal and Critical Indicators, please refer to Appendices 2 and 3 respectively.

Glossary of Key Terms and Abbreviations	
Key Term or Abbreviation	Definition or Full Name
Acceleration	Acceleration measures the rate of change in City Structure POP, GDP, HDI or EMP Velocity over time. A negative sign denotes a slowing down in the POP, GDP, HDI or EMP Velocity. Each change in the slope of the velocity curve relates to an inflection point on the acceleration curve.
Analysis A: City Structure Development Performance Trajectory Analysis	Analysis A comprises Key Indicator Analysis (Chapter 5) – longitudinal and cross sectional indicator analyses; Development Performance Trajectory Analysis (Chapter 6) – development performance trajectory and derived trajectory indicator analyses; and City Structure Development Stages and Points of Confluence (Chapter 7). Collectively the outcomes from Analyses A and B are used to explain City Structure Development Performance.
Analysis B: Compositional Aspects of City Structure Population	Analysis B comprises Compositional Aspects of City Structure Population (Chapter 8) – analyses of compositional indicators; network structure; and development performance trajectory benchmarking. Collectively the outcomes from Analyses A and B are used to explain City Structure Development Performance.
City Structure (CS)	<i>A city structure is an evolutionary process determined by its network of functional activities; relationships; capital and knowledge flows which influence its growth and density as it transitions through a series of development stages.</i> The term city will be used interchangeably with city structure as a short hand/abbreviation throughout the thesis and unless otherwise specified, refers to city structure.
CSDP	City Structure Development Performance.
City Structure Population or City Population	City Structure Population measures total city population (Oxford Economics) and/or the number of a country's people who agglomerate around urban centres/cities with over 750,000 inhabitants (United Nations).
City Structure Critical Indicator Matrix	The City Structure Critical Indicator Matrix comprises a shortlist of 25 critical indicators and their requisite datasets across the key Governance, Economic, Social and Environment sectors for key and cross reference cities.
City Structure Information System (CSIS)	The City Structure Information System is a frame of reference constructed to position segments of knowledge within a wider universe of knowledge regarding city structures.
City Structure Universal Indicator Matrix	The City Structure Universal Indicator Matrix is a frame of reference which acts as a repository of knowledge for a diverse range of indicators. It comprises a list of 76 universal indicators and their requisite datasets across the key Governance, Economic, Social and Environment sectors for key and cross reference cities.

DOCTORAL THESIS:

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

MICHELLE LEONG GLASTRIS

Glossary of Key Terms and Abbreviations continued...	
Key Term or Abbreviation	Definition or Full Name
Compositional Indicators	There are 11 compositional indicators out of the 25 critical indicators used to explain changes from within a city structure's population that impact its potential productivity, capacity and resilience.
Critical Indicator	Constitutes one of the 25 indicators selected for the City Structure Critical Indicator Matrix and are used in Analysis A and/or B to explain city structure development. Refer to Appendix 3 for a full listing of critical indicators.
Cross Reference City Structure or Cross Reference City	These are an additional 25 city structures selected for cross reference purposes to supplement the analysis of the 6 key cities. The cross reference cities provide representation from a diverse range of development stages and geographic regions. Refer to Sub section 3.4.2 City Selection for further details.
Cross Sectional Indicators	Cross sectional indicators are critical indicators with datasets of typically less than 15 years used to provide brief snapshots.
Derived Trajectory Indicators	There are 11 Derived Trajectory Indicators used to examine rates of change with respect to velocity, acceleration and resilience. These have been derived from the four development performance trajectory indicators.
Development Performance	<i>“Development performance is defined as the manner in which a city structure fulfils and evolves/develops around its functional networks.”</i>
Development Performance Trajectory Indicators	The four development performance trajectory indicators (City Structure Population, Gross Domestic Product, Household Disposable Income and Employment) are critical indicators used to subsequently obtain the derived trajectory indicators.
Development Stage	Refers to the six development stages within a city structure's life cycle. These were identified as Early Emerging, Emerging, Maturing, Mature, Obsolescence-Delay and Obsolescence-Re-Growth.
Early Emerging	A development stage that refers to city structures in their initial growth phase of development. In this thesis it refers to key city structure Bangalore and cross reference city structures Jakarta and Johannesburg.
Emerging	A development stage that refers to city structures in their rapid growth phase of development. In this thesis it refers to key city structure Guangzhou and cross reference city structures Sao Paulo, Mumbai, Dubai and Tel Aviv-Jaffa.
EMP	Employment
FAv	Forecasted Average
Frames of Reference	Frames of Reference are used to position, store and/or filter segments of knowledge.
GaWC	Globalization and World Cities
GDP	Gross Domestic Product measures total economic activity within a city/country and is useful for tracking developments over time. In this instance, Oxford Economics use the Production Approach to calculate GDP in constant 2005 US prices.

Glossary of Key Terms and Abbreviations continued...	
Key Term or Abbreviation	Definition or Full Name
GFC	Global Financial Crisis, a macro event that occurred in 2007-2009 and had systemic repercussions globally. Refer to Appendix 6 for further details.
HA _v	Historical Average
HDI	Household Disposable Income
Key City Structures or Key Cities	Key City Structures comprise six cities that represent different development stages and are primarily used in Analyses A and B – Bangalore (Early Emerging), Guangzhou (Emerging), Sydney (Maturing), New York (Mature), Detroit (Obsolescence-Decline) and Shanghai (Obsolescence-Re-Growth). The analyses are supplemented by analyses of cross reference cities. Refer to Sub section 3.4.2 City Selection for further details.
Key Protagonists	Key Protagonists refer to a frame of reference constructed to classify a range of major stakeholders involved in the development of city structures. These comprise Regulators, Generators and Actuators. Refer to Section 4.4 for further details.
Key Sector	Identified as one of the four major sectors (Governance, Economic, Social and Environment) from which the universal and critical indicators can be broadly classified into.
Knowledge Based Development	Identified as the fourth and current phase of city structure evolution. It is based on the proposition of technological transformation, knowledge generation and space of flows.
Longitudinal Indicators	Longitudinal indicators are critical indicators with datasets of typically more than 15 years used to provide long term trend insights.
Mature	A development stage that refers to city structures approaching a growth plateau in development. In this thesis it refers to key city structure New York and cross reference city structures Tokyo, Paris and London.
Maturing	A development stage that refers to city structures which have entered a moderate growth phase of development and can be further divided into Early Maturing and Established Maturing city structures. In this thesis it refers to key city structure Sydney (Established Maturing) and cross reference city structures - Early Maturing (Singapore, Auckland, Melbourne, Brisbane, Adelaide, Perth, Boston and Berlin) and Established Maturing (Los Angeles, Moscow, Toronto and Hong Kong).
Megacity	In this thesis, the quantitative city population threshold of 20M advocated by the United Nations was used as the primary criteria to clearly and quickly identify and classify megacities within the range of key and cross reference city structures.
Network Structure	A network structure is delineated by the physical geography and development of transport routes, industry clusters and activity networks and interactions within a city structure.
Obsolescence - Decline	A development stage that refers to city structures which have entered an obsolescence phase and/or are in development decline. In this thesis it refers to key city structure Detroit and cross reference city structures Athens, Budapest and Manchester.

Glossary of Key Terms and Abbreviations continued...	
Key Term or Abbreviation	Definition or Full Name
Obsolescence – Re-Growth	A development stage that refers to city structures which have entered an obsolescence-decline phase but have been re-invigorated and are in a re-growth phase. In this thesis it refers to key city structure Shanghai and cross reference city structure Beijing.
OE	Oxford Economics – One of the primary data source providers used in the thesis.
Points of Confluence	An analytical approach developed to examine different combinations and subsets of derived trajectory indicators to further determine signature characteristics of the six development stages.
POP	City Structure Population
Profile Overlays	Profile Overlays are a frame of reference constructed to filter segments of knowledge in order to compare city structures by different categories e.g. development stages, geographic region, primary economic industry and GaWC City classification.
Resilience	Resilience measures the responsiveness of City Structure Economic prosperity, Household prosperity or Employment opportunity relative to City Structure Population. It is the capacity of a City Structure Population to absorb elastic deformation or big impacts i.e. Boon/bust forces and external macro events e.g. GFC. A negative sign denotes a slowing down in the rate of GDP, POP, EMP and/or POP velocity and therefore the City Structure's resilience is under strain/declining/weakening.
Scale of Significance	Scale of Significance is a frame of reference constructed at a category specific scale to determine the level of scale that an analysis needs to be undertaken and also at what level an indicator's dataset is available at. For this thesis, all of the indicators and their respective datasets were primarily obtained at either a country or city level.
UN	United Nations – One of the primary data source providers used in the thesis.
Universal Indicator	Constitutes one of the 76 indicators selected for the City Structure Universal Indicator Matrix and is used to shortlist critical indicators for the City Structure Critical Indicator Matrix. Refer to Appendix 2 for a full listing of universal indicators.
Urban Agglomeration	Defined by the United Nations as the number of a country's people who agglomerate around urban centres/cities with over 750,000 inhabitants.
Velocity	Velocity measures the change in City Structure GDP, HDI, EMP or POP growth.

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Chapter 1

Introduction



Sydney CBD Skyline from Chowder Bay

Source: Michelle Leong Glastris

*“The Spirit of Antiquity -- enshrined
In sumptuous buildings, vocal in sweet song,
In picture, speaking with heroic tongue,
And with devout solemnities entwined --
Mounts to the seat of grace within the mind:
Hence Forms that glide with swan-like ease along,
Hence motions, even amid the vulgar throng,
To an harmonious decency confined:
As if the streets were consecrated ground,
The city one vast temple, --dedicate
To mutual respect in thought and deed...”*

(Wordsworth 1820: Sonnet III Bruges)

1 Introduction

1.1 Chapter Outline

This chapter presents an outline of the thesis and how this body of knowledge was attained. The *Introduction* chapter provides a chapter overview and establishes the rationale for undertaking the proposed thesis and hypothesis, purpose and objectives as well as the expected outcomes. The chapter concludes with what the proposed body of research will contribute to the field of knowledge and a profile of the Doctoral Candidate.

1.2 Outline of Thesis Chapters

To provide a frame of reference and to chart how this research was examined, an outline of the thesis chapters is tabled below:

Outline of Thesis Chapters:		
Chapter:	Chapter Title:	Outline:
1	Introduction	Provides a thesis outline, overview, rationale and hypothesis established for the thesis; identifies the purpose, objectives and expected outcomes; highlights the contribution to the field of knowledge; and provides a profile of the Doctoral Candidate.
2	Literature Review: Evolution of City Structures	Establishes the basis on which the Literature Review is undertaken and provides a wide body of knowledge that investigates definitions for “City” and “City Structure”; the evolution of cities; city structure development as a process; and key drivers. The chapter further identifies seminal works, the research gap and the point of departure for the development of further research.
3	Research Methodology and Data Collection	Discusses the methodology; data collection adopted for the thesis and identifies associated assumptions and limitations.
4	Frames of Reference	Assesses a “ <i>Systems Thinking</i> ” approach and builds on the concept by developing a series of frames of reference to position, store and/or filter segments of knowledge for the purposes of undertaking subsequent proof of concept analyses.
5	Proof of Concept: Key Indicator Analysis	Examines the process; key assumptions and limitations; and outcomes involved in undertaking the first stage of Analysis A which evaluates 10 longitudinal and cross sectional Critical Indicators.

Outline of Thesis Chapters continued...		
Chapter:	Chapter Title:	Outline:
6	Proof of Concept: Development Performance Trajectory Analysis	Establishes the process; key assumptions and limitations; and outcomes involved in undertaking the second stage of Analysis A which evaluates four Development Performance Trajectory Critical Indicators and their 11 derivations.
7	Proof of Concept: City Structure Development Stages and Points of Confluence	Examines the process; key assumptions and limitations; and outcomes involved in undertaking the third stage of Analysis A which highlights development performance trends, common characteristics and the impacts of city structure development with respect to the six key development stages.
8	Proof of Concept: Compositional Aspects of City Structure Population	Formulates the process; key assumptions and limitations; and outcomes involved in undertaking Analysis B which examines 11 Compositional Critical Indicators; Network Structure; and Development Performance Trajectory Benchmarking.
9	Conclusions and Recommendations	Highlights key findings, addresses the thesis proposition and identifies further applications, refinements and further investigations.
10	Appendices	Provides supplementary reference information.
11	References	Lists references sourced for the thesis.
12	Contact Details	Provides Candidate's contact details.

Table 1.1: Outline of Thesis Chapters

1.3 Overview

State of Play: In 1900 around 13% of the world's population lived in urban areas According to the United Nations and World Bank, in 1960 around 32.8% of the world's population resided in urban agglomerations compared to rural areas (United Nations - Habitat 2012; **World Bank** 2012c). In 2009, this rate of urbanisation rose to 50.3% with around 3.4 billion worldwide urban residents (**World Bank** 2012c).

The rate at which countries have concentrated their political, economic, social and built environment growth in cities has accelerated. But this growth tends to occur unevenly and in stages usually in sync with global influences or macro changes/events. It has been observed by the United Nations that in mature/maturing countries, the rate of urbanisation is 73.7% for Germany, 82.0% in the

USA, 88.9% in Australia and 90.0% in the UK. In comparison, emerging/developing countries such as India and China have urbanisation rates of around 29.8% and 44.0% respectively. By 2030, the United Nations estimate around 59.5% of the world's total population will live in urban areas (United Nations - Habitat 2012).

Cities undergo various development transition phases and develop at different rates of growth – some cities are in economic and functional decline, some cities develop at a slow, moderate or an extraordinarily fast rate whilst other cities catapult themselves out of an obsolescence phase to re-invent themselves to become revitalised and competitive.

Cities constantly evolve based on its people, surrounding stimuli (i.e. political, economic, social and environment forces) and global/macro influences. Over time, there is a continuum of city development that reflect a changing range of forces and influences e.g. competing land uses, infrastructure capacity and future requirements, transport networks, availability and pricing of residential land and housing configurations, access to amenities and facilities and urban planning policies, etc.

To ensure cities remain functionally viable and dynamic, they must compete with other cities to attract and retain residents, workers, international/national corporations and business in order to provide economic growth, attractive jobs, infrastructure, amenities and a host of commercial, civic and social activities and interactions.

But in order to facilitate this, what are the key factors that drive the development of cities? Can these drivers be identified (qualitatively and/or quantitatively) as lead indicators and if so, how can these lead indicators be used to evaluate why and how cities develop and to implement change?

The Problem:

To date, there has been limited research on looking at why and how cities develop from a holistic and multi-disciplinary perspective (Beall, Guha-Khasnobis & Kanbur 2010; Begg 2002). Planners, economists, urban geographers, institutional investors, corporations, real estate analysts, scientists, philosophers, etc all have their views on how and why cities develop (Blakely & Bradshaw 2002; Blowers & Sarre 1974; Brothie et al. 1995; Castells 2004; Cuthbert 2003; Friedmann 2002; Hall 2004; Kim & Short 2008; Lefebvre 1996; Pacione 2003; Taylor 2004b). However there does not appear to be an integrated multi-disciplinary framework to identify and evaluate key drivers in the development of cities and to implement change at an

international/national policy level (Beall & Fox 2009b; Glaeser 2008; Hurley 2012).

Proposed Thesis:

To date cities as a structural institution, are perceived to have little capacity to control their destiny. The thesis presents a different definition of city structure and contends there are a set of key drivers that can be consistently used to evaluate and guide city structure development performance. Whilst major events and structural changes may not be controlled directly, these key drivers can be used to navigate city structures, mitigate adverse risks and orchestrate change to improve a city structure's future capacity and responsiveness. Key protagonists impact these drivers and can affect changes in a city structure's development performance.

The literature review identifies and investigates the current body of knowledge on the evolution of city structures and what key drivers can be used to determine city structure development. In terms of new research, an integrated evaluative framework and tools will be developed to assess the development performance of city structures. This new research will be used to test what lead indicators signal a transition to each city structure's development stage and to evaluate if these indicators can be used to meaningfully explain why and how city structures develop based on certain patterns or organisation of activities. Furthermore, this new research explores and tests if key drivers can be used to effectively gauge the future development performance of cities to assist in the future planning and shaping of cities.

Proposed Methodology:

Based on the findings from the Literature Review, the candidate's research and advisory experience (Leong Willimott 2003a, 2003b, 2004a, 2004b, 2005, 2006a, 2006b; Leong Willimott & Long 2005a; Leong Willimott & Property Council of Australia (PCA) 1998; Leong Willimott & Van Der Walt 2006; Leong Willimott, Westerlund & Penza 2004) and data currently available, the research was constructed on four key sectors which comprised Governance, Economic, Social and Environment. These key sectors were identified as critical because the Candidate contends that a multi-discipline, holistic "*Systems Thinking*" approach (Anderson & Johnson 1997; Groesser & Schaffernicht 2012; Jackson 2006; Meadows 2012; Meadows & Meadows 2007; Sherwood 2002) can be used to explain how cities evolve from a complex series of inter-relationships. These are key drivers that describe the inter-relationships of a range of indicators at different scales of significance

(e.g. global, regional, country and city levels) in city structure development. This concept was developed further to construct a series of *Frames of Reference*. These Frames of Reference were used to position, store and filter segments of knowledge and are explained further in **Chapter 4 Frames of Reference**.

Selection of these indicators was based on accessing data from a range of institutional sources where accurate, consistent and timely historical data could be obtained over a typical time period of between 20-60 years. There was some overlap/cross-over of indicators in the four sectors which was expected and reinforced the notion there were synergies at play between the various indicators and sectors. These indicators formed the *City Structure Universal Indicator Matrix*.

From the *City Structure Universal Indicator Matrix*, various Frames of Reference and selection criteria were used to short list the number of indicators (this formed the *City Structure Critical Indicator Matrix*), enable a comparison of key and cross reference cities on the basis of a development stage category and undertake proof of concept Analyses A (*City Structure Development Performance Trajectory Analysis*) and B (*Compositional Aspects of City Structure Population*) to evaluate city structure development performance.

The thesis delves into an emerging field where research approaches, methodologies and evaluation processes are still evolving. In spite of the exploratory and multi-disciplined nature of the thesis' research focus and the paucity of city level data, at this early stage it is difficult (nor is it the thesis purpose) to definitively ascertain all aspects of city structure development performance. However in light of the assumptions, limitations and methodology identified, the predictive variables are robust - the evaluative platform has been developed, assessed and validated as a proof of concept and withstood an acceptable level of rigorous analysis.

1.4 Rationale

1.4.1 Background:

Limited research has been undertaken on the development performance of city structures and how this translates into an evaluative framework to assess the evolution of city structures.

There have been numerous well intentioned planning ideologies imposed on city structures. For example, some of these include Ebenezer Howard's Utopian Garden Cities of Letchworth and Welwyn (1902); Walter Gropius' New Objectivity movement that re-modelled Berlin, Karlsruhe and Dessau to include large scale housing projects

(1926-32); Walter Burley Griffin's ideal Garden City of Canberra (1911-1920); Le Corbusier's Contemporary City movement (1922) and Radiant City of Chandigarh (1952-59).

However many of these theories have failed to cater for and sustain a dynamic dichotomy of economic, commercial, political, social, aesthetic and psychological needs. For example from a planning perspective, Edmund Bacon advocated better "*Design of Cities*" (Bacon 1978); Jane Jacobs' "*The Life and Death of Great American Cities*" (Jacobs 1961) promoted urban renewal and community advocacy and Rob Krier examined the typology of city forms and arrangements (Krier 1979, 2006). From a perceptual and psychological outlook, Kevin Lynch examined how people perceive and navigate through cities and use mental maps to develop an image of a city (Lynch 1960, 1984) and Christian Norberg-Schulz explored "*Genius Loci*" or the Phenomenology of Place (Norberg-Schulz 1984). French philosopher Henri Lefebvre argued for the social production of space in cities (Lefebvre 1996). From an economic and urban geography perspective, there is a wide range of views on global cities (Friedmann 2002; Sassen 2001), networked societies/cities (Castells 2004; Taylor 2004b), regional/global trends (Scott 2001; Storper 1997) and a push for cities to develop greater economic activity and competitiveness (Brotchie et al. 1995; Fujita, Krugman & Venables 2001; Glaeser 2008; Leigh & Blakely 2013; Porter 1990). Each of these views advocates valid ways in which cities develop.

As will be evident in the Literature Review, whilst there is an overwhelming body of knowledge about cities in disciplines such as architecture and planning, economics and urban geography, there is not an integrated framework with which to evaluate the development performance of city structures.

This in turn reflects visions and plans for developing cities by a range of stakeholders which often lack social cohesion, economic/commercial viability, long term vision, strong community and political support (Brown 2011, 2013; Davey 2013; Hoges 2012; Hurley 2012; Jay 2012; Leong Willimott 2003b, 2004c; Leong Willimott & Long 2005b; Saunders 2013).

1.5 Hypothesis

There was an iterative process between developing the thesis topic, hypothesis, research framework and design (stage 1) and undertaking the literature review (stage 2) where a feedback loop was used to inform the development and completion of both stages.

This thesis evaluates the key drivers and indicators that shape city structure development performance. The proposed research falls within the fields of urban geography, urban development and strategic planning.

The terms “city structure” and “city structure development performance” have been specifically constructed for the purposes of this thesis.

City Structure: *“A city structure is an evolutionary process determined by its network of functional activities; relationships; capital and knowledge flows which influence its growth and density as it transitions through a series of development stages”.* A further explanation is provided in **Chapter 2 Literature Review** section **2.3.2 Defining a “City Structure”**.

City Structure Development Performance: *“City structure development performance is the manner in which a city structure fulfils and evolves and develops to become more advanced”.* A further explanation is provided in **Chapter 2 Literature Review** section **2.5.2 City Structure Development Performance**.

The fundamental premise for this research is that city structures undergo various transitional phases of development and develop at different rates of growth.

In **Chapter 3 Methodology and Data Collection**, the development of the thesis topic, hypothesis, research framework and design are discussed in detail. However for the initial purposes of introducing the hypothesis, a number of research questions were posed which led to the following working hypothesis:

Working Hypothesis: *Key governance, economic, social and environment drivers and the compositional aspects of city structure population can be used to collectively explain the development performance of city structures.*

1.6 Purpose and Objectives

The **purpose** of the thesis is to identify and assess the key drivers and indicators responsible for the evolution and development performance of city structures.

To achieve this, the objectives are as follows:

- a) Develop the thesis topic, hypothesis, research framework and design to undertake the proposed research;

- b) Investigate and evaluate current urban geography, planning, land economics/urban development and related literature on the evolution of city structures;
- c) Identify and assess the key drivers of city structure development and determine if these key drivers can be used to explain city structure development performance phenomena;
- d) Develop an evaluative framework and tools using these key drivers and indicators to assess and gauge the development performance of a selection of six key and cross reference city structures.

1.7 Expected Outcomes

In light of the proposed thesis hypothesis, rationale, purpose and objectives, the doctoral research will focus on:

- Key forces that shape, stimulate and sustain city structures;
- A structured approach to qualitatively and quantitatively assess the manner in which city structures develop;
- How can this approach be applied to meaningfully gauge the development performance of city structures.

At the conclusion of this thesis, the expected outcomes are:

- 1) Development of a **research methodology** that supports undertaking the proposed research;
- 2) Investigation and **review of current literature** on the evolution of city structures;
- 3) **Definitions** for “*City Structure*” and “*Performance Development*”;
- 4) Identification and assessment of the **key governance, economic, social and environment indicators** that drive city structure development;
- 5) Construction of a **new evaluative framework and tools** to assess city structure development;
- 6) **Application** of the evaluative framework and tools through an analysis of key and cross reference city structures to gauge their development performance;
- 7) Provide an indication of the **future development performance** of city structures.

The overall inputs, processes and outcomes for the proposed research have been highlighted and captured in a “**Roadmap**” for reference purposes. The Roadmap also maps out key functionalities, the interrelationships of variables/determinants and positions key segments of knowledge. Please refer to **Figure 9.1: Roadmap - City Structure Information System: Evaluation of Key Drivers in the Development Performance of City Structures** or as an A3 sized chart in **Appendix 1: Key Reference Charts**.

1.8 Contribution to the Field of Knowledge

It is envisaged this proposed body of knowledge will offer a structured and integrated approach in the monitoring, evaluation and pro-active encouragement of the development performance of city structures. Consequently it is anticipated the thesis will facilitate further critical discourse and investigations into the development of cities at a strategic level.

Applications of and how this may benefit the **Key Protagonists** who are Regulators; Generators; Actuators as well as the wider urban community are detailed in section **4.4 Frames of Reference A: Key Protagonists**.

In terms of contributions, it is anticipated this research will provide a new and valuable body of knowledge on the development of city structures and their future performance. The significance of this research is discussed outlined below.

1.8.1 Significance and Implications of Proposed Research:

By identifying the key drivers responsible for shaping city structures in terms of a structured framework, urban planners, developers, economists and policy strategists will gain further insights into how cities develop and evolve.

Currently, the nature of urban conditions is increasingly underpinned by the roles of uneven global connections and network infrastructure where “*Cities are vulnerable forms of human organisation*” (Schneider & Susser 2003: David Harvey “*The City As a Body Politic*” Ch 2:25). The proposed research gives new impetus to how city structure development is approached in a more structured, multi-disciplined and integrated manner.

Chapter 9 section **9.3 Thesis Proposition – Response Table part 7) Contribution to the Field of Knowledge** sets out the contribution to knowledge this doctoral research makes to the areas of Theory, Methodology, Policy and Practice.

1.9 Profile of Doctoral Candidate

An outline of the doctoral candidate's background is provided in this section with respect to academic background and professional career; reasons for undertaking the doctorate; and experience relevant to this doctorate.

The purpose of this Profile is to provide some insights that may have influenced the candidate's "*perspectives, interests, assumptions, orientations and biases*" (Wellington et al. 2005:19).

1.9.1 Academic Background and Professional Career Summary:

The Candidate, Ms. Leong Glastris, completed her Bachelor of Architecture at the University of Technology Sydney whilst working in three architectural offices. During her part time post graduate studies in Urban Estate Management, she worked as a National Policy and Research Analyst at the Property Council of Australia. She developed an interest in property investment research working as the Senior Research Manager for NSW and ACT at CB Richard Ellis (CBRE). Concurrently she completed a Master of Business in Finance specialising in funds management. Later as an Associate Director, Ms. Leong Glastris established and led the Strategic Research and Advisory national practice within CBRE.

In particular, the state/territory government advisory projects the Candidate undertook for the NSW Department of Planning (Leong Willimott 2003b, 2004c) and the ACT Land Development Corporation (Leong Willimott & Van Der Walt 2006) were instrumental in developing her interest in strategic planning, urban development, investment and the development of cities.

The "*Sydney City to Airport Corridor Study*" (Leong Willimott 2004c) was a major research and advisory project undertaken for the **NSW Department of Planning and Infrastructure**. The Sydney CBD, Airport and Port Botany functional activities provided key economic drivers for the Corridor and create demand for a wide range of services and industries. Key issues included infrastructure capacity and future requirements; competing land uses; obsolete building stock and the future supply of proposed commercial land. The current and future land use constraints and trends were assessed and recommendations made for long term planning strategies for this Corridor. This was accomplished by examining current land use activity, assessing projected land use trends for employment land (office, retail and industrial), determining future spatial imbalances, identifying future public infrastructure requirements, recommending the staging of the

future supply of employment land and making strategic urban policy recommendations.

It was this manner of advisory work which prompted the Candidate to undertake doctoral studies in the area of strategic planning and urban development affecting the development of cities.

The importance of the doctoral research was further reinforced when working as an Associate Director in the Global Real Estate Securities and Fund of Funds team for the global asset management, wealth management and investment bank, UBS. In order to invest in Real Estate Investment Trusts (REITs) and funds internationally, it was important to evaluate market dynamics, emerging trends and investment opportunities. This required an analysis of key drivers at a macro level (e.g. government and political stability, business transparency and market maturity, market dynamics, economic growth potential, etc) and at a micro/individual investment level (e.g. investment versus market returns, cash flow analysis, quality of assets and asset enhancement opportunities, etc).

As the Senior Economic Strategy Advisor at the City of Sydney Council, Ms. Leong Glastris directed a team of strategists responsible for the economic development of a wide range of sectors and programs across the City and its immediate surrounds. The broad strategic frameworks and actions plans were developed in consultation with Council's business units as well as other internal and external stakeholders for economic development across large sectors (Tourism; Entrepreneurs and Small Business; Retail; Tertiary Education and Creative Industries), cross cutting themes (Asia; Aboriginal and Torres Strait Islander Communities; Green Economy;) places (Local Economies in Precincts and Main Streets, Green Square) and major programs (conferences, events and musicals). The Council's Business Units facilitate the local communities to implement these plans and provide feedback to these economic strategies and programs.

What the Candidate finds challenging and enjoyable is applying her cross disciplinary knowledge to solve a diverse range of problems with a commercial focus.

Her involvement in a number of national industry committees and on the Editorial Committee of the "*Australia and New Zealand Property Journal*" together with her work expertise, has further convinced her of the necessity for a strategic planning model and predictive tools for the development of cities. This has been the focus of her doctoral studies.

1.9.2 Reasons for Undertaking the Doctorate:

There are several reasons for choosing to undertake the doctoral thesis:

- Personal interest in how and why cities develop and what makes some cities stand apart.
- To further develop knowledge and expertise in urban development, urban geography and strategic planning and as an extension of the Candidate's advisory work.
- The intellectual challenge and stimulation of learning as well as developing critical reasoning and inference skills.
- The doctorate presents an academic and commercial focus to provide original and valuable research which can contribute to the current body of knowledge.

1.9.3 Experience Relevant to this Doctorate:

In drawing from the Candidate's academic background and professional career, the following knowledge and experience are relevant to her doctoral research:

- Over 20 years of investment, research and advisory knowledge and experience in evaluating emerging global and regional trends; market dynamics; property investment opportunities, returns and their associated risks; deal transactions; formulation and implementation of national and global investment and business development strategies;
- Developing research methodologies;
- Formulating, undertaking & supervising surveys and primary fieldwork (building stock inventory and vacancy surveys, site feasibilities, etc);
- Managing research/advisory staff, project teams and supervising research/advisory projects and providing industry workshops and presentations;
- Establishing and supervising maintenance of commercially sensitive databases;
- Building and refining econometric, valuation, property, financial and forecast models used to evaluate development feasibilities, investment returns, transactions, sustainable cash flows, fund portfolio performance analytics, benchmarking/portfolio optimisation and project property/market investment returns;
- Writing research publications, consulting reports and media articles;

- Australian investment and advisory experience in Listed and Unlisted Real Estate Securities and Funds and in Direct Property - Office, Retail, Residential, Industrial, Transport and Other Built Infrastructure, Hotels, Hospitality, Community Living and Child Care Centres;
- International investment and advisory experience in Asia Pacific (China, Hong Kong, Japan, India, Indonesia and New Zealand), America and EMEA (UK, France, Germany, Spain and Dubai) and with global investment teams on cross border deals and global investment funds.

1.10 Chapter Conclusion

Chapter 1 Introduction established the foundations for the thesis by presenting an outline of thesis chapters and provided the basis for undertaking the proposed research with respect to the rationale, hypothesis, purpose and objectives. This chapter also identified expected outcomes and what the proposed research will contribute to the field of knowledge. The chapter concluded with a profile of the Doctoral Candidate.

Chapter 2

Literature Review: Evolution of City Structures



Crossing Eighth Avenue, New York

Source: Michelle Leong Glastris

“Vital cities have marvellous innate abilities for understanding, communicating, contriving and inventing what is required to combat their difficulties... Dull, inert cities, it is true, do contain the seeds of their own destruction and little else. But lively, diverse, intense cities contain their seeds of their own regeneration, with energy enough to carry over for problems and needs outside themselves.”

(Jacobs 1961: 447-448)

2 Literature Review: Evolution of City Structures

2.1 Chapter Outline

Chapter 1 identified the approach, overall structure and rationale for the proposed research. This chapter commences with the contextual framework on which the Literature Review is based; examines a definition of what constitutes a “City Structure” and discusses the formation and evolution of cities with respect to how various activities within cities are housed and sustained. Recent research on city drivers, indicators and indices are also examined. The final section draws together the key themes identified from the literature review, the research gap, points of departure and the development of research for this thesis.

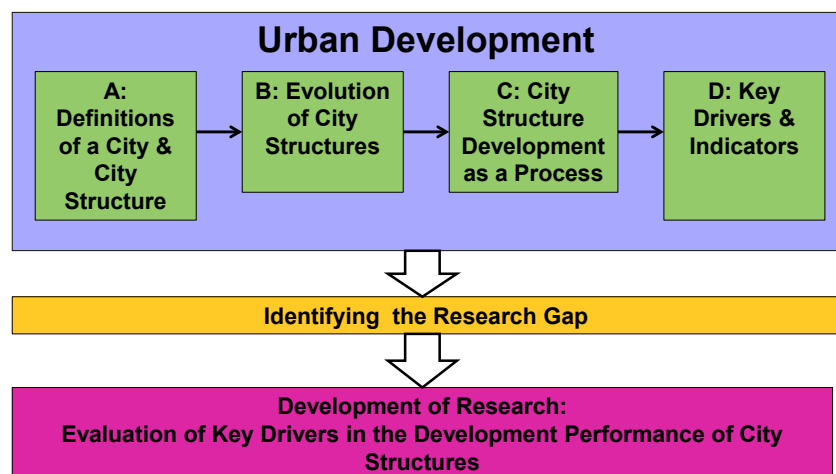
2.2 Literature Review Framework

In undertaking the Literature Review within the multi-disciplined field of Urban Development, there were four key components. These key components involved investigating:

- Definitions of a City and a City Structure;
- Evolution of City Structures;
- City Structure Development as a Process;
- Key Drivers and Indicators of City Structures.

This process is documented in the following flowchart (**Figure 2.1: Literature Review Framework**).

Literature Review Framework:



Research Developed by: Leong Glastris

Figure 2.1: Literature Review Framework

From the Literature Review, areas were identified where there were research gaps or limitations in the seminal works.

The final stage identified new areas of research with respect to the proposed thesis.

2.3 A: Definitions of a City and City Structure

2.3.1 Defining a “City”

In arriving at what constitutes a city, the literature review revealed an extensive range of definitions and theories. Historically the popular term of “city” tends to be regarded as a subjective representation of the physical form, its functionality and its associated perceptions (Bacon 1978; Krier 1979; Lynch 1960; Mumford 1968).

The Oxford Dictionary generically defines a city as “*a large and important town*” (Oxford University - Hornby 2003: 211). However for the purposes of the thesis, Pacione’s definition of a city is more instructive:

“City: *A large urban settlement with a dense population that is usually a centre of government and administration, culture, social networking and economic enterprise*” (Pacione 2003: 635).

From a social perspective, the city can be regarded as a vehicle for providing a series of social interactions whereby the physical organisation of the city facilitates these social needs - “*It is in the city, the city as theatre, that man’s more purposive activities are focused, and work out, through conflicting and cooperating personalities, events, groups, into more significant culminations*” (LeGates & Stout 2003: 94 - Lewis Mumford’s article “*What is a City?*” first published in Architectural Record (1937)).

From a metaphysical perspective and to borrow from and apply Derrida’s theories on Deconstruction, difference and identity, the city acts as both a **symbol** that signifies meaning and also as a **signifier** that generates meaning through its built and natural forms, activities, people, etc (Bowell & Kemp 2006; Lechte 1994; Norris & Benjamin 1988; O’Brien 2006). The city can be also be regarded as an oeuvre or canvas that reflects a series of events, interactions and activities of a wide group of players: “*The city writes and assigns, that is signifies, orders, stipulates...There is no oeuvre without a regulated succession of acts and actions, of decisions and conducts, messages and codes. Nor can an oeuvre exist without things, without something to shape,*

without practico-material reality, without a site,... an environment"
(Lefebvre 1996: 102-103).

From an orientation/way-finding perspective, Lynch advocates the city as an object to be perceived but also a construct built by a wide range of people with their own agendas; he places importance on the city's image and its ability to be legible to allow a person to orientate himself/herself around the city (Banerjee & Southworth 1991; Lynch 1960, 1984).

A city also reflects less tangible considerations such as cognitive and psychological imperatives. For example, the ease with which city inhabitants and visitors orientate themselves within and around a city (Lynch 1960, 1984), movement systems (Bacon 1978), engendering a sense of place and belonging (Norberg-Schulz 1984) and the attraction/aversion a person feels with respect to a place (Friedmann 2002). Lynch links settlement form to the physical configuration of cities:

"Settlement form is the spatial arrangement of persons doing things, the resulting spatial flows of persons, goods, and information, and the physical features which modify space in some way significant to those actions, including enclosures, surfaces, channels, ambiances, and objects."

(Lynch 1984: 48)

However recent literature has increasingly focused on the city as a node or a critical meeting place where a wide range of social, political, economic and other activities take place that enables a city to be connected within a wider regional/global network (Castells 2004; Friedmann 2002; Fujita, Krugman & Venables 2001; Sassen 2001; Scott 2001; Taylor 2004b). The city is also a complex entity that reflects a dynamic dichotomy of interactions:

"Cities are shaped in many ways. Economics, politics, society and culture all play crucial parts in this process...Cities are also shaped by the ways of seeing and understanding we bring to them...every day the city is made and remade through the active workings of its inhabitants..."

(Robbins & El-Khoury 2004: 1-2)

2.3.1.1 *Urban Morphology*

At this point, it is instructive to discuss the concept of urban morphology as a further extension of defining a city. Urban morphology can be defined as “*the study of the form and shape of settlements*” and concerns itself with the “*layout and configuration of urban form and space*” (Carmona et al. 2003: 61). Urban morphology looks at how the different functions distributed in a city are translated into an arrangement of urban design elements e.g. a town square relative to residential quarters and street networks. This is achieved through the arrangement of land uses, building forms, plot and street patterns within a city (Carmona et al. 2003; Krier 1979, 2006; Marshall 2005; Vance 1990).

Advances in urban morphology have been facilitated by the use of computer applications such as GIS to help study the (potential) impact of new urban forms; the use of linguistics and semiology to view urban landscapes; urban morphogenetics where “*urban form [is] based on the interrelationship of land value, economic fluctuations and innovative adoption...*”; economic and social forces that direct “*Agents of Change*” such as property owners, architects and developers to change the urban landscape and urban landscape design and management where there is an increasing concern over large scale developers and public agencies creating “*large areas and large complexes...that make people feel irrelevant*” and they feel less likely to identify with their cities, neighborhoods and communities (Whitehand 1992: 624-627).

Alexander Cuthbert (Cuthbert 2006) posits city development as a form of urban morphology can be viewed in chronological/time series (Cuthbert cites Mumford, Gutkind, Benevolo and Roseneau, 2006) or it can be viewed as a typology / form series (Cuthbert cites Moholy-Nagy, Kostoff Rob Krier and Hall, 2006) but there are also implications for a spatial political economy (Cuthbert cites Saunders, Castells, Soja and Foucault, 2006). However the study of urban morphology is largely based on aesthetics “*where certain morphological arrangements are seen to possess greater or lesser aesthetic appeal*” (Cuthbert 2006: 175). Cuthbert (Cuthbert 2006) advocates the aesthetics of urban form is dominated by four main factors: abstract ideas of beauty, urban morphology, what is referred to as picturesque and use of symbolism to generate meaning in urban forms.

2.3.2 Defining a “City Structure”

A city structure is traditionally viewed as a spatial entity: *“City structure is taken to mean the size and shape of the city and the spatial concentration or dispersal of homes and workplaces”* (Black & Katakos 1987: 93).

A city structure is a physical manifestation of the manner in which cities are organised. It initially stemmed from the work undertaken by Ernest Burgess’ 1925 Concentric Zone Model of Urban Land Use; Homer Hoyt’s Sector Model of Urban Land Use, White’s Model of the Twenty-First Century, Walter Christaller’s Central Place Theory, Rossi-Hansberg and Wright’s City Size Distribution Approximating Zipf’s Law et al (Pacione 2003; Rossi-Hansberg & Wright 2007). These theories established there were various functional/operational efficiencies gained based on the internal structure and/or the way cities were physically configured or that cities of different sizes relate to each other in a distinct hierarchy or system.

2.3.3 Thesis Definition of “City Structure”

Defining a city structure for the purposes of this thesis was more challenging because whilst the Black and Katakos definition (Black & Katakos 1987) emphasises the physical configuration of a city structure, it does not address more recent advances in the evolution of city structures with regards to knowledge based development and network structures (as will be discussed further in the next section on the Evolution of City Structures). In this phase there is an increased focus on information, capital and knowledge flows based on networks of activities and relationships.

Physical configuration is not intended to be examined in this thesis as the focus is on the current phase of city structure evolution – knowledge based development.

To further develop this definition of city structure, a more definitive term was required that recognised more recent evolutionary developments. Therefore for the purposes of this thesis, the Candidate formulated the following definition of a City Structure:

“City Structure: A city structure is an evolutionary process determined by its network of functional activities; relationships; capital and knowledge flows which influence its growth and density as it transitions through a series of development stages.”

This definition of City Structures examines networks of functional activities, relationships; capital and knowledge flows. It moves away from the popular term of a city as a subjective representation of the

physical form, its functionality and its associated perceptions and also moves away from the traditional “*physical form based*” definition of city structure. The proposed definition also acknowledges that a city structure has both spatial and temporal dimensions.

Based on the discussion of cities and urban morphology there is also an emphasis on physical configuration. Urban morphology focuses on the arrangement of urban forms and settlements with respect to the arrangement of urban design elements and aesthetics. However the development of city structures examines not only the physical organisation of these built forms and its spaces, but also concerns itself with the commercial impetus (such as governance, economic, social and environment drivers) that evolves city structures i.e. the networks of activities and flows of information, capital, etc. By examining these networks, greater understanding and insights can be gained from what informs the development of city structures and why they are shaped in a certain way and what drives them to stagnate/renew and evolve.

This definition is based on the literature review of the evolution of city structures and the network relationships of cities which promotes the analysis of city structures. It is acknowledged there is a wide range of definitions of cities and individually they address aspects of city structures. This definition assists in this research and proposed method of analysis. With this City Structure definition in mind, the term city will be used interchangeably with city structure as a short hand/abbreviation in subsequent chapters and unless otherwise specified, refers to city structure.

It is with this understanding of a city structure, that the thesis explores the first cornerstone of interest - the key drivers and their synergies that drive the development of city structures. It is also the “how and why” a city structure develops in a particular way to provide these network of functional activities; relationships; capital and knowledge flows that will form the second cornerstone of interest.

2.4 B: Evolution of City Structures

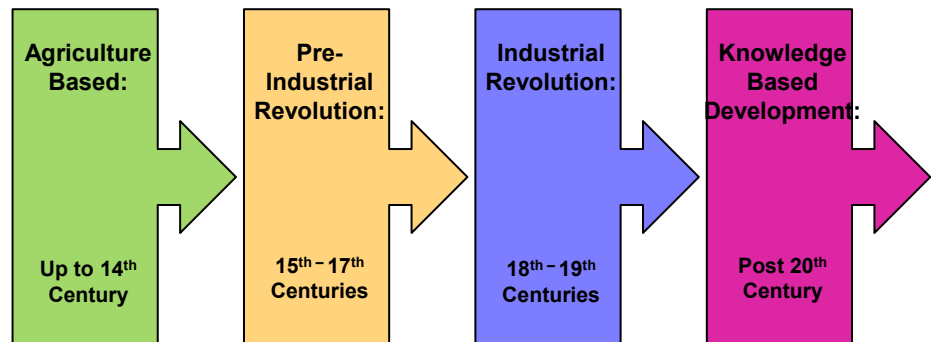
The following sections examine these two questions:

- 1) What is the process in which cities are built?
- 2) Who influences the formation and evolution of city structures?

2.4.1 The Evolution of City Structures

The formation and evolution of city structures can be broadly classified into three distinct phases – Agriculture Based, Pre-Industrial Revolution and the Industrial Revolution (Pacione 2003). Refer to **Figure 2.2**.

Evolution of City Structures: Four Distinct Phases



Source: Modified and Adapted from Pacione (2003) and Castells (2004) by Leong Glastris

Figure 2.2: Evolution of City Structures

Currently, a fourth phase “*Knowledge Based Development*” is underway which has local, regional and global implications for how city hierarchies are structured. This phase arose from the process of major technological transformation and the resulting knowledge based technologies and network phenomena (Castells 2004).

Whilst there is some dissension over when the first city was formed and an awareness of the city as part of a wider network (Morris 1994; Pacione 2003; Taylor 2004b), the driving force that separates the city from secondary meeting places such as villages, communes, etc was the higher order level of commerce that took place. This driving force which created a higher order level of commerce included transactions on a large scale i.e. commercial trade and transactions at a regional, national and/or international level.

Pacione and Fletcher (Fletcher 1938; Pacione 2003) identify evidence of early city growth in the Old World (Mesopotamia 3500 BC, Egypt 3500 BC, The Indus Valley 2500 BC, The Yellow River 1800 BC) and in the New World (Mesoamerica 200 BC) which sprang from the development of agriculture, urban settlements and for the purposes of trade.

The city structures that evolved during this phase were driven by proximity to fertile land and the ability to tap into irrigation sources as

agricultural communities evolved into cities with a political/religious administration centre. Early cities such as Ur (2300 BC-2180 BC) located at the southern tip of the Fertile Crescent were physically defined by both geographic features (mound of previous ruins, River

Euphrates and harbours) as well as manmade features (an eight metre high wall surrounding the oval shaped city, canals and a processional avenue as well as a religious precinct and a relatively densely populated residential area).

City structures in Mesopotamia and Egypt tended to be more organic in form and less densely populated. This reflected the way changing prominence was given to capital cities when there was a change in pharaoh reign.

In contrast, city structures in the cities of Punjab and Mohenjo-Daro in the Indus Valley were more grid like in form with wide, straight streets forming rectangular blocks.

Whilst in Mesoamerica, ancient civilisations such as the Mayan (AD 300-1000) created cities (Tikal, Vaxactum and Mayapan) which operated like small states ruled by a priest. The city structure reflected a highly defined social hierarchy where palaces and temples took a central place followed by the surrounding elite classes with the lower classes consigned to the city periphery.

By 800 BC, urbanism spread throughout the Greek and Roman Empires in Athens, Sparta around 800 BC, Sicily and Naples around 750 BC and in Rome, Carthage around 264-146 BC and into Western Europe post 55 BC.

City structures in Greek cities evolved from the organic form of mainland cities like Athens to a more steadfast gridiron form in the newly established cities in 750 BC and 650 BC.

City structures in ancient Roman cities were highly structured around civic functions (Morris 1994). The city perimeter was square or rectangular in form and two main cross streets following a north-south and east-west axis intersected the city's centre. This in turn was supported by a secondary street grid based hierarchy. A central meeting place (forum) was typically a colonnaded courtyard and the main temple, theatre and public baths were located close by.

At the dawn of the Dark Age in the fourth century, the fall of the Roman Empire, significantly restricted long distance trade and Viking raids contributed to an unsettled period where there was little economic and cultural development. This impacted on the physical form of cities and

towns as they isolated themselves from their previous open long distance trade networks, fortified themselves against attacks and became more insular/introspective.

As the long distance trade routes reopened in the tenth century, the church began to stimulate commerce. With the decline of the feudal system, economics and politics became key catalysts in driving the growth of towns and cities.

In advocating the concept of cities as a networking process, Taylor (Taylor 2004b) cites the “*Abu-Lughod’s transcontinental archipelago of cities*” (1250-1350 AD) as one of the earliest world cities. This archipelago treks the trading network/routes between cities in Eurasia as opposed to countries e.g. Bruges, Genoa, Venice, Constantinople, Damascus, Baghdad, Samarkand, Peking, Canton, etc. As trading activity became increasingly sophisticated, primary and secondary courier routes were developed in late medieval Europe through trading companies. Later the “Hanseatic League” was developed in response to an association of merchants wishing to trade within a community or network of 70-80 cities.

Whilst these European medieval cities hosted a cathedral/temple and monasteries, the city was dominated by the central marketplace where trade and commerce were conducted. Often there was a “symbiotic relationship” between the medieval town and the surrounding countryside and cities such as Venice and Nuremberg “*annexed large areas of their surrounding lands to guarantee food supplies*” (Pacione 2003: 46).

As the development of cities moved into the pre-industrial revolution, the concept of cities attained greater symbolic significance.

The Renaissance period extended from the fifteenth through to the seventeenth century and the central theme of the all powerful Church translated into precise and clear city forms through radial based geometry and symmetry which symbolised a higher order, mathematical/scientific universe. During this time city populations grew considerably which constrained redevelopment opportunities unless there was destruction by fire (e.g. 1666 Fire of London) or military action. According to Morris, the five broad areas of Renaissance urban planning are (Morris 1994):

- i) Fortification systems;
- ii) Regeneration of parts of cities by creating new public spaces and related streets;

- iii) Restructuring of existing cities via new construction of main streets systems which frequently extended regional routes and therefore generated further growth;
- iv) Addition of extensive new districts mainly for residential uses;
- v) Layout of a limited number of new towns.

As the development of cities moved into the Industrial Revolution of the eighteenth and nineteenth centuries, the “industrial city” became a driving force. Factories and the associated “economies of scale”, the push for greater productivity, an ability to tap into a ready labour catchment, supportive services and good access to markets resulted in factories clustering in towns. As urbanisation levels increased to cater for the increased demand in labour, these successful centres of commercial activity amassed into cities.

With the move into the twentieth century, city structures became more diverse in their physical form in light of various planning theories and city models espoused by a gamut of modern planners, architects, economic geographers. For example, the concept of utopian cities was advocated by a number of modern leading planners and architects (Bacon 1978; Howard 1965; Le Corbusier 1987 (1929 Originally); Mumford 1968).

One of the key themes is the concept of urbanisation which is defined as “*the process by which an increasing proportion of a national population lives in towns and cities*” (Pacione 2003: 642). This is brought about essentially by the attraction of regional dwellers wishing to earn a better wage in order to improve their quality of life for themselves and their family.

Yet a distinction is made between population clusters that constitute different forms of human settlement with respect to the degree of urbanisation e.g. village, town, city and megapolis (Friedmann & Alonso 1961).

The city performs a vital cultural role where “*the consciousness of self is brought to an acute sensibility. Ideas are formed, change in fads and fashions is the order of the day. News and discussion of news are essential to it. Here the present and the future intersect*” (Friedmann & Alonso 1961: 343-347) and Friedmann also refers to how cities can be arranged systematically in accordance to the functions they perform.

This aspect of urbanisation continued in defining cities through rates of urbanisation (Pacione 2003) and where this has been further developed by examining the relationship between urbanisation and

urban sustainability, the stages of the urbanisation process and a methodology for measuring sustainable urbanisation e.g. urbanisation velocity and velocity of urban sustainability (Shen et al. 2012).

Significant work has also been undertaken in the area of the world hierarchy of cities in terms of Friedmann's "World City Hypothesis" (1986), Sassen's "Global City" (1991), Castells' "Space of Flows in the Network Society" (1996) and Taylor's "World City Network" (2004, 2011).

2.4.1.1 Evolution of City Structures: Knowledge Based Development Phase

The current phase, "Knowledge Based Development" is based on the preposition of technological transformation, knowledge generation and space of flows. The catalyst for this was a "*nucleus of information technologies*" where a series of major technological breakthroughs resulted in the 1980-1990 e.g. "*in advanced materials, in energy sources, in medical applications, in manufacturing techniques (current or potential, such as nano-technology), and in transportation technology, among others*" (Castells 2004: 29). The exponential spread of these technologies was supported by their ability to span technological fields and for the information to be readily stored, reproduced and transmitted. Castells defines the "space of flows" as the "*material form of support of dominant processes and functions in the informational society*" and comprises three layers – **a circuit of electronic exchanges** (e.g. micro-electronics-base devices, telecommunications, broadcasting systems, high speed transportation, information technologies, etc); **nodes and hubs** (where the network links to specific places, the nodes act as locations for strategically important functions and the hubs act as places to exchange and communicate information); **spatial organisation of the dominant, managerial elites** (which results in the manner in which space is formed around these critical functions) (Castells 2004: 442-445).

In particular, cities are regarded as a global network which is a continual process of generating and transmitting information and advanced service activities. This "network society" is a manifestation of the contradistinction between physical space, the space of flows and the allocation of resources (Castells 2004). Castells contends networks are open, dynamic, flexible structures "*capable of integrating new nodes as long as they are able to communicate within the network*" and are "*appropriate instruments for a capitalist economy based on innovation, globalization, and decentralised concentration; for work, workers, and firms based on flexibility and adaptability; for a culture of endless deconstruction and reconstruction...*" (Castells 2004: 501-502).

Networks and space of flows enable a greater concentration of resources and activities within the global arena and further widens the differential between cities that have a high connectivity compared with those that are poorly connected within the global network of cities (Taylor 2004b; Taylor et al. 2011). This encourages specialisation, diversification and competition in cities (Komninos 2002; Porter 1990, 2004) and within regions in a borderless world with continuous space (Fujita, Krugman & Venables 2001; Scott 2001; Storper 1997; Storper 2001).

The importance of network behaviour has also been acknowledged and how this shapes dynamic and innovative behaviour in order to pursue competitive growth strategies and to tap into the advantages cities have from being part of a network (Camagni 2001).

This also applies at a community scale with the local economic development of cities through a better understanding of the economic profile; fostering intelligent cities through innovation and industry cluster development; employing a range of economic, business development, community and implementation strategies; and creating specialised clusters of dense social and cooperation networks (Blakely & Bradshaw 2002; Florida 2005; Komninos 2008; Leigh & Blakely 2013; Porter 1995; Saxenian 1996, 2006).

Growing evidence supports knowledge based city-region development where greater collaboration between business, government and university sectors have transformed cities into knowledge efficient and innovation systems for transmitting different kinds of knowledge and knowledge interactions (Metaxiotis, Carillo & Yigitcanlar 2010; Saxenian 1996).

Intelligent cities are technologically savvy with greater innovative capability which translates into competitiveness and prosperity – a key function is to manage knowledge flows. These cities house people and organisations that are each in turn, “*a nucleus of explicit and tacit knowledge*” where their level of interaction determines how information and knowledge pathways and are created (Komninos 2008: 15).

In order to foster and develop an innovative environment and greater levels of innovative capability, the importance of governance, public policy and greater academic, research and private industry cooperation is critical.

For example, recent research has indicated that in order for Sydney and Melbourne to raise its global competitiveness it needs to improve the areas of “*Governance, Connectivity and Enterprise Hub*” (Hu,

Blakely & Zhou 2013: 10). This is also borne out in an article recently reporting that Australia runs the peril missing out of growing new/emerging industries which are net employment generators (compared to established industries which tend to be net job destroyers as they look to improve operational efficiencies) because it fails to provide the right innovation and venture capital environment. According to Australian-born Silicon Valley entrepreneur, Adrian Taylor, *"Australia's commercialisation ecosystem is on the verge of collapse...Commercialisation of innovation fuels economic growth. The right ecosystem conditions need to exist to help stack the odds in favour of the entrepreneurs and new ventures. The fastest-growing new ventures create the bulk of jobs for a country, as well as enormous wealth...There are technology-driven tectonic shifts that mean global entrants will marginalise these Australian industries, if they don't innovate...It will happen because of the intersection of technology trends evolving at exponential rates; the internet, mobile computing, cloud services and machine learning. It's happening now"* (Jay 2012: *Australian Financial Review* article 23/3/2012). The article also highlighted that government policy has shown a fundamental lack of understanding on why and how these emerging industries can best be commercialised within Australian innovation programs.

Over the next 50 years, cities will be vying for episodes of growth associated with particular industries. Based on the work by Krondratieff and Schumpeter, city development occurs in sync with long waves of business cycles where each wave is associated with a rise of key emerging industries which take hold in particular cities (Leong Willimott 2003b, 2004a). Thus ascendant cities (fourth wave of civil aviation, plastics and pharmaceuticals – where aviation centred on Los Angeles, Seattle and Bristol) caught in the upsurge benefit from significant economic development and prosperity whilst well established cities (London, Paris, New York and Tokyo) are able to adapt from one wave to the next because they contain their own clusters of economic activity or because of their financial centre status. Cities will depend on their ability to compete in new industries (Montgomery 2007).

However the speed in which these cities has evolved has accelerated. This is highlighted by the growing significance & dependence on knowledge based technology which underpins the speed and higher degree of connectivity between cities and regions, its economic competitive ability and the fluidity of how city structures and other spatial agglomerations are formed (Castells 2004; Fujita, Krugman & Venables 2001; Glaeser 2008, 2011).

This concept of city structure fluidity is explored by Smith who compares the traditional spatially bound cities (conceptualised by Mumford and Wirth) which are two distinct entities with in/out ratios to more recent overlapping cities (conceptualised by Beaverstock, Smith and Taylor and subsequently Latour) with a skein of networks (Smith 2003). These world cities are considered “spatial non-conformities” with numerous local sites where multiple lines of networks criss-cross. Castells cites David Harvey’s phrase of “*time-space compression*” and uses the capital markets as a key example of how time has been organised around these flow of spaces so that “*unified global markets, working in real time, has emerged*”; these dense informational networks permit the same capital to be “*shuttled back and forth between economies in a matter of hours, minutes, and sometimes seconds*” (Castells 2004: 465).

2.5 C: City Structure Development as a Process

City structures evolve from a continual, dynamic and complicated process of activity generation. Economic, commercial, political and social activities have always driven the city formation process. However current emerging trends such as the greater connectedness to global information intensive functions, engendering a greater capacity of knowledge generation, global competitiveness and a greater awareness of the cognitive/psychological needs of the city’s inhabitants are playing an increasing role in shaping the city building process.

Each of these considerations and needs collectively translate into diverse multi-layers of functions which in turn create and continually evolve the process by which city structures are formed.

It is posited the city building process is not without major oversights; that somehow the structural framework which should pull together the formation of a city structure as a strategic and integrated process is compromised and results in less than optimum city development (Camagni 2001; Lynch 1984).

Camagni remarks the formation process of global cities lacks overall co-ordination and integration:

“These processes, however, are giving rise to contradictions in the physical form of global cities, whose settlement patterns, largely unconstrained by planning regulations..., tend to evolve in response to a series of short term and fragmented decisions made by uncoordinated agents...”

(Camagni 2001: 96)

Similarly Lynch describes city building as a procedural quagmire:

“complex and plural, marked by conflict, cross purpose, and bargaining, and whose outcome, while often inequitable or even unwanted, seems uncontrollable as a glacier...”

(Lynch 1984: 41)

This sentiment is more recently echoed by Paul McClintock, Chairman of the Council of Australian Governments (COAG) Reform Council, whose intergovernmental panel recently examined how Australian cities are organised and planned. The conclusions include government had a naive understanding of commercial realities for infrastructure delivery; poor integration of the private sector in terms of infrastructure investment and delivery and a disconnect between people doing strategic planning and private sector implementation: *“how to make propositions investable and get the private sector confident in the returns... You can plan a whole new city and then find out that none of it is viable.. That’s one area where we see consistently right across Australia that the linkages between the people who are doing this high-level planning integration and the practical experience of what the private sector can, and will, do, is not strong”* (Hurley 2012: Australian Financial Review article 29/3/2012).

Moholy-Nagy envisaged the development of cities as an organic process that is fundamentally based on people’s emotional attachment and responses to their city environment:

“Cities, like men, are embodiments of the past, and mirages of unfulfilled dreams. They thrive on economy and waste, on exploitation and charity, on the initiative of the ego and the solidarity of the group. They stagnate and ultimately die under imposed standardisation, homogenised equality, and a minimum denominator of man-made environment. Most decisive of all, cities like mankind, renew themselves unit by unit in a slow, time bound metabolic process.”

(Moholy-Nagy 1969: 11)

Extending the concept of cities as complex and organic systems further, it is advocated that *“self organising systems”* maintain highly ordered states because they have a *“flow of energy passing through them, a flow of energy that connects any given system with its appropriate environment... It is the connectedness of the component parts of the system with each other, and of the systems as a whole*

with its environment, that is the central reason for order being maintained, and indeed created" (Allen 2004: 15).

Allen further posits in order for a self organising system to maintain some degree of order so it does not disintegrate, the system must be an **open system** where *"energy is continuously pumped into, and through the system to maintain that order, with the consequence that when that energy flow ceases, the system will degrade"* (Allen 2004: 15-16). This has parallels to city structures and their need for flows of energy i.e. information/knowledge, capital/resources, people, etc to generate activity, feed networks, instigate structural changes and the development of city structures. The concept of the city as a dynamic, complex and adaptive system is further expressed by du Plessis in her examination of cities operating as ecosystems (du Plessis 2008).

Feedback is also integral to self organising systems as it allows a process of "self correction" and Allen explains many biological systems are self-correcting i.e. **"homeostasis"** (Allen 2004: 16-17). The corollary is that city structures also have mechanisms i.e. key sectors (governance, economic, social and environment) which are in turn driven by feedback i.e. key drivers/indicators and market dynamics to ensure the city structure adapts and evolves as a complex, dynamic system.

As will be discussed later in this chapter, Urbanisation can also be regarded as a process of development stages (Pacione 2003; **Shen** et al. 2012). The concept of **"Shrinking Cities"** was developed by Martinez-Fernandez et al where *"A 'shrinking city' can be defined as an urban area – a city, part of a city, an entire metropolitan area or a town – that has experienced population loss, economic downturn, employment decline and social problems as symptoms of structural crisis"* (Martinez-Fernandez et al. 2012: 35). This is evident in cities such as Manchester, Detroit, Athens and Budapest where they have each experienced prolonged population declines and hit an economic impasse.

2.5.1 City Structure Development Stages

In examining the literature on city structure development as a process, it was important to investigate how this development process could be broken down into stages in order to track a city structure's progress as it transitioned through its evolution cycle.

One of the ways in which staged development is applied is in studying the Urbanisation Cycle. Whilst there is a relationship between urbanisation and industrialisation, it should be noted that urbanisation is not always a unidirectional (low to high) process. Rather it should be

regarded more as a population redistribution that *“involves either the relatively faster growth of smaller urban places or the absolute decline of the largest cities”* (Pacione 2003: 75). Davis (1969) posited that urbanisation followed a logistic curve where the first short section of the curve had high rates of urbanisation associated with large population shifts from rural areas to cities. The next stage comprised a longer period of more moderate growth rates in urbanisation. As the urbanisation level approaches 60%, *“the curve begins to flatten and approaches a ceiling of around 80% where the rural and urban populations appear to reach a functional equilibrium. At any one time individual countries are at different stages in the urbanisation cycle”* (Pacione 2003:78). An adapted urbanisation curve (Brunn, Williams & Zeigler 2003: 28) is presented in **Figure 2.3: Urbanisation Curve** where the Initial stage is associated with the population living predominantly in rural areas and as the region transitions from rural occupations to industry based occupations, the movement of the population from rural to urban areas accelerates urban growth (Acceleration stage) from around 30%. As in Davis’ curve, the third stage depicts the rate of urbanisation growth declining and reaching a ceiling of around 75-80% (Terminal stage).

A theory of differential urbanisation was developed by Geyer and Kontuly based on large, intermediate sized and small cities undergoing successive periods of fast and slow growth in a cycle of development – the three stages were Primate city category, Intermediate-size city category and Small-size city category (Geyer & Kontuly 1993; Pacione 2003). According to Pacione, this concept was developed further by *“Klaassen et al (1981) and van den Berg et al (1982) to study the growth patterns within urban agglomerations”* who identified four stages of urban development – Urbanisation, Suburbanisation (or Exurbanisation), Counterurbanisation (or Disurbanisation) and Rurbanisation (Pacione 2003: 79). Counterurbanisation and Reurbanisation occur during the Terminal stage (Champion 2001). Whilst this is an instructive way to approach development, this has been used at a country level. If more developed/highly urbanised cities already in the terminal stage were to be studied, there would be limited value in making a comparison of cities in the terminal stage because there would be little /negligible growth across cities within this category.

Urbanisation Curve

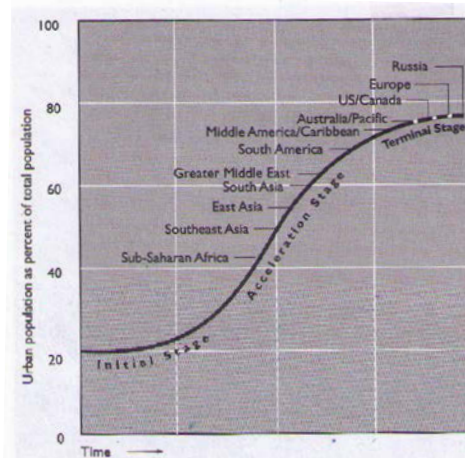


Figure 1.15 Urbanization Curve. Source: Adapted from Ray Northan, *Urban Geography* (New York: Wiley, 1979), 66.

Source: Brunn, Williams & Zeigler (Ed) 2003: 28

Figure 2.3: Urbanisation Curve

A second approach to assessing stages of development is to examine global competitiveness. The annual report “*The Global Competitiveness Index*” (World Economic Forum 2013) is compiled from 12 key indicators and classifies development into three key stages with two intermediary or transition stages and are typically classified by GDP per capita (US\$). These stages and their GDP per Capita thresholds comprise:

- Stage 1: Factor Driven Economy (<2,000);
- Transition from Stage 1 to Stage 2 (2,000-2,999);
- Stage 2: Efficiency Driven Economy (3,000-8,999);
- Transition from Stage 2 to Stage 3 (9,000-17,000);
- Stage 3: Innovation Driven Economy (>17,000).

This approach is more economic driven and the classification of broad development stages is used for country economies. Due to the lack of data at a city level, it would be difficult to undertake this classification at a city level and in addition, whilst these stages are sufficient for the purposes of the report’s Global Competitiveness Index, there is insufficient graining to grade cities into the more definitive development stages required for the thesis.

A third approach is that developed by David Shane who has adapted James Gleick's Chaos theories (Gleick 1987) to develop "*Heterotopias of Illusion and Normative City Models*" based on five phases of city growth which comprise three steady phases and two transition phases (Shane 2005). These phases and a brief description are:

- Steady State: The Archi Citta: Gleick's First Phase - Steady state of self-organisation and growth around a single centre;
- Steady State Disturbed: Heterotopia Type 2: Gleick's First Phase - Heterotopias of deviance or discipline (H2 - moved to outside the city or placed in a central position at the city's core) move into dominance over heterotopias of crisis (H1 - located anywhere inside the fabric of the city);
- Linear Dynamic & the Cine Citta: Gleick's Third Phase - Looking at the city as a network of heterotopias;
- Disturbing the Binary Dynamic: Heterotopias 3: Gleick's Fourth Phase - Based on Turing's pattern of growth around a city's perimeter and emergence of satellite cities;
- Multicentered Network Cities: The Tele Citta: Gleick's Fifth Phase - Based on a "*chaotic system which switches between multiple models, nodes and systems of growth, stasis and shrinkage*".

(Shane 2005: 291)

This approach is based on a hypothetical city and incorporates useful theories posited by Gleick, Krugman and Turing. Whilst this approach provides an interesting theoretical framework for conceptualising a city's growth, it would be difficult to undertake this classification because it does not elaborate on what city level indicators could be employed; how each of these phases could be quantified and how development performance could be quantitatively measured and monitored.

A fourth approach is to look at population growth trajectories in cities as advocated by Turok and Mykhenko (Turok & Mykhnenko 2007). Their work will be discussed in detail later in this chapter, however it should be noted that they identified nine different trajectory paths e.g. continuous decline, recent decline, growth setback, medium term resurgence, continuous growth, etc. Again this approach was also instructive at a trend analysis level however for the purposes of comparing cities at different development stages, it requires one level up in analysis.

Consequently from this analysis, a fifth approach was adopted where a six stage development process was devised by the Candidate as part of the methodology for the thesis that captures cities in the early emerging stage through to mature and obsolescence stages. This is discussed more fully in **Chapter 3 Methodology and Data Collection**.

2.5.2 City Structure Development Performance

In evaluating the development performance of city structures, it would be prudent to arrive at an understanding of “*development performance*”.

Given the unique definition of city structure devised for the thesis, it was difficult to find a definition of development performance that was appropriate for the concept of city structure.

The Oxford Dictionary defines “*development*” in terms of growth i.e. “*the gradual growth of something so that it becomes more advanced, stronger*” and in terms of a new product as “*the process of producing or creating something new or more advanced*” (Oxford University - Hornby 2003: 344). The Oxford Dictionary also defines “*performance indicators*” as “*things that show how well or badly something is working*” (Oxford University - Hornby 2003: 939).

To build on these elementary definitions, city structure development performance involves the city structure undergoing an evolving process to becoming more advanced whilst reflecting outcomes achieved; the execution of its network of functional activities, relationships and information flows; and a set of behaviours that define the city structure.

For the purposes of this thesis, the following definition for Development Performance was devised:

City Structure Development Performance:

“Development performance is defined as the manner in which a city structure fulfils and evolves/develops around its functional networks.”

This approach relies on a multi-disciplinary and integrated assessment of a city structure’s productivity, capacity, innovation and adaptability. As will be discussed in **Chapter 3 Methodology and Data Collection**, key drivers such as GDP and City Population can be used to measure these aspects.

2.6 D: Key Drivers and Indicators

Key Drivers and Indicators are important because they can be used to predict the development performance of city structures and when would be an appropriate time to facilitate investment, structural and/or strategic planning changes to a city structure to achieve desired outcomes. Key lead indicators precede or signal a transition to each of these development stages.

Both key drivers and indicators also act as catalysts to produce improved outcomes e.g. higher investment returns and productivity, better quality of life and education, greater regulatory transparency and improved business climate.

The difference between key drivers and indicators is the universal relationship key drivers hold with other indicators i.e. there is a strong connection or relationship between a key driver and each indicator. Key drivers act as a common link across a range of indicators. This concept is explored further in sub section **3.4.1.5 Selection of Indicators – City Structure Critical Indicator Matrix**.

In undertaking the Literature Review and investigating a range of indicators, there was an incredibly diverse range of indicators available and the Candidate explored over 100 indicators. These indicators were sourced from a variety of multiple institutional sources such as the World Bank, International Monetary Fund, United Nations, Organisation for Economic Cooperation and Development, Oxford Economics, etc. It should be noted at this stage, that in spite of the wide range of indicators, there was a very limited subset of indicators that provided consistent long term data at a city level. This lack of empirical data viewpoint was supported by other researchers (Beall, Guha-Khasnobis & Kanbur 2010; Kim & Short 2008; Taylor 2004b).

Based on the Literature Review and indicator investigations, key drivers can be structured across four key sectors: Governance, Economic, Social and Environment. These key sectors are often discussed in government policies regarding cities and their development.

Both City Structure Population and Economic Growth emerged as key drivers. **City Structure Population** is critical because changes in its population are an important consequence of and influence on urban and economic conditions. Economic activity drives the development of city structures – cities concentrate knowledge, capital & resources to provide greater opportunities and benefits to its workers, residents,

investors & visitors. **Economic Growth or GDP** is a measure of economic productivity within a city/country. Both City Structure Population and GDP represent universal drivers that relate to a wide range of sectoral indicators. Both of these key drivers are discussed in further detail in Chapter 3 Methodology and Data Collection and in subsequent analyses chapters (Chapters 5-8).

It should be noted however that there are several theories that support City Population as a key driver and these are outlined in the following figure (**Figure 2.4: Nutshell: City Population as a Key Indicator**):

Nutshell: City Population As A Key Indicator

- **Klaassen, Molle & Paelinck** (1981) and Van den Berg et al (1982) examined the cycle of urbanisation in terms of growth patterns within individual urban agglomerations.
- **Geyer & Kontuly's** (1993) theory of Differential Urbanisation postulates small, medium and large size cities undergo successive periods of fast and slow growth in a cycle of development.
- **Champion** (1997) advocated 4 stages of urban development – Urbanisation, Suburbanisation, Counterurbanisation and Reurbanisation.
- **Rossi-Hansberg & Wright** (2007) examined urban structure and growth by applying Zipf's Law to the size distribution of cities and economic activity.
- **Turok & Mykhnenko** (2007) asserts cities are “*continuous built up areas*” where the main indicator of city trajectories is “population change” because it impacts on and is impacted by urban and economic conditions.
- **Shen, Zhang & Wu** (2011) examined the relationship between urbanisation and urban sustainability where a sustainable urbanisation elasticity coefficient was defined by an urbanisation velocity and an urban sustainability velocity.

Figure 2.4: Nutshell: City Population as a Key Indicator

City populations reflect/influence responses to ready access to information and capital networks, opportunities and amenities which affect the development of city structure phenomena.

Within a city population, decisions made at a stakeholder level (e.g. individual, family, corporate, government) determine aggregate/city outcomes e.g. education and employment choices, economic activity, investment climate and determining knowledge and wealth transfer between stakeholders.

Economic aspects form a fundamental cornerstone in driving the development performance of city structures (Beall & Fox 2009b; Kim &

Short 2008; Montgomery 2007). Economic activity dominates the development of city structures where capital, resources and knowledge are concentrated offering inhabitants a greater number of jobs, higher wages, a wider and better range of infrastructure and amenity and other benefits (Allen 2004; Glaeser 2008). GDP is a measure of economic production within a city or country and relates to the majority of indicators selected in the City Structure Critical Indicator Matrix. Whilst it has been argued that an alternative economic indicator such as the Genuine Progress Indicator which measures economic activity as well as *“how that activity impacts the well being of individuals living in that economy and how sustainable that activity is”* may be perceived as a better measure, data for this indicator is not widely available and it is also acknowledged that GDP is one of the most respected and widely used economic indicators by economists and Government (Dean 2014: Online Article, ABC Drum *“Dethroning GDP as Our Measure of Progress”*).

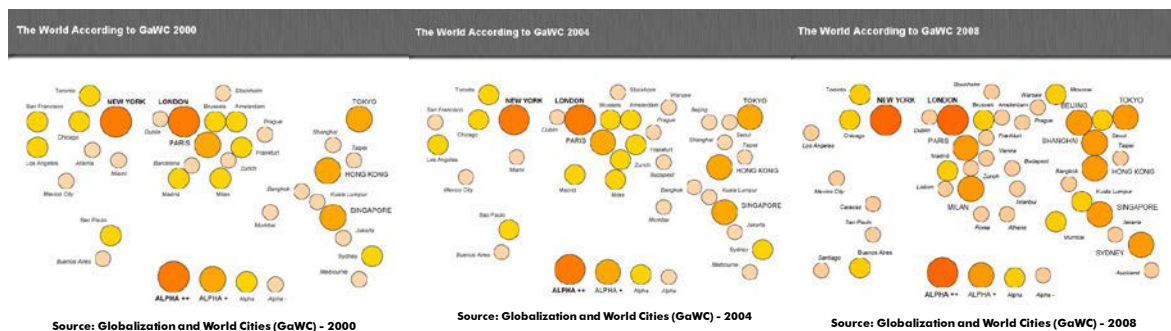
Other indicators were identified that could be used to explain the development performance of city structures across the various Governance Economic, Social and Environment sectors – again these will be discussed in further detail in **Chapters 3** and **5-8**. However, examples include:

- **Governance** – Claims on Central Government, Health Expenditure, Public Expenditure on Education, Current Account Balance, etc.
- **Economic** – GDP, Inflation, Total Investment, Employment, etc.
- **Social** – City Structure Population, Net Migration, Completed Tertiary Educational Attainment, etc.
- **Environment** – Number of Hospital Beds, City Office Occupancy Costs, Energy Use, Carbon Dioxide Emissions, etc.

Whilst other types of indicators investigated were aggregations of other indicators in the form of indices. The following is not an exhaustive list, rather it provides a general indication of the types of indices currently available:

- **Global Network Connectivity Score** – Measures how well connected a city is within the world city network in terms of connectivity to advanced producer services and also categorises cities in terms of alpha, beta and gamma cities (for an example of developments in alpha class cities refer to **Figure 2.5: World City Network Connectivity**) but has a limited data range (2000, 2004 and 2008) (Derudder et al. 2010; Globalization and World Cities (GaWC) Research Network 2010; Taylor 2000, 2004a; Taylor et al. 2011);

World City Network Connectivity: Alpha World Cities: 2000 - 2008



Source: Globalization and World Cities (2000, 2004 & 2008)

Figure 2.5: World City Network Connectivity

- **Global Competitiveness Index** – Measures microeconomic and macroeconomic aspects of global competitiveness and sustainability based on indicators across 12 key sectors/pillars and categorises these countries into factor driven, efficiency driven or innovation driven economies (World Economic Forum 2013);
- **City Liveability Index** – Examines the liveability/desirability and cost of living in a range of cities based on indicators in the 6 key areas of stability, healthcare, culture and environment, education, infrastructure and spatial characteristics (Economic Intelligence Unit 2012);

- **Global Peace Index** – Examines the state of global peace and its benefits at a country level and is based on 22 qualitative and quantitative indicators over a six-year trend (Institute for Economics and Peace 2013);
- **Global Real Estate Transparency Index** – Tracks transparency improvements within the real estate market at a country level (since 1999) with regards to 83 factors in the 5 broad sectors of performance measurement, market fundamentals, governance of listed vehicles, regulatory and legal and transaction process (Jones Lang LaSalle 2012).

It should be noted that whilst these indices initially appear attractive due to their aggregation of a range of indicators, it also poses challenges in determining the terms of the research methodology, assumptions and limitations associated with the choice of sectors, indicators and weightings within these indices and associated modelling. There is also a lack of transparency in being able to assess the sensitivities of individual indicators. These challenges are discussed in further detail in section **3.5.2.7 Lack of Transparency in Research Methodology for City Based Indices**.

In October 2013, Richard Hu, Edward J. Blakely and Yimin Zhou co-authored and published an *Urban Policy and Research* journal article titled “*Benchmarking the Competitiveness of Australian Global Cities: Sydney and Melbourne in the Global Context*” (Hu, Blakely & Zhou 2013). The Candidate became aware of this research during the late stage of her doctoral thesis (during a State of Australian Cities PhD Research Symposium mentoring session 26.11.2013). The candidate therefore acknowledges whilst the objectives, methodology and results differ from her own, the approaches to identifying key sectors/determinants and indicators as well as some of the determinants themselves are very similar but have been independently developed along parallel lines for this doctoral thesis.

2.7 Seminal Works

Whilst the thesis is founded on a wealth of knowledge delivered from the Literature Review, there were two seminal works that were influential in the shaping of the research design framework. Each of these works will be discussed in terms of their key findings.

2.7.1 Seminal Work 1: Turok and Mykhnenko (2007)

In 2007, Ivan Turok and Vlad Mykhnenko co-authored a Cities journal article titled “*The Trajectories of European Cities, 1960–2005*” (Turok & Mykhnenko 2007).

Turok and Mykhnenko contended the main indicator of urban change or city trajectory is **population change** because it is an important consequence of and influence on urban and economic conditions. Turok and Mykhnenko tested this by examining population change in 310 European cities across 36 countries during 1960-2005.

Turok and Mykhnenko concluded the following:

- Confirmed population change is a main indicator of urban change and that it is linked to economic change, particularly over the longer term;
- There were nine different trajectories of change where 30% of the sample followed a continuous growth trajectory, 24% followed a medium-term decline trajectory and 13% followed a recent decline trajectory;
- A consistent pattern of slowdown in the population growth rate – there was a limited number of resurgent cities which could be attributed to the “*level of momentum in city trajectories*” (Turok & Mykhnenko 2007: 171);
- City size is significant between differential growth rates of cities where average growth rates for large cities exceeds that of small cities;
- City growth rates no longer relate to urbanisation. In particular there was a “*slowdown in city growth rates in countries with relatively low levels of urbanisation in Eastern Europe*” (Turok & Mykhnenko 2007: 173);
- There is no significant relationship between climate with high levels of solar radiation and the population growth rate;
- There were differences in population growth trajectories in Western and Eastern Europe.

2.7.2 Seminal Work 2: Shen, Peng, Zhang and Wu (2011)

In 2011, Liyin Sheng, Yi Peng, Xiaoling Zhang and Yuzhe Wu co-authored a Cities journal article titled “*An Alternative Model for Evaluating Sustainable Urbanization*” (**Shen** et al. 2012).

Shen et al posited sustainable urbanisation could be defined in terms of an urbanisation velocity and an urban sustainability velocity. This was tested by examining the relationship between urbanisation and urban sustainability, developing a methodology and a model for evaluating sustainable urbanisation on a case study evaluating four medium-sized Chinese cities in 1995-2000.

Shen et al concluded the following:

- Confirmed Sustainable Urbanisation Elasticity Coefficient can be defined by two parameters – Urbanisation Velocity and Urban Sustainability Velocity;
- Urban sustainability is linked to urbanisation by virtue of the “economic, social and ecological development of a city”; as such urbanisation is a “*key variable determining the performance of urban sustainability*” and can be expressed quantitatively (**Shen** et al. 2012);
- A methodology was constructed to evaluate sustainable urbanisation based on a three step procedure – this comprises measuring the urbanisation state; measuring the urban sustainability; and evaluating the sustainability of urbanisation.
- **Urbanisation Velocity** is calculated by dividing the change in Urbanisation by the change in Time. Similarly the **Urban Sustainability Velocity** is calculated by dividing the change in urban sustainability by the change in time.
- **Sustainable Urbanisation Elasticity Coefficient** is calculated by dividing the Sustainable Velocity by the Urbanisation Velocity.
- Sustainable urbanisation can be evaluated into four categories or quadrants – Sustainable Urbanisation; Sustainable Counter-Urbanisation; Unsustainable Counter-Urbanisation; and Unsustainable Urbanisation.
- The case study validated the above methodology was effective in evaluating changes and improvements to sustainable urbanisation.

2.8 Identifying the Research Gap

With the research undertaken by Turok and Mykhnenko (Turok & Mykhnenko 2007), the research was to primarily examine population changes over time but did not examine in detail the constituent elements of those populations and their respective rates of change. There are also limited insights into the compositional nature of those cities to obtain a better understanding of their future performance.

Shen, Peng, Zhang and Wu (**Shen** et al. 2012) limited their research to urbanisation and did not examine rates of change within urban agglomerations, so once urbanisation levels hit the terminal stage of around 70-80%, urbanisation growth is limited and is no longer a strong indicator of the development growth rate of a city structure (Brunn, Williams & Zeigler 2003; Pacione 2003; Turok & Mykhnenko 2007). There are also limited insights into the compositional nature of those cities to obtain a better understanding of their future performance.

2.9 Development of Research

This research will build on these theories (**Shen** et al. 2012; Turok & Mykhnenko 2007) by:

- **Applying** a rate of change approach to population and key economic indicators at a city structure level.
- **Examining** development trends and trajectories of city structures through critical indicators and their development performance derivations (velocity, acceleration, resilience, etc) with respect to GDP and city population to better understand these rates of change.
- **Supplementing** this with an analysis of compositional aspects of city structure population (compositional indicators and development performance trajectory benchmarking, etc) to better understand changes from within a city structure's population that impact its productivity, capacity and resilience.

Collectively, this approach aims to build a more comprehensive profile of city structure development performance.

2.10 Chapter Conclusion

The Literature Review draws from the diverse fields of urban geography, urban development and strategic planning and the review is by no means exhaustive. The chapter offers insights into how city structures have evolved in four key phases. It is the current “*knowledge based technologies*” phase that provides research impetus for the thesis.

The knowledge gained from this chapter provides a useful starting point with newly developed concepts for city structure and city structure development performance; the identification of city population and economic (GDP) growth as key drivers in city structure development; and how the seminal works authored by Turok et al and Shen et al have informed the proposed development of research.

Chapter 3

Methodology and Data Collection



Queen Victoria Building, Sydney CBD Midtown Precinct

Source: Michelle Leong Glastris

“To put one brick upon another,
Add a third and then a forth,
Leaves no time to wonder whether
What you do has any worth.

But to sit with bricks around you
While the winds of heaven bawl
Weighing what you should or can do
Leaves no doubt of it at all.”

(Larkin 1951: *To Put One Brick Upon Another*)

3 Research Methodology and Data Collection

3.1 Chapter Outline

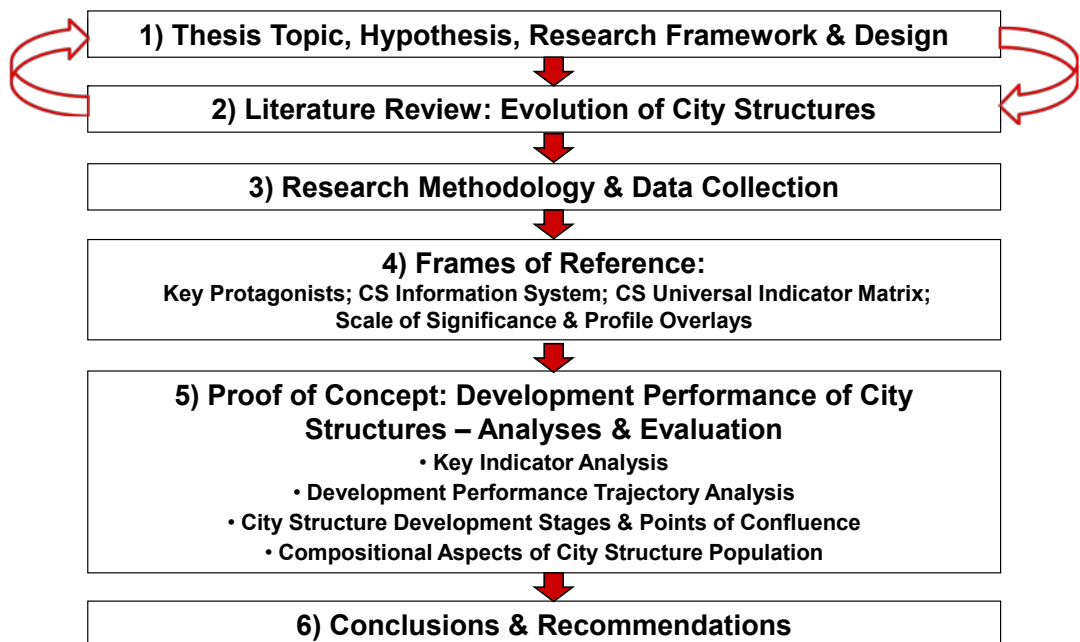
In Chapter 2 a literature review was undertaken to identify how cities form and evolve with respect to how a range activities are housed and sustained; the evolution of key theories and models; key themes identified and a contextual framework for the thesis. This chapter builds on that introduction by examining key considerations with regard to the thesis methodology – the methodological approach, research design, research methodology and data collection, data assumptions and limitations. Further methodological considerations are respectively detailed in individual Chapters 4 - 7 with regard to City Structure Matrix of Key Indicators; Development Performance Trajectory Analysis; Development Stages and Compositional Aspects of City Structure Population.

3.2 Methodological Approach

As previously stated in **Chapter 1 Introduction**, the overall inputs, processes and outcomes for the proposed research have been highlighted and captured in a “**Roadmap**” for reference purposes. The Roadmap also maps out key functionalities, the interrelationships of variables/determinants and positions key segments of knowledge. Please refer to Chapter 9 **Figure 9.1: Roadmap - City Structure Information System: Evaluation of Key Drivers in the Development Performance of City Structures** or as an A3 sized chart in **Appendix 1: Key Reference Charts – vi) City Structure Information System: Evaluation of Key Drivers in the Development Performance of City Structures**.

To undertake this research, the following methodology is proposed (Figure 3.1 and in **Appendix A: Key Reference Charts**):

PhD Thesis Methodology:



Research, Methodology and Analysis Developed By: Leong Glastris

Figure 3.1: PhD Thesis Methodology

Stages 1-2 and 4 (Thesis Topic, Hypothesis, Research Framework and Design; Literature Review and Frames of Reference) are inherently qualitative in nature. Stage 3 (Research Methodology and Data Collection) required both qualitative skills in developing the research methodology and evaluating some data collection aspects as well as quantitative skills in evaluating, screening and normalising the data. Stage 5 (Proof of Concept: Development Performance of City Structures), is predominantly quantitative in approach.

The stages of PhD Thesis Methodology are outlined below:

Stage 1 (Thesis Topic, Hypothesis, Research Framework and Research Design) involved identifying the fields of research, formulating the thesis and hypothesis and establishing the research framework. This is examined later in section **3.3** of this chapter. This section sets out the rationale and foundation for the proposed research in terms of Methodological Approach, Research Design, Data Collection as well as Assumptions and Limitations. Stage 1 was an iterative process (as indicated by the feedback loop in **Figure 3.1: PhD Thesis Methodology**) where findings from Stage 2 Literature Review were fed back to further inform the development of the thesis hypothesis, research framework and design and in turn, Stage 1 provided further direction and scope to the Literature Review.

Stage 2 (Literature Review: Evolution of City Structures) is discussed in **Chapter 2 Literature Review: Evolution of City Structures**. A review of current literature was undertaken on the evolution of cities to derive an appropriate definition of a city structure; identify city building as a process; determine key protagonists; and identify how various activities (e.g. global linking of cities, economic, political, etc) within cities are housed and sustained. As mentioned above, there was an iterative process between Stages 1 and 2 which formed a feedback loop that informed the development and completion of both stages.

The degree with which the current body of knowledge successfully explains city structure development was also assessed in terms of key theories and models that track the development of city structures and subsequent of points of departure for the proposed research.

Stage 3 (Research Methodology and Data Collection) establishes how the research was conducted in terms of research methodology and the collection of indicator data. This includes the aspects of indicator selection; city selection; data sources and data treatment.

Stage 4 (Frames of Reference) examines contextually how the proposed research fits within a wider body of knowledge and formulates frameworks for analysing information in categories with common characteristics. The five key frames of reference are listed below:

- A: Key Protagonists;
- B: City Structure Information System;
- C: City Structure Universal Indicator Matrix;
- D: Scale of Significance;
- E: Profile Overlays.

These contextual frameworks are discussed in **Chapter 4 Frames of Reference**.

Stage 5 (Proof of Concept: Development Performance of City Structures) provides the proof of concept in validating the hypothesis and answering the key research questions presented in Stage 1. The proof of concept evaluates the development performance of city structures through a series of analyses. These are:

- Key Indicator Analysis;
- Development Performance Trajectory Analysis;
- City Structure Development Stages and Points of Confluence;
- Compositional Aspects of City Structure Population.

The analyses and evaluation are provided in the **Proof of Concept Chapters 5 – 8**.

Finally Stage 6 (Conclusions and Recommendations), the key findings derived from this body of research are highlighted, addressing the thesis proposition and recommendations are made for how this work can be further progressed in terms of refinements and further investigations.

3.3 Thesis Topic, Hypothesis, Research Framework and Research Design

3.3.1 Thesis Topic, Hypothesis and Research Framework

The general field of research, hypothesis and thesis topic were formulated prior to admission to the doctoral program. The topic, hypothesis and scope of the thesis were further refined in subsequent meetings and discussions with Academic Supervisors – initially with Dr David Higgins and Dr Glen Searle; subsequently with Dr Garry Glazebrook and Professor Alan Peters; and finally with Dr Sumita Ghosh and Professor Shankar Sankaran.

In section **1.9 Profile of Doctoral Candidate**, background information regarding the Candidate's academic background and professional career (section 1.91); Reasons for undertaking the doctorate (section 1.92); and Experience relevant to this doctorate (section 1.93) were provided. Collectively this provided the impetus for undertaking the doctorate in the fields of urban development and strategic planning and for the Candidate's particular focus on the development performance of city structures.

The thesis topic, hypothesis and research framework were developed in light of the candidate's academic and professional interest in urban and economic development; strategic planning; global real estate investment/funds management; property research and advisory. As such, the Candidate recognised the value in adopting a cross disciplined approach in undertaking her doctoral research.

The original thesis topic "*The Synergies and Typology of City Structures*" was later amended to the current thesis topic "*Evaluation of Key Indicators in the Development of City Structures*". The former topic was to examine key factors and their synergies in city structure development and how these drivers could be used to develop a typology of drivers for city structures. However in refining the hypothesis and developing the research framework (i.e. foundation meta and research questions and research design), further consideration was given to the evaluative and predictive aspects of how city structures evolve. Identifying the key indicators and developing evaluative tools for the development performance of city structures increasingly engaged the Candidate's attention. Consequently the thesis topic was altered to enable further critical analysis in this area.

An abductive reasoning approach was applied as it allows inferring "A" (key drivers and compositional aspects of city structure population) as an explanation of "B" (City Structure Development Performance). However prior to developing the working hypothesis and research questions, it is useful to ask a few universal or broader level Meta questions. Whilst the detailed investigation of some of these questions falls outside the scope of this research, these questions are instructive in constructing a broader research context (**Figure 3.2: Meta Questions**):

Meta Questions:

- What makes a city structure attractive and successful?
- What determines the development cycle and performance of city structures?
- What can be done to redress or enhance a city structure's development trajectory?

Figure 3.2: Meta Questions

These Meta questions draw attention to a city structure as the product of a complex and dynamic process; its evolution can be staged within a development cycle and its development performance can somehow be altered/improved.

To date, the connection between the development performance of city structures and the translation into an integrated, evaluative and predictive framework have been weakly addressed. Whilst there is a growing need to objectively evaluate the development of cities across a wide range of disciplines, very little work has been done which successfully incorporates these disciplines in a holistic and integrated manner. The proposed research will address this gap by providing an evaluative framework for the evolution of cities and their future long term sustainability.

City structures evolve in a series of development stages (Pacione 2003). Key lead indicators precede or signal a transition into each of these development stages and can be used to determine the driving force behind the development of cities. These key drivers can be used to predict the development performance of city structures and when would be an appropriate time to facilitate investment, structural and/or strategic planning changes to a city structure to achieve desired outcomes. These lead indicators also act as catalysts to produce outcomes e.g. higher investment returns and productivity, better quality of life and education, greater regulatory transparency and improved business climate.

In particular, city population can be used as a strong indicator to quantify a city's development (Klassen et al 1981, Geyer et al 1993, Champion 1997, Turok et al 2007 and Shen et al 2011). City populations reflect/influence responses to ready access to information and capital networks, opportunities and amenities which affect the development of city structure phenomena.

This raises the immediate question of whether city structure population can be used as a lead indicator to precede or signal a transition to each of these development stages. In addition, what compositional aspects of city population are instructive in evaluating city structure development?

In asking these questions, the foundation for the research framework and the subsequent hypothesis were developed:

Working Hypothesis: *Key governance, economic, social and environment indicators and the compositional aspects of city structure population collectively explain the development performance of city structures.*

In investigating the proposed hypothesis, an additional number of research questions were raised which further contributed to building the research framework (**Figure 3.3: Research Questions**):

Research Questions:

- What are the key governance, economic, social and environment indicators that drive the development of city structures?
- How can these indicators be used to evaluate, gauge and improve the development performance of city structures?
- Can city structure population and economic growth be regarded as lead indicators that signal a transition to each development stage within a city structure's development cycle?
- Does the investigation of development performance trajectory determinants (velocity, acceleration, resilience, etc) with respect to city structure population and economic growth improve our understanding of the development of city structures as a complex and dynamic process?
- To what extent does the evaluation of key indicators, development performance trajectory determinants and the compositional aspects of city structure population (compositional indicators, magnitude, density and development performance trajectory determinants) explain how these factors collectively shape the development performance of city structures?

Figure 3.3: Research Questions

It is anticipated that answering the research questions will prove the hypothesis valid, where:

- There are key governance, economic, social and environment drivers that dominate city structure development;
- Some of these key drivers can be derived as city structure development performance trajectory determinants;
- City structure population and economic growth can be regarded as strong indicators of city structure development. In conjunction with development performance trajectory determinants and population compositional aspects, city structure population can be used to instructively explain the development performance of city structures;

- Collectively city structure key drivers, development performance trajectory determinants and the compositional aspects of city population can be used to gauge the future development performance of city structures.

In exploring and testing this premise, there will be an emphasis on both the process of how a City Structure Indicator Matrix, an evaluative framework for assessing development performance trajectory determinants and the compositional aspects of city structure population are derived as well as the products and performance outputs themselves.

3.3.2 Research Design

In light of the hypothesis posed, literature reviewed, points of departure and research framework sections discussed, it is instructive to discuss the research design for the thesis.

A conceptual framework (Figure 3.4 and in Appendix 1: Key Reference Charts) for the research design was developed. The flow chart maps out input, output, processes, links and also identifies and tracks the independent, dependent and control variables involved. The variables are colour coded – independent variables are mauve, control variables are green and the dependent variables are fuchsia pink. **City Structure Development Performance** is the dependent variable i.e. the effect being tested.

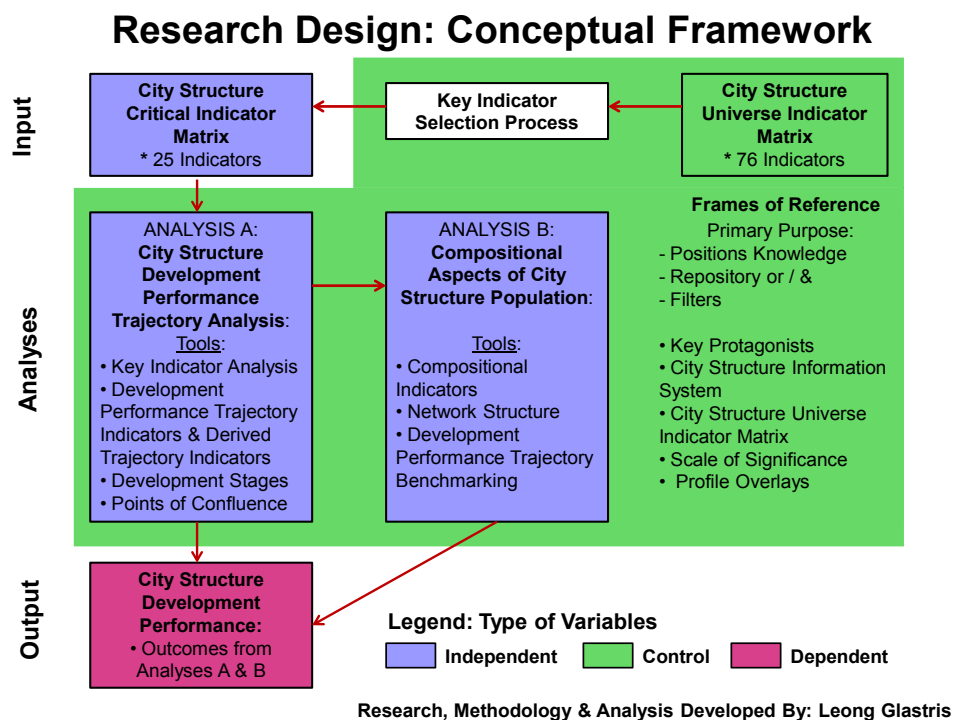


Figure 3.4: Thesis Research Design: Conceptual Framework

The framework commences at the input level with the **City Structure Universe Indicator Matrix** as a frame of reference – in this instance a repository of the 76 indicators. Other frames of reference are applied i.e. scale of significance, profile overlays, etc to reduce to a shortlist of 25 indicators known as the **City Structure Critical Indicator Matrix**. This second matrix provides the set of independent variables used as input for two types of analyses. Analysis A - **City Structure Development Performance Trajectory Analysis**, is classified as an independent set of variables and uses a range of tools to evaluate development trajectories. Analysis B - **Compositional Aspects of City Structure Population**, is also classified as an independent set of variables and builds on the outcomes from Analysis A and other frames of reference by using a range of tools to evaluate the compositional make up of the city structure population. Collectively the outcomes from Analyses A and B provide historical and predictive insights into the desired output, the **Development Performance of City Structures**.

3.4 Research Methodology and Data Collection

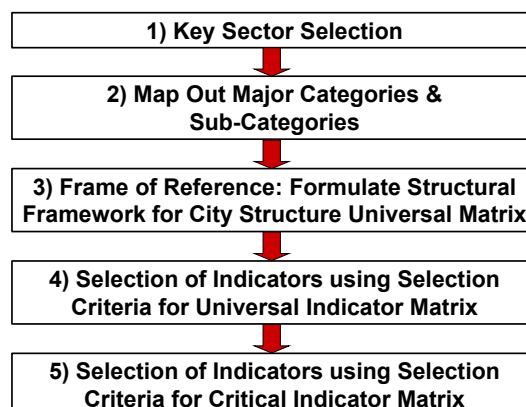
The data set collected for this research project is extensive and unique. Two key challenges in undertaking this research were to identify appropriate indicators and then source and collect accurate, reliable and consistent historical data from multiple sources for 31 cities and/or 19 countries with a significant time series (preferably 20-60 years).

This section discusses research methodology and data collection with respect to indicator selection; city selection; data sources and data treatment.

3.4.1 Indicator Selection Process

The process of indicator selection was developed in four stages and is depicted in the flowchart, **Figure 3.5**:

City Structure Indicator Selection Process: Key Stages



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Figure 3.5: Indicator Selection Process

3.4.1.1 Key Sector Selection

Based on the key findings from the Literature Review and on the Candidate's academic and professional background, four key sectors were selected to generate an initial selection of indicators that would best explain the development performance of city structures. These sectors were:

- **Governance** – To examine governance and regulatory constructs;
- **Economic** – To examine economic, investment and workforce utility, capacity and competitiveness;
- **Social** – To examine collective social and urban values and socio-demographic trends; and
- **Environment** – To examine the natural and urban/built environment utility, capacity and sustainability.

3.4.1.2 Map Out Major Categories and Sub-Categories

The second step involved mapping out major categories and where required, sub-categories within each sector to provide a good cross representation within that sector regarding critical city structure development performance.

3.4.1.3 Formulate Structural Framework for City Structure Universal Matrix

These sectoral categories and sub-categories were structured in a matrix to form the City Structure Universal Indicator Matrix. The structure of the Matrix is provided in **Table 3.1: City Structure Universal Indicator Matrix – Structural Framework**.

The categories and sub-categories were selected based on key findings from the Literature Review and also to ensure a good cross representation for each of these sectors was maintained.

There was only one instance where later in the selection of the 76 indicators, the Social category “*Collective Values*” could not be represented as the indicator selected “*Total Public Social Expenditure* (% of GDP) did not have sufficient historical and country coverage from any of the data sources used and there were no other proxy indicators available that complied with the key criteria for indicator selection (refer to sub section **3.4.1.5 Selection of Indicators – City Structure Critical Indicator Matrix**).

3.4.1.4 Selection of Indicators – City Structure Universal Indicator Matrix

This matrix structure facilitated the subsequent selection of appropriate indicators by ensuring that subject to indicator data availability, there was

a reasonable representation of indicators to explain city structure development performance within each sector.

Based on the above matrix structure, an investigation of key data sources and data availability was undertaken to select over 100 indicators which were then reduced to 76 universal indicators based on data availability, city coverage, quality of the data and appropriate representational fit within the matrix.

It should be noted there was some cross over representation - a number of indicators could be used to represent or explain more than one sector and/or category. For example, the indicator "*Time Required to Start a Business*" measures the average time it takes to start a business and was assigned to the sector **Governance**; the category **Modes of Governance and Meta-Governance** because it measures the capacity to achieve economic efficiencies, collective goal attainment and social cohesion through forms of Government and the sub-category **Market Maturity** (alternatively it could have been assigned to the category Regulatory Constructs and its sub-category Regulatory Frameworks) because it can be used as a measure of how well Government encourages start up businesses. The indicator could also be assigned to the sector Economic, category Economic Competitiveness and to the sub-categories Comparative Advantage; Competitive Advantage and/or Investment and Business Climate. Where indicators provided multi-sector/category representation, this was considered an advantage because the information only had to be collected once but could be analysed for multiple purposes. Wherever appropriate, indicators with this multiple purpose use were selected and noted. However indicators that measured a specific or unique aspect of city development performance were also sought and selected to complement the sectoral suite of indicators and maximise sectoral representation.

As discussed in subsequent Proof of Concept chapters, a number of these indicators (e.g. Gross Domestic Product, Household Disposable Income, Employment and City Population) were further derived to produce additional indicators. These were in addition to the original 76 indicators incorporated in the City Structure Universal Indicator Matrix.

It should be noted that a Frame of Reference - Scale of Significance (refer to section **4.3 Frames of Reference**) together with selection criteria were applied to shortlist these indicators.

The **Scale of Significance** was either at **country** or **city** levels. The exception was in the customised Oxford Economics economic and population data for Bangalore where data was at the Karnataka state level and Mumbai at the Maharashtra state level.

City Structure Universal Indicator Matrix : Structural Framework

City Structure Universal Indicator Matrix: Structural Framework			
Key Sector: Governance	Key Sector: Economic	Key Sector: Social	Key Sector: Environment
Major Categories and Sub-Categories			
i) Governance	i) Key Economic Drivers	i) Collective Values	i) Climate and Natural Environment
a) Regimes of Financial Capital Accumulation and Consumption - Modes of Accumulation			
b) Modes of Governance and Meta-Governance	ii) Economic Competitiveness	ii) Urban Concepts	ii) Urban Environment
c) Market Maturity			
d) Leadership and Vision			
e) Fiscal Management			
i) Regulatory Constructs	iii) Workforce	iii) Socio-Demographic Trends	iii) Transportation
a) Regulatory Frameworks			
iii) Governance Trade-Offs	iv) Technology Transfer	iv) Health and Education	iv) Water and Energy
	v) Investment and Business Climate	v) Social Trade-Offs	v) Sustainability
	vi) Infrastructure Support		vi) Pollution
			vii) Environment Trade-Offs
	vii) Forms of Capital		
	viii) Economic Trade-Offs		

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Table 3.1: City Structure Universal Indicator Matrix – Structural Framework

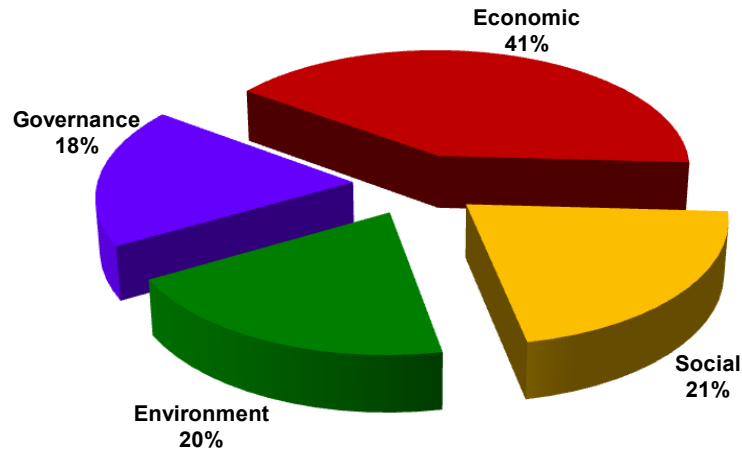
Key Criteria for Universal Indicator Selection

In selecting the 76 indicators for the City Structure Universe Indicator Matrix, a range of criteria was developed to ensure consistency of approach and a desired/prescribed quality level of indicator for the purposes of this research:

- 1) Each indicator selected must conform to the structure established for the City Structure Universal Indicator Matrix and provide good insight into the key sector it represents. Where applicable, preference should be given to indicators where it has the universal ability to represent more than one sector and/or category/sub-category.
- 2) The data providers offering the indicator datasets, must have a strong reputation for developing robust research methodologies and for providing accurate, reliable, timely and consistent data.
- 3) Indicator data obtained has to be accurate, reliable, timely and consistent over a significant time series (preferably 20-60 years).
- 4) Frame of Reference - Scale of Significance: Indicator data must be provided at preferably city or country level. The exceptions were the Indian cities of Bangalore and Mumbai where customised Oxford Economics economic and population data could only be provided at state level.
- 5) For any one indicator selected, the dataset should cover all of the six key cities and as much of the 25 cross reference cities and/or their respective countries as possible from one data source.
- 6) Indicator data should be publicly and/or freely available and preferably online so large tracts of data can be downloaded electronically for review and incorporated into the City Structure Universal Indicator Matrix database in a timely and streamlined manner.

The **City Structure Universal Indicator Matrix** is tabled in **Appendix 2: City Structure Universal Indicator Matrix** and lists the 76 indicators under the key sectors, categories and where relevant, sub-categories. It also provides a reason for why the indicator was selected; identifies if it can be used in another sector's category; a definition of the indicator; where the dataset is sourced and other pertinent comments.

Universal Indicators: Sector Composition



Note: Total number of Critical Indicators - 76

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Figure 3.6: City Structure Universal Indicators: Sector Composition

As depicted in **Figure 3.6**, there was a reasonable cross representation of the key sectors across the 76 Universal Indicators selected. The higher representation of economic indicators reflects the greater availability of indicators and datasets as per the prescribed indicator selection criteria.

3.4.1.5 Selection of Indicators – City Structure Critical Indicator Matrix

A further indicator selection process using GDP and City Population criteria was employed to shortlist from the **City Structure Universal Matrix** of 76 indicators to the **City Structure Critical Indicator Matrix** of 25 indicators.

This was achieved by assessing connections/relationships and relevance to two common criteria – GDP and City Population. Each indicator was evaluated to see if it could be assessed in terms of GDP (e.g. percentage of GDP, component of GDP or equivalent) or in city population terms (e.g. per capita; per 1,000 people or percentage of the total city/country population or equivalent).

As a cross check, three preliminary correlation analyses were separately undertaken verifying the selection discussed in sub section 5.2.2 Validation of City Structure Critical Indicators.

The distinction between Key Drivers (GDP and City Structure Population) and other Critical Indicators should be noted. Key Drivers exhibit a strong, universal relationship across the range of Critical Indicators. This was demonstrated through both qualitative analysis (**Appendix 3: City Structure Critical Indicator Matrix**) and quantitative correlation analyses (**Appendix 4: Correlation Tables – Critical Indicators**).

It should be noted that other Frames of Reference (refer to section **4.3 Frames of Reference**) were also applied (e.g. scale of significance, profile overlays, etc) to assist shortlist these indicators for the purposes of the analyses undertaken in Chapters 5 to 8:

- **Scale of Significance** was either at **country** or **city** levels. The exception was customised Oxford Economics economic and population data for Bangalore which was at the Karnataka state level and Mumbai at the Maharashtra state level.
- A **Profile Overlay** was used to compare cities at different **development stages**.

Key Criteria for Critical Indicator Selection

In selecting the 25 indicators for the **City Structure Critical Indicator Matrix** from the City Structure Universal Matrix, two key criteria were used. The indicator selected either had to be explained by or connected to GDP and/or City Population in the following way:

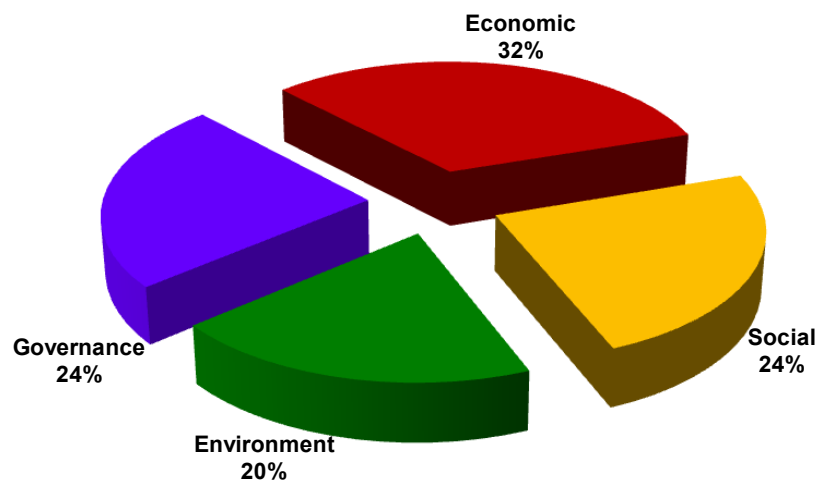
- 1) **GDP**: Had to be measured as a percentage of GDP; could be a component attributed back to measuring GDP; or a GDP based equivalent.
- 2) **City Population**: Had to be measured on a per capita basis; per 1,000 or 100,000 people; percentage of the total city/country population; a component attributed back to measuring City Population; described an aspect of the composition of the City/Country Population; or a City/Country Population based equivalent.
- 3) **Frame of Reference - Scale of Significance**: Indicator data must be provided at preferably city or country level. The exceptions were the Indian cities of Bangalore and Mumbai where customised Oxford Economics economic and population data were provided at state level.
- 4) **Frame of Reference – Profile Overlay**: A profile overlay is a form of template used to classify or filter information. As this research looks at how city structures evolve in various development stages, a profile

overlay was used to categorise cities to enable a comparison of city structures at different **development stages**.

The **City Structure Critical Indicator Matrix** is provided in **Appendix 3**. The Matrix lists the 25 indicators under the key sectors, categories and where relevant, sub-categories. It also provides a reason for why the indicator was selected; identifies if it can be used in another sector's category; a definition of the indicator; where the dataset is sourced; the connection/relevance to GDP and/or City Population and other pertinent comments.

As depicted in **Figure 3.7**, there was a more even cross representation of the key sectors across the 25 Universal Indicators selected compared to the sector composition for the 76 Universal Indicators. Again the higher representation of economic indicators reflects the greater availability of indicators and datasets as per the prescribed indicator selection criteria.

Critical Indicators: Sector Composition



Note: Total number of Critical Indicators - 25

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Figure 3.7: City Structure Critical Indicators: Sector Composition

For indicative purposes, an extract from **Appendix 3: City Structure Critical Indicator Matrix** that provides a typical example for each key sector is listed in the following table (**Table 3.2**).

Table 3.2: Extracts – Examples from Key Sectors

The following tables should be read in conjunction with **Appendix 2: City Structure Universal Indicator Matrix** and **Appendix 3: City Structure Critical Indicator Matrix**.

City Structure Critical Indicator Matrix:					
Key Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP or City Population:	Source:
GOVERNANCE SECTOR INDICATOR:					
Public Spending on Education, Total (% of GDP)	Definition: The World Bank defines this: "<i>Public expenditure on education consists of current and capital public expenditure on education includes government spending on educational institutions (both public and private), education administration as well as subsidies for private entities (students/households and other private entities).</i>" Scales: Country & World	Sector: GOVERNANCE Category: Governance - Leadership & Vision Reason: Identifies the leadership vision, measure of importance & financial support the Government gives to the provision of education and associated services for the entire population - impacts on the general education of the population and reflects the knowledge based capacity of the country's workers and residents.	Other Sectors & Categories: Sector – GOVERNANCE - Fiscal Management Sector - ECONOMIC - Economic Competitiveness - Workforce - Investment & Business Climate. Sector - SOCIAL - Collective Values - Socio-Demographic Trends - Health & Education.	GDP: Indicator would be included as a Government Spending component in calculating GDP & unit expressed as a % of GDP. City Population: Impacts on the country's general level of education as well as the productivity and capacity of the workforce.	Source: World Bank – World Development Indicators

Table 3.2: Extracts – Examples from Key Sectors continued...

City Structure Critical Indicator Matrix:					
Key Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP or City Population:	Source:
ECONOMIC SECTOR INDICATOR:					
Gross Domestic Product (\$USM, Constant 2005 Prices)	Definition: Oxford Economics defines this: "<i>Gross domestic product (GDP) is an aggregate measure of production equal to the sum of the gross values added of all resident institutional units engaged in production (plus any taxes, and minus any subsidies, on products not included in the value of their outputs). It is also the sum of the final uses of goods and services (all uses except intermediate consumption) measured in purchasers' prices, less the value of imports of goods and services, or the sum of primary incomes distributed by resident producer units.</i>" Scales: City & Country	Sector: ECONOMIC Category: - Key Economic Drivers Reason: Measures total economic activity with respect to constant prices and is useful for tracking developments over time (Leong Glastris 2013c). In this instance, the Production Approach is used to calculate GDP where intermediate consumption (e.g. cost of materials, supplies, services, etc used to produce final goods and services) is deducted from the Gross Value of domestic Output from various economic activities (Stutely 2003). It is regarded as a universal indicator with multiplier effects (e.g. increased employment, increased consumption and investment, etc). It reflects how slow/fast a country/city's economy is growing. Developing cities and countries have a relatively higher capacity for faster GDP growth than more developed/mature cities/countries (circa 3% real GDP growth pa) (Wikipedia 2013k).	Other Sectors & Categories: Sector – GOVERNANCE - Regimes of Financial Capital Accumulation and Consumption > Modes of Accumulation - Market Maturity - Fiscal Management Sector - ECONOMIC - Economic Competitiveness - Investment & Business Climate.	GDP: Indicator is a GDP measure and evaluates the economic activity with a city/country. City Population: Economic activity is achieved through its city/country population working at a various levels of productive capacity and implementing multiplier effects. It can be expressed as GDP per capita to evaluate general economic activity with respect to a city/country population.	Oxford Economics - 2013 Customised Data for M Glastris

City Structure Critical Indicator Matrix:

Key Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP or City Population:	Source:
SOCIAL SECTOR INDICATOR:					
City Structure Population (000's People) A) Total City Population ('000s, People) B) Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011 (000's, People)	Definition: a) Oxford Economics defines this: "<i>Total population of the city consists of all persons falling within the scope of the census. In the broadest sense, the total may comprise either all usual residents of the city or all persons present in the city at the time of the census. The total of all usual residents is generally referred to as the de jure population and the total of all persons present as the de facto population</i>". b) The United Nations defines this: "<i>Refers to the de facto population contained within the contours of a contiguous territory inhabited at urban density levels without regard to administrative boundaries. It usually incorporates the population in a city or town plus that in the sub-urban areas lying outside of but being adjacent to the city boundaries</i>". Scales: City	Sector: SOCIAL Category: - Socio-Demographic Trends Reason: Measures total city population (Oxford Economics) or the number of a country's people who agglomerate around urban centres/cities with over 750,000 inhabitants (United Nations). It reflects government's ability to provide a supportive policy and regulatory framework to encourage city population growth. This impacts on economic productivity and capacity levels, tertiarisation and education levels, workforce composition, cultural & religious diversity, community & cultural identity, health and education support and social trade-offs/benefits and the city's ability to attract residents, workers, visitors, etc.	Other Sectors & Categories: Sector – GOVERNANCE - Modes of Governance & Meta-Governance > Capacity - Leadership and Vision - Fiscal Management - Regulatory Constructs > Regulatory Frameworks Sector - ECONOMIC - Key Economic Drivers - Workforce - Investment & Business Climate. - Forms of Capital Sector - SOCIAL - Collective Values - Socio Demographic Trends - Health & Education - Social Trade-Offs Sector - ENVIRONMENT - Urban Environment - Transportation - Water & Energy - Sustainability - Pollution - Environment Trade-Offs	GDP: An increased city population level has the potential to raise economic activity through greater production, investment and consumption. City Population: Indicator provides a direct measure of a city's population.	Oxford Economics - 2013 Customised Data for M Glastris

Table 3.2: Extracts – Examples from Key Sectors continued...

City Structure Critical Indicator Matrix:					
Key Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP or City Population:	Source:
ENVIRONMENT SECTOR INDICATOR:					
Motor Vehicles (per 1,000 people)	Definition: The World Bank defines this: "Motor vehicles include cars, buses, and freight vehicles but do not include two-wheelers. Population refers to midyear population in the year for which data are available". Scales: Country	Sector: ENVIRONMENT Category: - Transportation Reason: Reflects a country's reliance on motor vehicles, motor vehicle consumption and impacts journey to work/speed to markets and urban sprawl trends. It reflects the Government's leadership and vision in planning for future needs in Government urban development, planning, manufacturing/investment and transport policies, tax revenues and expenditures. It also impacts the efficiency of the public transport system, community and business values and expectations of transport efficiencies, living sustainably, and environment trade-offs e.g. traffic congestion, urban sprawl, pollution, etc.	Other Sectors & Categories: Sector – GOVERNANCE - Modes of Governance & Meta-Governance > Capacity - Leadership and Vision - Fiscal Management - Regulatory Constructs > Regulatory Frameworks Sector - ECONOMIC - Economic Competitiveness - Workforce - Investment & Business Climate. - Infrastructure Support - Economic Trade-Offs Sector - SOCIAL - Collective Values - Urban Concepts Sector - ENVIRONMENT - Urban Environment - Sustainability - Pollution - Environment Trade-Offs	GDP: An increased level of motor vehicles has the potential to raise economic activity through greater production, investment and consumption and also to devalue with the cost of offsetting/rectifying economic and environment trade-offs. City Population: Gives an indication of the number of motor vehicles as a proportion of the country's population.	World Bank – World Development Indicators

3.4.2 City Selection

One of the research questions discussed in **Section 3.3 Thesis Topic, Hypothesis, Research Framework and Design**, raised the point the development of city structures could be viewed in terms of a life cycle where there were discernible development stages. Therefore in proving the hypothesis, it was necessary to examine cities in terms of development stages to ascertain if there are common development performance characteristics. Furthermore, if there was an evaluative framework that could be employed to provide meaningful insights into city structure development performance.

Classifying cities into various development stages did pose a “*chicken or the egg*” conundrum. The approaches to city classifications were:

- Analyse all selected cities generally, identify common characteristics and then classify them into their development stages or
- Make an initial attempt to classify the cities into indicative development stages and see if certain common characteristics are borne out in the development performance analysis.

Given the emphasis of this thesis was to evaluate development performance using key indicators, the second approach was adopted.

The second approach enabled the Candidate to keep the analytical focus on development performance rather than potentially going off track analysing a wide array of factors which may or may not have direct bearing on the thesis.

Consequently the development stages within a city structure’s life cycle were identified as:

- Early Emerging;
- Emerging;
- Maturing;
- Mature;
- Obsolescence - Decline; and
- Obsolescence – Re-Growth.

A general description of each of these development stages is included in **Table 3.3**. As outlined above, a key outcome of the proposed research is to identify if there are certain common development performance characteristics that can be ascribed to each development stage.

Therefore the following six key cities and their four respective countries were selected to represent the six different stages of city structure development and were also based on the literature research and the Candidate's industry experience. It is these six key cities that will be the primary research focus for the thesis.

Profile Overlay: City Structure Development Stages - Key City Structures

Profile Overlay: City Structure Development Stages - Key City Structures		
Indicative Development Stage:	General Description:	City Structure and Country:
Early Emerging:	City structures in their initial growth phase of development.	Bangalore , India
Emerging:	City structures in their rapid growth phase of development.	Guangzhou , China
Maturing:	City structures which have entered a moderate growth phase of development.	Sydney , Australia (Established Maturing)
Mature:	City structures approaching a growth plateau in development.	New York , United States of America
Obsolescence - Decline:	City structures which have entered an obsolescence phase and/or are in development decline.	Detroit , United States of America
Obsolescence - Re-Growth:	City structures which have entered an obsolescence-decline phase but have been re-invigorated and are in a re-growth phase.	Shanghai , China

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Table 3.3: City Structure Development Stages - Key City Structures

It is acknowledged that some of the key cities are located in the same country such as Detroit-New York and Guangzhou-Shanghai and that an attempt could have been made to look broadly geographically. However it was reasoned that it would be useful to analyse some cities on a country basis. But as will be discussed shortly in this section, a further range of cross reference cities was selected both to broaden the geographic and development stage representation and to facilitate a wider analysis across multiple fronts.

It is further acknowledged that some of these cities can remain in a particular stage for decades, whilst other cities transition more rapidly across development stages.

An additional 25 cities and their 15 respective countries were selected for cross reference purposes and were selected on the basis of cross representation on a development stage and geographic (EMEA, Asia Pacific, Americas, etc) basis. These additional cities were: Adelaide, Athens, Auckland, Beijing, Berlin, Boston, Brisbane, Budapest, Dubai, Hong Kong, Jakarta, Johannesburg, London, Los Angeles, Manchester, Melbourne, Moscow, Mumbai, Paris, Perth, Sao Paulo, Singapore, Tel Aviv-Jaffa, Tokyo and Toronto. The classification of these cross reference cities into the six development stages is tabled in **Table 3.4**.

Profile Overlay: City Structure Development Stages – Cross Reference City Structures

Profile Overlay: City Structure Development Stages - Cross Reference City Structures		
Indicative Development Stage:	General Description:	City Structures
Early Emerging:	City structures in their initial growth phase of development.	Jakarta; Johannesburg
Emerging:	City structures in their rapid growth phase of development.	Sao Paulo; Mumbai; Dubai; Tel Aviv-Jaffa
Maturing:	City structures which have entered a moderate growth phase of development.	Early Maturing - Singapore; Auckland; Melbourne; Brisbane; Adelaide; Perth; Boston; Berlin Established Maturing - Los Angeles; Moscow; Toronto; Hong Kong
Mature:	City structures approaching a growth plateau in development.	Tokyo; Paris; London
Obsolescence - Decline:	City structures which have entered an obsolescence phase and/or are in development decline.	Athens; Budapest; Manchester
Obsolescence - Re-Growth:	City structures which have entered an obsolescence-decline phase but have been re-invigorated and are in a re-growth phase.	Beijing

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Table 3.4: City Structure Development Stages – Cross Reference City Structures

Within the Maturing cities selected, it was later noted there were some distinct differences within this group which necessitated the split into Early Maturing cities and Established Maturing cities.

As mentioned earlier, the initial classification of these cities into development stages was based on the general descriptions tabled earlier (**Tables 3.3-3.4: City Structure Development Stages - Key Cities & Cross Reference Cities**), the literature reviewed and the Candidate's industry experience in global real estate investment, research and advisory. There was however one instance where one cross reference city was re-classified. Budapest was initially classified as an emerging city by the Candidate in light of the many international funds managers investing in the city to take advantage of high growth and return opportunities in the 2005-2008 period. However, as subsequent literature and research analysis has borne out, Budapest has hop scotched into the Obsolescence – Decline stage where the Global Financial Crisis aftermath has precipitated its development decline. This showed that the proposed research methodology and evaluation metrics were successful in identifying Budapest as an outlier and identifying the need for it to be re-classified. Generally however, the initial classification approach was successful in enabling both the key and cross reference cities and their respective large swathes of data to be more conveniently evaluated.

Where available, aggregated World average or proxy (e.g. OECD average) data were also collected for a number of the City Structure Universal Indicators.

3.4.3 Data Sources

Key to data source selection was that indicator data used for this research should be sourced from world recognised institutions and be publicly/freely available (preferably online) so large tracts of data could be downloaded electronically and in a timely manner, reviewed and incorporated into the City Structure Universal Indicator Matrix database. However as will be discussed in section **3.6 Assumptions and Limitations**, there were limitations on publicly/freely available indicator data at the city structure level. This generated the need to acquire customised data to complement the publicly available data.

Another important criterion was that institution data source providers maintain a strong reputation for developing robust research methodologies and for providing accurate, reliable, timely and consistent data. The two types of data sources, Publicly Available Data and Customised Data, are discussed in the following sub-sections.

It should be noted that some of these sources (e.g. World Bank, Oxford Economics) conducted primary research and/or also acted as a secondary source or conduit collecting data from primary sources (e.g. individual country bureaus of statistics, etc), cross referenced and/or worked with other data providers to provide various datasets. There was also a preference for using these key data source providers who could tap into primary data from individual country bureau of statistics and other sources and make the appropriate adjustments as per their research methodology requirements to ensure there was accurate, reliable, timely and consistent treatment. This facilitated a more methodologically rigorous approach and enabled indicators to be readily compared globally across cities in a consistent manner – as opposed to sourcing data from individual country bureau of statistics and other data sources and addressing methodological and compatibility concerns.

The list of Universal Indicators, their respective sources and selection rationale are provided in **Appendix 2: City Structure Universal Indicators Matrix**.

3.4.3.1 Publicly Available Data

To ensure modelling ease, statistical accuracy, data consistency, an ability to obtain longer historical (and where available, forecasted) time series and at different scales (e.g. world, country and/or city levels), the majority of this quantitative data was sourced from primary and secondary database sources online. In some instances, the research publications were downloaded or books were referenced and the data manually data entered.

These eight key institutional data sources and their respective database(s)/research are listed below in descending order of most intensively sourced:

- **World Bank (WB)** – World Development Indicators, Education Statistics – Barro and Lee (World Bank 2008, 2012a, 2012b, 2013a, 2013c).
- **United Nations (UN)** – World Population Prospects, World Urbanisation Prospects, Population of Urban Agglomerations with 750,000 Inhabitants or More, United Nations Energy Programme (UNEP) The Emissions Gap Report and State of the World's Cities 2010/2011 - Cities for All: Bridging the Urban Divide (United Nations - Habitat 2002, 2012; United Nations 2011a, 2011b, 2011c, 2011d, 2012, 2013; United Nations Department of Economic and Social Affairs 2011b; United Nations Energy Programme (UNEP) 2012; United Nations Human Settlements Programme UN-HABITAT 2008);

- **International Monetary Fund (IMF)** – World Economic Outlook Databases and Reports, International Financial Statistics and Balance of Payments Database (International Monetary Fund 2011a, 2011c, 2011b, 2012a, 2012b, 2013a, 2013b, 2013c; International Monetary Fund 2012c, 2013d);
- **Demographia** – Demographia World Urban Areas (World Agglomerations) publications (Demographia 2000, 2005, 2007, 2009, 2010, 2011, 2012, 2013a, 2013b);
- **Globalisation and World Cities (GaWC) and Professor P.J. Taylor** – GaWC databases and research publications and Professor Peter J. Taylor's book "*Global Urban Analysis*" and requested 2004 data (Globalization and World Cities (GaWC) Research Network 2010; Taylor 2000, 2004a; Taylor 2004b; Taylor et al. 2011);
- **CB Richard Ellis (CBRE)** – Global Market View: Office Occupancy Costs and Detroit Office MarketView publications (CB Richard Ellis (CBRE) Global Research and Consulting 2008, 2009, 2010, 2012, 2013a, 2013b);
- **Organisation for Economic Cooperative Development (OECD)** – OECD Factbook and Education at a Glance (OECD 2010, 2011, 2012, 2013); and
- **World Economic Forum (WEF)** World Competitiveness Report (World Economic Forum 2008, 2009, 2010, 2011, 2012, 2013).

3.4.3.2 Customised Data

Where there was insufficient economic indicator data at a city level, customised data was obtained from Oxford Economics. A research brief was prepared by the Candidate specifying selected cities, data outcomes and requesting information on research methodology, definitions, assumptions and limitations.

Oxford Economics provided data for **City Total Population** (number of people); **Gross Domestic Product** (Millions US\$ Constant 2005 Prices); **Household Disposable Income** (Millions US\$ Constant 2005 Prices); and **Employment** (number of people). Subject to city and country level data availability, historical data was provided for 1980-2013 and forecasted data from 2014-2025. This data was across 27 key and cross reference cities and 17 countries.

3.4.4 Data Treatment

Data compilation, screening and normalisation for 76 indicators for each of the 31 cities, 19 countries and world aggregates over timeframes that varied between 1950-2100 constituted a time intensive task. There were

over 1,700 city and country indicator fields populated with annual or five yearly data for up to 150 years. The following sub sections discuss data compilation and data screening and normalisation.

3.4.4.1 Data Compilation

Data required for the identified list of Universal indicators was downloaded/referenced from publicly available and customised data sources (previously discussed in sub-section **3.4.3 Data Sources**). The information was then collated, compiled and sorted in a central master database in a series of spreadsheets sorted by Country to facilitate comparative analysis of multiple cities within a country and globally.

As different analyses were conducted as part of the Proof of Concept stages, individual city/country datasets were selected and consolidated into spreadsheets sorted by the type of analysis required and within the spreadsheet were grouped by key cities, cross reference cities and cities classified by development stages.

3.4.4.2 Data Screening and Normalisation

Data for each of the 76 indicators was evaluated, quality screened, adjusted and checked in cross sections with respect to time (3-150 years) and country and/or city levels.

The data was evaluated initially in terms of reliability, accuracy and consistency of data as well as the length of the time series provided (both historically and forecasted),

In terms of quality screening, anomalies (e.g. outliers, identification of missing gaps in data series, etc) were investigated, excluded and/or noted.

In terms of making adjustments, data was compiled from multiple sources and either electronically pasted or data entered, transposed (where required), converted (where required), interpolated (where required), checked and updated for each of the 76 indicators for each of the 31 cities and/or 19 countries and where available aggregated World data that extends between 1950-2012/2013 and for some indicators extends from 2013/2014 to 2015, 2025 or 2100.

As is expected with large volumes of historical data, there were gaps/missing data, outliers and numerous revisions in data. Data treatment techniques were employed for collecting, screening, interpolating, testing and analysing data. Considerable time was required to collate, normalise and compile data from multiple sources for each of the 76 indicators at either city/country and where available, world level. During the course of the analysis for this thesis, the majority

of these indicators were updated where the steps outlined above were repeated in 3-5 update rounds.

Where prudent, any indicator and its requisite city/country datasets which had insufficient or questionable data, was discarded and another more appropriate indicator and its data were substituted.

3.5 Assumptions and Limitations of Research Methodology and Data Collection

There is currently a large range of indicators available. However, when weighed against critical factors (e.g. data source providers having a strong reputation for developing robust research methodologies and for providing accurate, reliable, timely and consistent data at a city and/or country level), the field narrows to a smaller set of indicator data. The following sub-sections examine key underlying assumptions and limitations regarding the thesis' research methodology and data collection.

3.5.1 Assumptions

Key concepts such as “**City Structure**” and “**City Structure Development Performance**” were defined and discussed in **Chapter 1 Introduction** and **Chapter 2 Literature Review**.

Key definitions and abbreviations used for this research were compiled in the **Glossary of Key Terms and Abbreviations** located at the beginning of the thesis.

In evaluating indicators and their datasets for selection and subsequent analysis, the research methodology for constructing the indicator (where available), a definition of the indicator, its time series and geographic coverage, any relevant assumptions, source(s) of data and other assumptions were reviewed. This information was summarily noted in the Notes section of **Appendix 2: City Structure Universal Indicators Matrix**.

Oxford Economics were asked to provide GDP in terms of one currency, US\$M and at constant 2005 prices for all cities to facilitate comparative analysis and avoid current currency and purchasing power parity exchange rate issues.

In terms of growth rates applied to city structure population forecasts, for its urban agglomerations the United Nations applies an “*Average exponential rate of growth of the population of urban agglomerations over a given period*” (United Nations Department of Economic and Social Affairs 2011b: Glossary of Demographic Terms) whilst Oxford Economics assumes “*Regional **population** forecasts are predominantly*

based on official population projections produced by National Statistical Agencies and/or organisations such as Eurostat where available. Small adjustments are sometimes made by Oxford Economics to the migration assumptions underpinning these official projections to allow for relative future job opportunities (to allow for the fact that migratory labour tends to be attracted to places with the strongest perceived job opportunities). Regional projections are also constrained to be consistent with the most up to date national projections (these too may include adjustments by Oxford Economics to the migration assumptions)" (Oxford Economics 2013: Methodology Notes).

3.5.2 Limitations

Indicator data from the eight key data sources were consolidated, compiled and a consistent research methodology applied for all selected cities/countries. There were, however, still inherent limitations.

Each of these key limitations and how they were addressed are discussed below.

3.5.2.1 Obtaining data over a significant time series

A key criteria in indicator selection was to obtain accurate, reliable, timely and consistent indicator data over a significant time series. As highlighted previously, there were difficulties in obtaining indicator data of this calibre. Ideally the time series should be 20-60 years in order to capture longer term trends in development performance. In reality there were instances where only smaller time series data were available for some indicators.

To overcome these limitations, data source providers with strong research credibility (with widely recognised and accepted research methodologies and data outcomes) were identified and investigations were undertaken to determine what indicator data was available and on what basis. Preference was given to data providers who were able to provide clear guidance on their assumptions and limitations (e.g. definitions, methodology, data sources, etc), had strong city/country/geographic and time series coverage and who provided regular updates (preferably on quarterly, semi-annual or annual basis) on these indicators.

In some instances, forecasted indicator data up to 2025 and even 2100 were obtained and were used which considerably extended the time series. For example, Oxford Economics customised indicator data at country and city levels provided data from anywhere between 1980 to 2025. Similarly, United Nations urban agglomeration city population

indicator has a time series extending from 1950-2100 in five year intervals for all of the key and cross reference cities.

Reliance on time series data from different sources may also pose some limitations. Whilst utmost care was undertaken to check there were no significant changes to research and data collection methodology, unless undertaking the primary research directly, it is impossible to control these changes. In order to gain insights on the longer term development of cities and enable development performance trajectory modelling for the thesis, it is acknowledged that some data inconsistencies must be accepted as part of the assumption and limitation base.

It is also acknowledged, that whilst an evaluative framework (City Structure Universal Indicator Matrix) was constructed to guide indicator selection and notwithstanding the other limitations discussed in this section, after the quality and availability of the indicator and its datasets, assumptions and limitations were evaluated, prudent judgement was exercised in the final selection of the Universal Indicator Matrix of 76 indicators which were subsequently shortlisted down to the Critical Matrix of 25 indicators.

3.5.2.2 Obtaining indicator data at a city level

One of the most challenging problems regarding data collection was obtaining indicator data at a city level for a wide range of cities. This view regarding the lack of comparable data and its associated challenges has also been expressed by a number of other researchers (Beall, Guha-Khasnobis & Kanbur 2010; Kim & Short 2008; Taylor 2004b: 20-38, 74-78 & 31-42 respectively).

Whilst a large amount of publicly/freely available data exists for countries, regions and even markets, there was considerably less information on cities that met the criteria outlined previously in sub section **3.5.2.1 Obtaining data over a significant time series**.

To overcome this limitation, available city level data was obtained through:

- Downloading online data from sources such as the UN, Demographia and CBRE;
- Directly requesting data/research from authors/researchers such as Professor P. J. Taylor and Dr. Michael Hoyler (GaWC) and Dr. Ray Torto (CBRE);
- Purchase of customised data from Oxford Economics (Oxford Economics 2013) or research as part of a book/research publication (Taylor et al. 2011); and

- Deriving new indicators from existing indicators e.g. using GDP per capita and office occupancy costs to create “**Revenue Multiplier**” and deriving “**City Structure Development Performance Trajectory Determinants/Indicators**” from the customised data obtained from Oxford Economics.

The majority of city level Critical Indicator data obtained was based in the sectors of **Economic** (Gross Domestic Product, Household Disposable Income, Employment, Unemployment, Global Network Connectivity Score and the subsequently derived Revenue Multiplier) and **Social** (Total City Population, Population of Urban Agglomerations and Population Density). No **Governance** indicators were available at a city level and one Environment indicator (City Office Occupancy Costs) was available at a city level in light of the indicator selection criteria discussed.

It was reasoned that whilst there were no direct Governance indicators at a city level, broader/larger issues affecting sovereign debt, migration, health, ageing and education are often formulated at national government policy level. These aspects were picked up in the Governance indicators at a country level within the Matrix. In addition, all other Economic, Social and Environment indicators at city level have some cross-representational element which can also be attributed to Governance aspects/sub-categories (refer to **Appendix 2 City Structure Universal Indicator Matrix** for comments on proxy) thus enabling a separate analysis of Governance aspects.

It is acknowledged that whilst it was desirable/ideal to have a greater number of indicators at a city level, the severe limitations of data availability and other indicator selection criteria previously discussed prohibited the collection of additional data for further analysis.

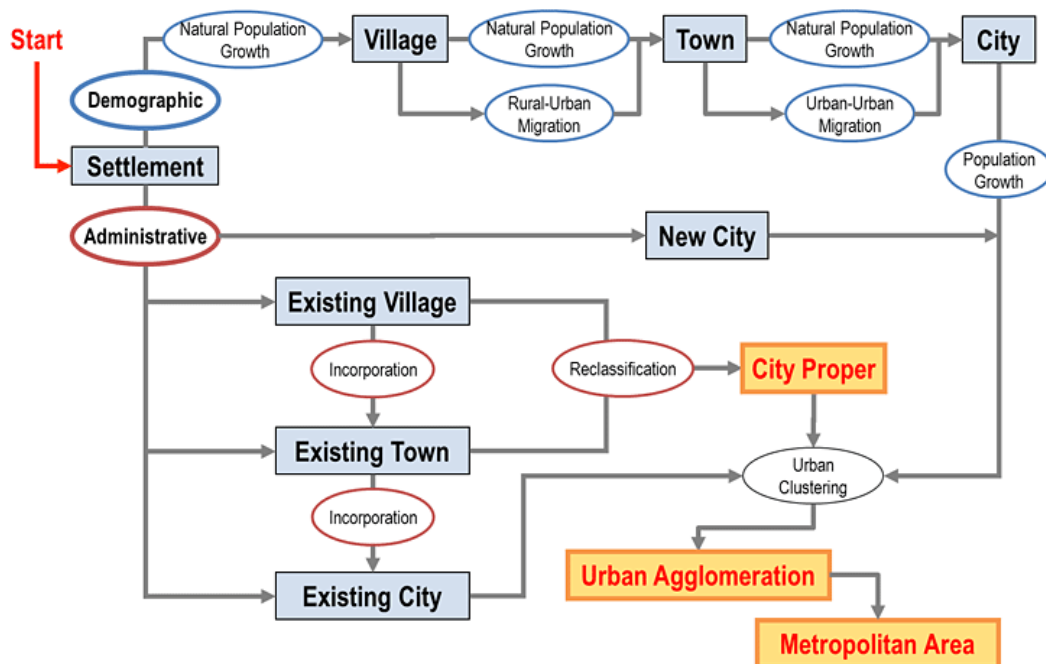
Consequently there was an increased focus on the customised economic and population city indicator level data obtained from Oxford Economics as well as UN population data, particularly for the development performance trajectory analysis. This was later complemented with a wider analysis of the compositional aspects of city population in addition to the initial longitudinal and cross-sectional indicator analyses which examined indicators at both city and country level across all four indicator sectors.

3.5.2.3 Geographic Coverage

Whilst the United Nation’s Urban Agglomeration population data provides a city level population dissemination for historical and projected data, it does have certain limitations which should be acknowledged.

The United Nations acknowledge a number of challenges associated with classifying, tracking and estimating the population of urban agglomerations. In particular, discerning population growth that emanates from natural population growth factor (e.g. population increases resulting from net births, accretion from migration from rural or other urban agglomerations) versus population growth that stems from administrative changes e.g. city boundary definitions, re-naming urban agglomerations, etc. The United Nations have documented these challenges in the following flowchart (refer to **Figure 3.8: United Nations: World Urbanisation Prospects – Methodology Definition Problems**).

World Urbanisation Prospects - Methodology Definition Problems



Source: United Nations, Department of Economic and Social Affairs, Population Division: *World Urbanization Prospects, the 2011 Revision*, New York 25/4/2012 Update

**Figure 3.8: United Nations: World Urbanisation Prospects – Methodology
Definition Problems**

A more detailed explanation is provided on their website documenting definition problems (United Nations Department of Economic and Social Affairs 2011a: Methodology Definition Problems). In summary, in their *World Urbanization Prospects* database and report the United

Nations have made a concerted effort to “*prepare consistent population estimates over historical time periods for human settlement that follow the same definition. This often requires that historical population estimates have to be re-adjusted to a current definition that may not necessarily coincide with other popular definitions for that city*” (United Nations Department of Economic and Social Affairs 2011a: Methodology Definition Problems).

In addition to the United Nations’ challenges, overall data collection at city level from other multiple institutional sources also proved challenging. The lack of city data was markedly noticeable for less developed cities where the country (usually a Bureau of Statistics or equivalent) simply did not track the information or was inconsistent in its coverage.

Given the difficulties in obtaining city level data for a reasonable time period and for the 31 key and cross reference cities, customised economic and population data was obtained from the renown institution, Oxford Economics for 29 of the cities (no data was available for Dubai or Tel-Aviv-Jaffa). Both historical (typically ranging from 1980-2013) and forecasted (2014-2025) data was provided at both country and city levels.

Another key case in point was the lack of available indicator data for Indian city structures as per the criteria outlined previously in sub section **3.5.2.1 Obtaining data over a significant time series** and **3.5.2.2 Obtaining indicator data at a city level**. City level data for Bangalore and Mumbai was simply not available from the Statistics of India - Department of Statistics and Economics; Office of the Registrar General and Census Commissioner, India; or the Reserve Bank of India.

To overcome this limitation, United Nations urban agglomeration city population indicator data was used for Bangalore and Mumbai. However obtaining key economic data for the two Indian cities was more problematic. Because this data was not collected and made available by the usual primary research providers such as the three identified above, Oxford Economics were subsequently unable to provide data at the city level. Consequently data was provided at the next level up which was at a state level. Therefore the customised Oxford Economics data was provided for Bangalore - Karnataka and Mumbai – Maharashtra. Other geographic definitions for the Oxford Economics customised data are presented in **Table 3.5**.

Oxford Economics Customised Data: Geographic Definitions

Oxford Economics Customised Data: Geographic Definitions		
Country/Region	City	Geographic Definition
Australia	Sydney	Statistical Division
	Melbourne	Statistical Division
	Brisbane	Statistical Division
	Perth	Statistical Division
	Adelaide	Statistical Division
New Zealand	Auckland	Regional Council Area
China	Shanghai	Provincial Level Municipality
	Beijing	Provincial Level Municipality
	Guangzhou	Sub-Provincial City
Hong Kong	-	Special Administrative Region (SAR)
Indonesia	Jakarta	Special Capital Territory of Jakarta (DKI Jakarta)
Singapore	-	Republic of Singapore
Japan	Tokyo	Southern-Kanto Region (Greater Tokyo Area)
		Tokyo Prefecture
EMEA	Moscow	City of Moscow
	London	NUTS2 or NUTS3 region
	Manchester	NUTS2 or NUTS3 region
	Athens	NUTS2 or NUTS3 region
	Budapest	NUTS2 or NUTS3 region
	Paris	NUTS2 or NUTS3 region
	Berlin	NUTS2 or NUTS3 region
	Johannesburg	City of Johannesburg Metropolitan Municipality
Americas	Sao Paulo	Metropolitana de Sao Paulo
	Toronto	Census Metropolitan Area (CMA)
	New York	New York-Northern New Jersey-Long Island, NY-NJ-PA (Metropolitan Statistical Area)
	Boston	Boston-Cambridge-Quincy, MA-NH (Metropolitan Statistical Area)
	Detroit	Detroit-Warren-Livonia, MI (Metropolitan Statistical Area)
	Los Angeles	Los Angeles-Long Beach-Santa Ana, CA (Metropolitan Statistical Area)
India	Bangalore	State of Karnataka - No city level data available
	Mumbai	State of Maharashtra - No city level data available

Source: Oxford Economics

Table 3.5: Oxford Economics Customised Data: Geographic Definitions

It should be noted that where customised data from Oxford Economics was obtained and due to the unavailability of some data at a city level, state or province level data was provided as the next smallest discrete unit. For example, city level data for Bangalore and Mumbai was unavailable because the *Office of the Registrar General and Census Commissioner India* does not publish data at a city level. Therefore Oxford Economics provided state level data respectively for Karnataka and Maharashtra. Similarly Provincial Level Municipality data was provided for Shanghai and Sub-Provincial City data was provided for Guangzhou. Where required this was taken into account and noted in the analysis. In comparison United Nations City Population data is based on city urban agglomerations of over 750,000 inhabitants (United Nations 2013; United Nations Department of Economic and Social Affairs 2011a) and the UN data methodology and limitations have been documented (Beall, Guha-Khasnobis & Kanbur 2010; United Nations 2013; United Nations Department of Economic and Social Affairs 2011a).

The United Nations city population indicator used was “**Population of Urban Agglomerations with 750,000 inhabitants**” where all of the key and cross reference cities met this threshold. The city populations used by United Nations and Oxford Economics were closely matched and showed a strong correlation of +/- 0.70 and greater (Everitt 2010; Johnson & Wichern 2007; Levine et al. 2008) which ranged from -0.97

(Detroit) through to +0.85 (Tokyo) to +1.00 (Adelaide, Brisbane, Melbourne, Perth, Singapore and Johannesburg). Even where the city populations varied markedly from the state populations for Bangalore and Mumbai, the way in which the population size moved between the two datasets were still highly correlated at 0.99 and 1.00 respectively. The only two exceptions where there was a poor correlation between the two datasets were for the cross reference cities Budapest and Manchester. Refer to **Table 5.1: Summary Table of Correlation Analyses for the Key Cities**, sub section **6.3.3 Key Limitations** and **Appendix 4 Correlations Tables – Critical Indicators**.

In addition, there were two cross reference cities and their respective countries where data was unavailable and/or limited from Oxford Economics and other publicly available data sources. These were Dubai in the United Arab Emirates and Tel Aviv-Jaffa in Israel. Whilst these two cities were not part of the six Key Cities and therefore of primary research focus, analysis on these two cities for cross reference purposes was limited.

3.5.2.4 Different data assumptions and limitations from multiple data sources

Given data was being compiled from multiple sources, differences in data assumptions and limitations were inevitable. These concerns were compounded when other critical research methodology and data collection aspects were brought into play such as reliability and longevity of the time series; changes in research methodology; a lack of transparency in research methodology; discrepancies in definitions and/or geographic coverage, interrupted or discontinued coverage, etc.

These limitations were overcome by investigating concerns regarding research methodology and data collection aspects further by downloading methodology, assumptions and limitation information that corresponded to the indicator and data. If the information provided failed to satisfactorily explain these concerns, the Candidate directly approached the data providers themselves requesting further clarity. In such cases requests for missing/additional data/research and/or questions on research methodology and assumptions resulted in additional data/answers. Such data and information was obtained from:

- **Professor Peter Taylor**, GaWC Director (City Networks and City/State Relations) and **Dr Michael Hoyler**, **GaWC Associate Director (European Cities)**, Loughborough University.

- **Monsieur Francois Pelletier**, Chief, Population Estimates and Projections Section, United Nations Population Division;
- **Mr Anthony Light**, Head of International City Forecasting, Oxford Economics;
- **Dr Ray Torto**, Global Chief Economist and Executive Managing Director of Global Research and Consulting, CBRE.

3.5.2.5 Challenging Research Methodologies

According to David Satterthwaite (Beall, Guha-Khasnobis & Kanbur 2010: David Satterthwaite's Chapter 5 "*Urban Myths and the Mis-Use of Data that Underpin Them*": 83-99) the data collected and associated data collection processes for the UN raises several concerns. In summary, Satterthwaite highlights the following:

- Official definitions for urban populations (that includes settlements with 20,000 or more inhabitants) can vary depending on what smaller settlements government include as urban centres;
- The use of city boundaries to define cities and their population depends on whether the city proper, metropolitan area or a wider planning (or administration) region is being considered;
- Lack of census data impacts on the accuracy and timeliness of the urban population statistics particularly where urban trends may have changed dramatically in the 1980-90s and have not been accurately reflected in the historical data and/or adequately adjusted for in the forecasts data.
- Generation of myths (urban growth in emerging/developing countries, population growth in low-middle income nations, primacy and urban bias and data limitations distorting urban policies) based on making claims predicated on urban population data that fails to recognise limitations in the urban data.

There is significant merit in what Satterwaite has highlighted. Unfortunately within the scope of this research, there is little that can be done to directly redress concerns at a broad spectrum level. However it is important to remain cognisant of the challenges posed when using urban population indicator data in the proposed analyses.

3.5.2.6 Importance of Indicator Data with a Short Time Series

There is significant value in analysing longer time series data particularly when evaluating development performance trends of cities over 20-60 years. However, more recent and perhaps significant trends which were

not present decades ago, may be highly influential now and in the future.

Some of these indicators have only been recently established (3-5 years) and though they lack a longer trend series to model more accurately, are important to include because they reflect deeper underlying structural changes that may not have been relevant/dominant 30-60 years ago. For example, impacts of globalisation or recent waves of technological innovation due to computer and internet technology advances. Therefore, where possible, some of these indicators were used to capture short term trends and are presented in cross sectional analyses or as snapshots in time.

3.5.2.7 Lack of Transparency in Research Methodology for City Based Indices

One final limitation involves the lack of transparency in research methodology developed for indices based on cities. There are a growing number of these indices being produced such as the Economic Intelligence Unit's *Global City Liveability Index*; Hales and Pena *AT Kearney 2012 Global Cities Index and Emerging cities Outlook*; United Nation's *City Development Index* and Jones Lang La Salle's *Global Transparency Index*; (Economic Intelligence Unit 2008; Hales & Pena 2012; Jones Lang LaSalle 2012; United Nations Human Settlements Programme UN-HABITAT 2008).

However when some of these indicators are investigated further with respect to methodology, data sources, assumptions and limitations, time series and geographic coverage, a "Black Box Mentality" becomes evident. Information is not available either because some key aspects were not considered/poorly considered or the data providers do not wish to have their research/product subjected to scrutiny (be it for commercial in confidence reasons or for evasive reasons).

There are also inherent dangers in using too many of these indices as indicators, not only from a lack of transparency, limited time series and geographic coverage perspective, but also in terms of the assumptions adopted and how various factors/components may be weighted to aggregate to the index itself.

To overcome this limitation, only one index was selected as a Critical Indicator, the "*Global Network Connectivity (GNC) in the World City Network Connectivity Score*" produced by Professor Taylor and colleagues (Taylor 2000, 2004a; Taylor et al. 2011). The reason this indicator was selected despite only having limited data (2000, 2004 and 2008), was that it measures how well connected a city is within the world city network in terms of connectivity of "Advanced Producer Services"

such as legal, accounting, advertising, business, real estate services firms that have offices located globally. The research methodology was explained at length, robustly developed by academic researchers and is an interesting, insightful indicator given the ever increasing globalisation push for connectedness to cities via business, financial, people and information networks.

One other index was included in the Universal Indicator Matrix – this was the Global Competitiveness Index (GCI) produced by the World Economic Forum in their annual “*World Competitiveness Report*” (World Economic Forum 2013). This is a highly commendable index which provides an aggregated index which comprises indicators compiled across 12 pillars (1) Institutions; 2) Infrastructure; 3) Macroeconomic Environment; 4) Health and Primary Education; 5) Higher Education and Training; 6) Goods Market Efficiency; 7) Labour Market Efficiency; 8) Financial Market Development; 9) Technological Readiness; 10) Market Size; 11) Business Sophistication; 12) Innovation. The GCI collectively provides both a score as well as a ranking. GDP per capita thresholds are used to classify economies into Factor-driven, Efficiency-driven and Innovation-driven as well intermediary/transition economies. Whilst it produces an insightful analysis which can be used as a Universal Indicator, it only examines competitiveness at a country level. Furthermore, a number of the indicators used are either similar/identical to some of the indicators already selected for the Universal and/or Critical Indicator Matrices.

Overall however and in light of the above limitations regarding indices, there was a marked preference to use individual indicators for modelling to obtain a more comprehensive picture of what key individual indicators drive city structure development performance and their synergistic effects.

3.5.2.8 Reliability of the Data and Data Methodology

Given the time and resource constraints it was not feasible to undertake primary/field work to obtain all of the datasets required for each indicator. Therefore there was a heavy reliance on external data source providers to capture the data using credited research methodologies. Given the difficulties in obtaining data at a city level (particularly over 20-60 years), collection of data was challenging.

The data was reasonably reliable given the use of eight key data source providers with strong reputations for developing robust research methodologies and for providing reasonably accurate, reliable, timely and consistent data.

In utilising this data, careful consideration was given to selecting indicators and their respective datasets that were prescribed in the indicator selection data discussed earlier. All assumptions and limitations of the data were duly noted and considered when using the data for analysis. As discussed earlier, senior executives within the data provider organisation were contacted if there were concerns that needed clarification or if additional data was required. It is acknowledged that whilst the situation was imperfect, the Candidate was able to work with realistically obtained datasets in a productive and efficient manner which formed the basis for credible analysis and results.

3.6 Chapter Conclusion

Chapter 3 Research Methodology and Data Collection formulates a research methodology for undertaking the proposed research. In particular it examines key considerations regarding the methodological approach (i.e. research design; research methodology and data collection; data assumptions and limitations).

The knowledge gained from this chapter establishes the rationale and methodological framework for constructing a unique and useful:

- Evaluative platform in terms of **Frames of Reference** (e.g. City Structure Universal Indicator Matrix and City Structure Indicator Matrix); **Key Analyses** (e.g. Analysis A and Analysis B); and **Evaluative Tools** (e.g. Development Performance Trajectory Formulae and other analyses);
- Basis for indicator and city selection;
- Identification of data sources and treatment.

It is anticipated this knowledge will assist fellow researchers and practitioners in the investigation and evaluation of the development performance of city structures.

Chapter 4

Frames of Reference



Sydney CBD Core Precinct Skyline – Features some Premium Investment Quality Global Finance, Banking and State Government Buildings

Source: Kyle Willimott

“The city is essentially a meeting place. It is valued by the character of its availabilities. A city should be a place where a little boy walking through its streets can sense what he someday would like to be.”

(Kahn 1973: Extract from lecture delivered to the Fleisher Art Memorial).

4 Frames of Reference

4.1 Chapter Outline

This chapter commences with a discussion on adopting a “*Systems Thinking*” approach and builds on this concept to develop a series of frames of references that enable a segment of knowledge to be positioned, stored and/or filtered. These frames of references are then used to subsequently undertake proof of concept Analyses A (City Structure Development Performance Trajectory Analysis) and B (Compositional Aspects of City Structure Population).

4.2 Adopting a “Systems Thinking” Approach

With this complexity in mind and based on the Literature Review and the Candidate’s experiences, a holistic perspective based a “*Systems Thinking Approach*” has been applied to develop an evaluative framework and tools that identify the processes and system for collecting, evaluating and transforming a wide body of information on city structure development.

A “**System**” is defined as “*a group of interacting, interrelated, or interdependent components that form a complex and unified whole*” and have five essential characteristics (Anderson & Johnson 1997: 2-3). The concept of “**Systems Thinking**” is based on the process of understanding why a system behaves in a certain manner and how a system is likely to behave in the future (Sherwood 2002).

Therefore a city structure can be viewed as a complex system that comprises a series of interconnected drivers or key indicators. It is the identification of these key drivers, their synergies and the evaluation of how they determine the performance of city structure development that is the primary focus of this research.

Relating Anderson’s five essential characteristics of systems to city structures (Anderson & Johnson 1997: 3-5):

- 1) ***In order for a system to perform optimally, it must have all its parts or components.*** In order for a city structure to perform optimally, it must have certain governance, economic, social and environment based drivers or indicators in place.

For example if there is an insufficient economic base such as a lack of capital investment in a particular “city structure system”. The knock on consequences could result in the reduction of investment activity and consequent weaker economic stimulus. If not provided, city structure system performance may wane; governance may become difficult/ineffectual as business transparency and market

maturity is not supported by efficient policy and regulatory platforms; businesses may become increasingly discontent with insufficient or obsolete infrastructure and amenities; business certainty, returns and investment climate are adversely affected; employment may stall, etc. This reinforces the degenerating cycle of the city structure system. Its city stakeholders (e.g. workers, investors, residents, etc) may decide to relocate elsewhere for better, more productive prospects.

- 2) ***A system's parts must be arranged in a specific way for the system to operate.*** Key drivers, information flows, networks and feedback loops all impact within the city structure system. It is important to consider how these factors develop and evolve within the "city structure system".
- 3) ***Systems have specific purposes in relationship to larger systems.*** City structures develop at various scales of significance and maintain relationships with other external systems. This involves building interactions and networks between that city structure system and other city structure systems, nationally, regionally and globally.

With the rapid onset of globalisation, city structures no longer operate in a vacuum but are now part of an increasingly wider regional and global network system e.g. the tackling of poverty at city structure, national, regional and global scales.

- 4) ***Systems maintain their stability through fluctuations, interactions, feedback and adjustments.*** In order for city structures to successfully develop, these city structure systems need to have an ability to fluctuate, take measure, self-adjust, etc. This involves using a continual "check and balance" to monitor, interpret, adjust and evolve the development performance of city structures.

For example, if a city structure signals traffic pollution is getting out of hand, its governance regulators may put in place indicators to monitor and improve traffic congestion, investigate and improve air quality throughout the city structure and around major transport hubs, encourage and endorse more efficient public transport systems and routes, plant more parks, etc. Other stakeholders may also decide to reduce traffic pollution by taking direct action. Companies may encourage their employees to car pool or take public transport, allow flexibility in work hours, corporate sponsor community groups and industry organisations to counter traffic pollution, etc. Residents may decide to make other life style changes to do their bit to fight traffic pollution e.g. walk, cycle or take public transport to work; volunteer to plant more trees in green areas and parks, etc.

5) **Systems have feedback which is the transmission and return of information both within the system and between itself and external systems.** With the impact of globalisation, international trade and the exchange of capital (human, financial, information and other forms of capital) city structures are tied into a wider network of other city structures, national, regional and global systems.

The concepts of hierarchies of scale (where characteristics of a system can be quantitatively measured); the nesting of hierarchy across multiple scales; and the holon (an evolving, self-organising structure which is simultaneously a whole and a part where holons act as autonomous, self-reliant units) (du Plessis 2008; Koestler 1969) are useful concepts to consider when examining complex systems which contain a multi-levelled hierarchy of sub wholes/holons and are across multiple scales.

These “Systems Thinking” approach and concepts can be applied to the Frames of Reference developed for this thesis and are examined in the following section.

4.3 Frames of Reference

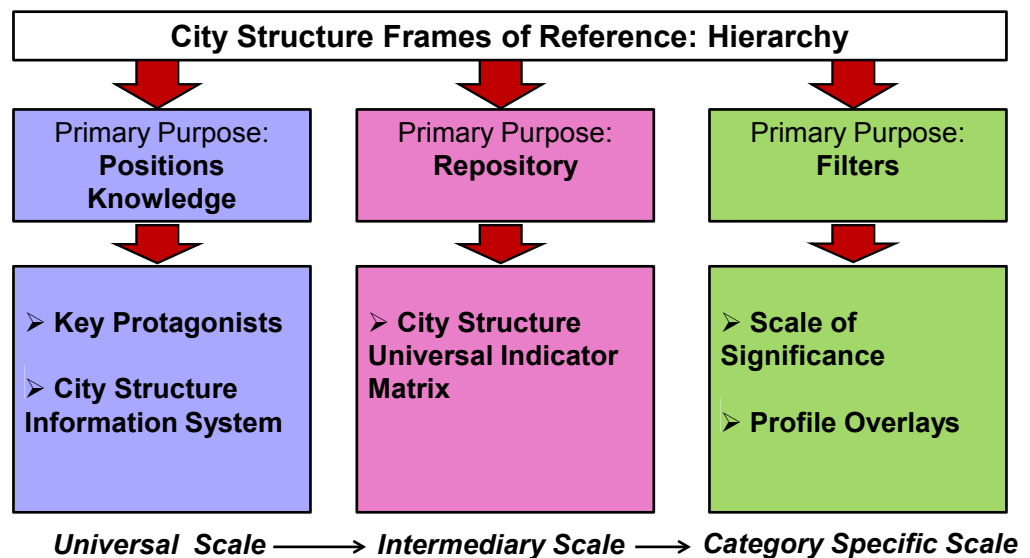
In order to undertake the two key analyses (Analysis A: **City Structure Development Performance Trajectory Analysis** and Analysis B: **Compositional Aspects of City Structure Population**) discussed earlier (Section 3.3.2 Research Design and Figure 3.4: Thesis Research Design: Conceptual Framework), a number of different frames of reference were applied.

The purpose of applying a frame of reference is to:

- **Position** a segment of knowledge within a larger body of knowledge and is generally undertaken at a universal scale;
- Act as a **repository** of knowledge and lies between the universal and category specific scale where it draws from both scales to help locate knowledge and also structure it in some form of classification system; and/or
- **Filter** knowledge to distil key information from a wide body of knowledge; classify/categorise comparable data; and/or evaluate some key element or set of characteristics. This is undertaken at a category specific scale.

These frames of reference can be nested within a hierarchy and based on the primary purpose of each frame of reference. This is summarised in **Figure 4.1** and in **Appendix 1: Key Reference Charts**.

Frames of Reference: Hierarchy & Primary Purpose



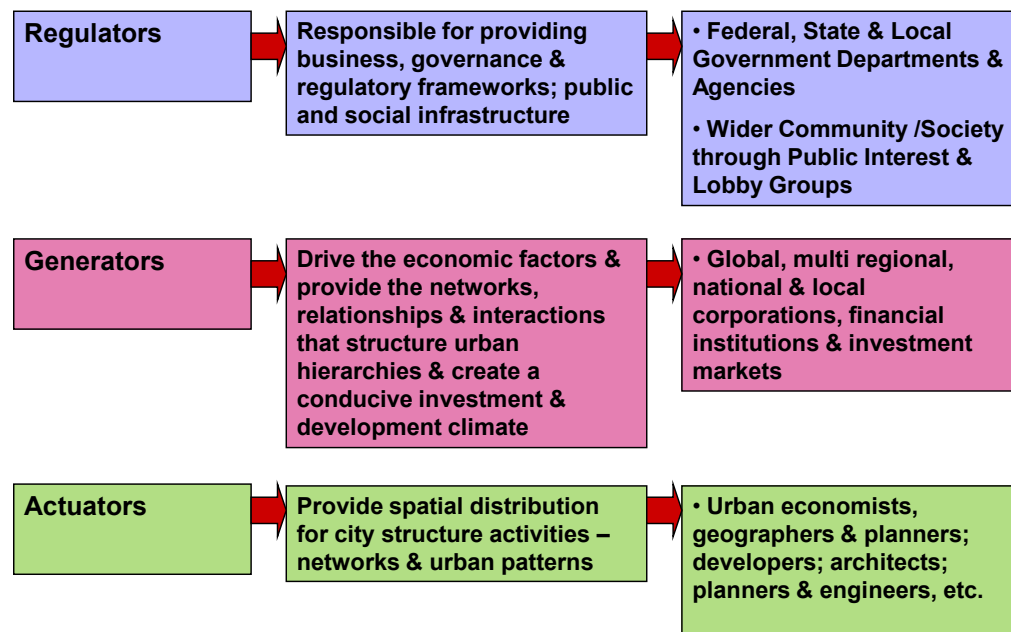
Note: Chart should be read in conjunction with Research Design: Conceptual Framework chart
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Figure 4.1: Frames of Reference: Hierarchy and Primary Purpose

4.4 Frame of Reference A: City Structure Key Protagonists

In light of the findings from the Literature Review, the Candidate developed a classification of the key protagonists involved in the development of city structures (**Figure 4.2**). This classification of city structure key protagonists into the three categories holds universally – in spite of the geographic location (e.g. New York versus Shanghai versus Sydney) or scale of significance (e.g. country level, city level or market level). The key protagonists in driving the formation of city structures are:

City Structure Key Protagonists



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Figure 4.2: City Structure Key Protagonists

4.5 Frame of Reference B: City Structure Information System

The **City Structure Information System** (**Figure 4.3** and as an A3 sized chart in **Appendix 1: Key Reference Charts**) is used in this thesis to pull together the vast array of information and analyses in a formalised structure. This draws from a wide repository of information and in particular from the key governance, economic, social and environment sectors to position segments of knowledge within a wider universe of knowledge.

For the purposes of this thesis, the proposed research is positioned at the middle tier or key drivers level as the **City Structures Knowledge Base**. This is explained in the following sub sections and in **Figure 4.3: City Structure Information System**.

4.5.1 Top Tier – Input-Product Outcome:

4.5.1.1 Topics of Study

The key purpose of the Topics of Study (designated as a pale pink box on the left hand side) is to identify the areas of study. This can be categorised into one of the following areas:

- **Goal Orientated:** Driven by a singular objective consisting of sets of issues e.g. world cities, globalisation, connectivity, etc.
- **Issues Driven:** Driven by specific factors e.g. competitive performance, economic growth, population growth, rates of urbanisation and tertiarisation levels, etc.
- **Causal Activated:** Driven by a set of circumstances e.g. containment of urban sprawl, reducing traffic congestion, etc.
- **Holistic Driven:** Driven by fundamental aspects of the whole i.e. what are the key focus areas/issues and how do they inter-relate as a whole e.g. the key challenges and market factors driving the office market.

This then determines the context to analyse the network of activities.

4.5.1.2 Transactional Network Analysis

The key function of the Transactional Network Analysis (designated as a mauve box in the middle) is to draw together various frames of reference as knowledge repositories, to evaluate, filter and position bodies of knowledge and to undertake analyses. This is achieved by working through three key stages:

- **Contextual:** Provides the relational circumstances and background and includes two frames of reference – the **City Structure Universal Indicator Matrix** (a knowledge repository) and the Scales of Significance (a scale filter based on the level the indicator is based on e.g. global, country, city, etc.).
- **Deconstruct:** Provides a fragmentary analysis of key issues and comprises an assessment of the **City Structure Universal Indicator Matrix** against **Profile Overlays** (criteria filter e.g. alpha cities, manufacturing based cities), **Other Criteria** (criteria filter e.g. GDP and City Population) in order to reduce the number of indicators down to a shortlist for further analysis i.e. the **City Structure Critical Indicators Matrix**.
- **Construct:** Draws together separate parts to form an evaluative framework and tools to produce a set of prescribed outcomes as defined by the topics of study. This comprises two analyses – **Analysis A: City Structure Development Performance Trajectory Analysis** and **Analysis B: Compositional Aspects of City Structure Population**.

The Transactional Network Analysis is the process undertaken to generate the product outcomes.

4.5.1.3 City Structure Development Performance

This represents the City Structure Development Performance outcomes (designated as a fuchsia pink box on right hand side) based on the prescribed topic of study and the transactional network analysis process undertaken to produce the expected outcomes. The outcomes from the two analyses collectively explain the city structure development performance phenomena in terms of its networks (functional activities, relationships, capital and knowledge flows), its transition through development stages as well as historical and forecasted development performance trends.

The outcomes also provide a gauge to the city structure's productivity, capacity, innovation and adaptability.

4.5.2 Middle Tier – Key Drivers:

The Key Drivers tier enables the graining of information that facilitates the Key Protagonists to interact with the input-product outcome. The key drivers comprise:

4.5.2.1 Key Protagonists

The key function of the Key Protagonists (designated as a golden yellow box) is to transform Input to Product Outcomes through inference, knowledge and governing mechanisms. As identified and defined earlier (section **4.4 Frame of Reference A: Key Protagonists**), the key protagonists are:

- Regulators
- Generators
- Actuators

City Structure Information System

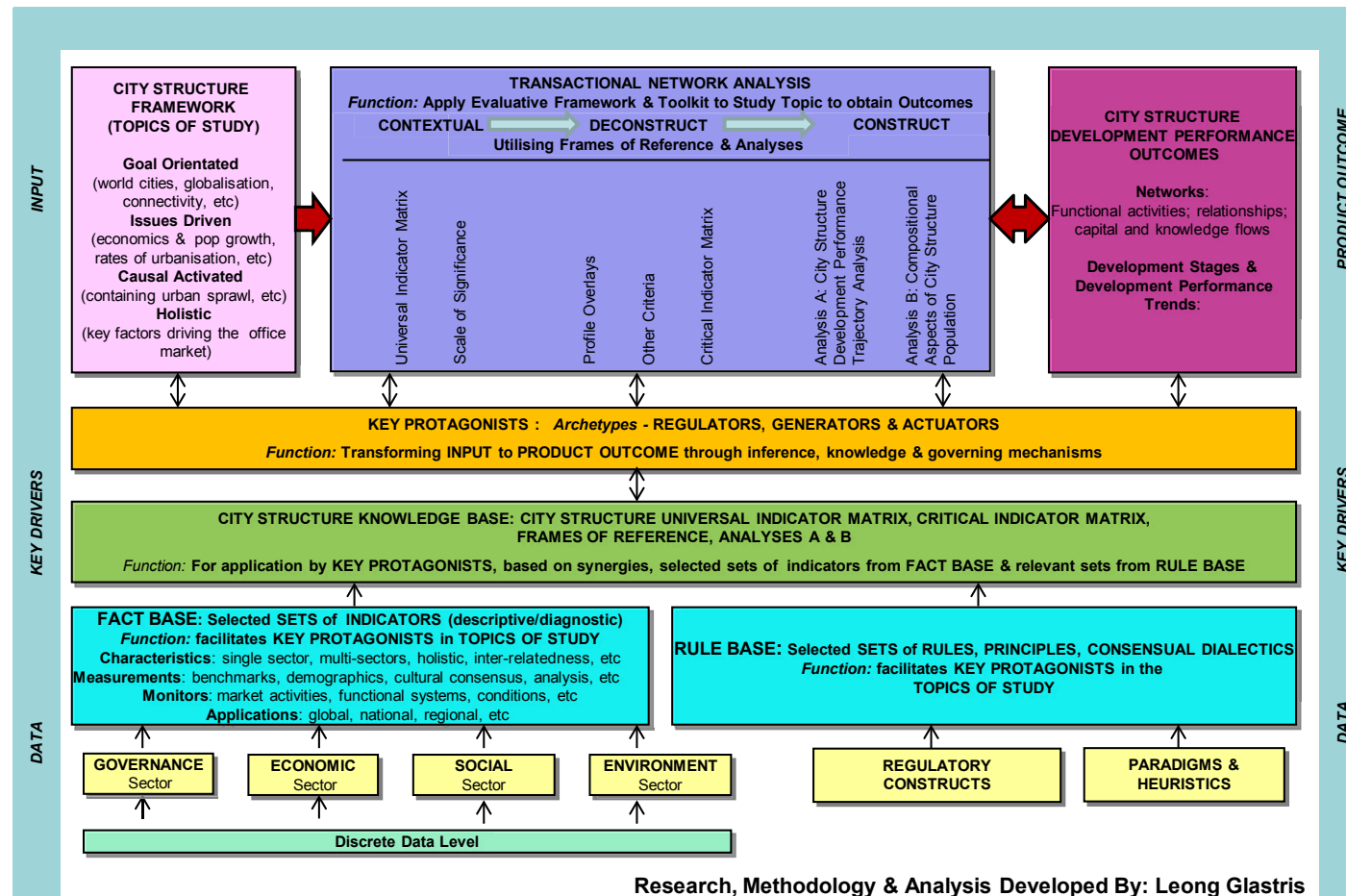


Figure 4.3: City Structure Information System

4.5.2.2 City Structure Knowledge Base

The primary function of the Knowledge Base (designated as an olive green box) of Key Drivers is to enable the protagonists to apply a body of information to undertake the top tier activities in a cohesive and integrated manner. This is based on the significance and synergies of the sets of indicators drawn from the Fact Base and the Rule Base.

The City Structure Knowledge Base comprises:

- City Structure Universal Indicator Matrix
- City Structure Critical Matrix
- Frames of Reference
- Analysis A: ***City Structure Development Performance Trajectory Analysis***
- Analysis B: ***Compositional Aspects of City Structure Population***

4.5.2.3 Fact Base

The Fact Base (designated as a turquoise box on the left hand side) comprises selected sets of descriptive and/or diagnostic indicators. The primary function is to assist the Protagonists in their particular Topic of Study. Characteristics of the fact base can address single or multi sectors as well as holistic and inter-relatedness concerns. They can be measured through benchmarks, demographic trends, cultural/market consensus, market analysis, etc. The Fact Base is monitored through an ongoing evaluation of market activities, functional systems, market conditions and trends, etc. The Fact Base also has applications at various scales of significance i.e. global, regional, national and local levels.

4.5.2.4 Rule Base

Like the Fact Base, the primary function of the Rule Base (designated as a turquoise box on the right hand side) is to assist the Protagonists in their particular Topic of Study. The Rule Base comprises selected sets of rules, principles and consensual dialectics.

4.5.3 Bottom Tier – Data:

In order to formulate the Fact Base and Rule Base, information in the form of Data (designated as a pale green box on the lower bottom left) is channeled into selected sets of indicators from a range of datasets.

4.5.3.1 Fact Base Indicators

Indicators are selected to represent key aspects of the Governance, Economic, Social and Environment sectors (designated as the four cream boxes on the left hand side) and are channeled into the City Structure Knowledge Base for processing in the top tier activities. These sectoral indicators comprise:

- **Governance Sector Indicators** that examine Regimes of Financial Capital Accumulation and Consumption; Modes of Governance and Meta-Governance; Market Maturity; Leadership and Vision; Fiscal Management and Governance Trade-Offs.
- **Economic Sector Indicators** that examine Key Economic Drivers; Economic Competitiveness; Workforce; Technology Transfer; Investment and Business Climate; Infrastructure Support; Forms of Capital and Economic Trade-Offs.
- **Social Sector Indicators** that examine Collective Values; Urban Concepts; Socio-Demographic Trends; Health and Education and Economic Trade-Offs.
- **Environment Sector Indicators** that examine Climate and Natural Environment; Urban Environment; Transportation; Water and Energy; Sustainability; Pollution and Environment Trade-Offs.

4.5.3.2 Rule Base Information

Rule Base Information (designated as the two cream boxes on the right hand side) collectively comprise formalised and codified information whilst the latter comprises esoteric knowledge gained empirically that is pertinent to the Topic of Study. This leads to:

- Policies, Regulations, Codes and Regulations e.g. research and publications
- Paradigms and Heuristics e.g. experientials and collectives.

This in turn provides:

- Governance Sector Indicators that examine Regulatory Constructs – Regulatory Frameworks.

An example of how this City Structure Information System can be further applied is given in **Appendix 6: Macro Event – Global Financial Crisis and its Impacts**. A preliminary analysis was undertaken using the City Information System as a frame of reference to trace the impacts of the GFC. It should be noted that one of the primary sources for information was the Wikipedia article “*Financial Crisis of 2007-08*” and it is acknowledged that whilst it may not necessarily be regarded as an authoritative text, the array of information, discussion areas and sources in the article were used to illustrate the ability of the *City Structure Information System* to capture data, information, signatures and handle contradistinctive issues. This enabled a diverse and complex range of information to be separated, ordered and integrated into the *City Structure Information System* and highlights the positioning, repository and filtering abilities of the *City Structure Information System* to evaluate a Macro Event such as the GFC. Consequently, it highlights the universal value and versatility of the *City Structure Information System* as a valuable frame of reference tool.

4.6 Frame of Reference C: City Structure Universal Indicator Matrix

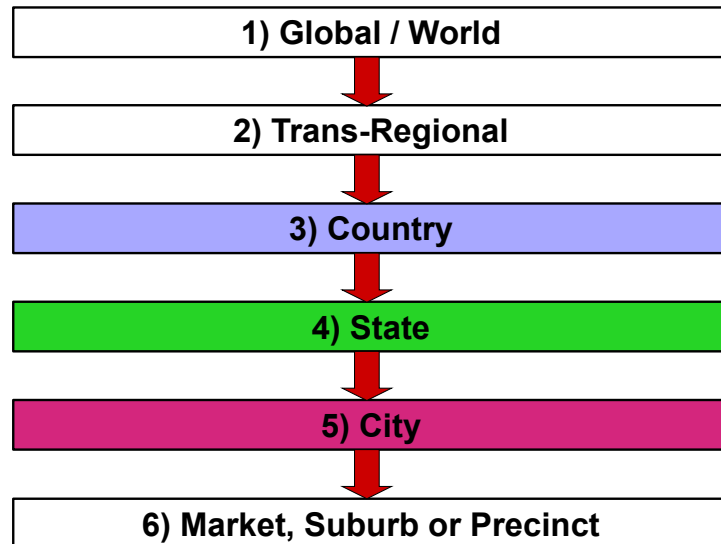
In this instance the frame of reference, the **City Structure Universal Indicator Matrix** of 76 indicators, is used at an intermediary scale and as a repository of knowledge (**Appendix 2**). From there, indicator selection criteria were used to shortlist down to the City Structure Critical Indicator Matrix of 25 indicators.

For further details regarding the City Structure Universal Indicator Matrix, refer to previous sections 3.3.2 Research Design; 3.4.1.3 Formulate Structural Framework for City Structure Universal Matrix; 3.4.1.4 Selection of Indicators – City Structure Universal Matrix and 4.5 Frame of Reference B: City Structure Information System.

4.7 Frame of Reference D: Scale of Significance

The Scale of Significance (**Figure 4.4**) is used at a category specific scale to determine the level of scale that an analysis needs to be undertaken (e.g. studying the effects of Greenhouse gas emissions at a world or city scale) and also at what level an indicator’s dataset is available at (e.g. GDP available at a country, state or city level).

Scale of Significance



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Figure 4.4: Scale of Significance

For the purposes of this research, all of the indicators and their respective datasets were primarily obtained at either a country or city level.

The only exception was the customised Oxford Economics data (GDP, Household Disposable Income, Employment and Population) for Bangalore and Mumbai which was only available at a State level i.e. Karnataka and Maharashtra respectively. In all other instances, indicator data was provided for Bangalore and Mumbai at either city or country level.

Where available/relevant there were some instances where World data was obtained for some indicators and was used for cross reference purposes.

4.8 Frame of Reference E: Profile Overlays

Another type of Frame of Reference constructed was the Profile Overlays which are used as a filter template to compare types of city structures by different categories.

For the purposes of evaluating cities in different development stages in this thesis, a Profile Overlay classifying City Structures by Development Stages was used (**Table 4.1**):

Profile Overlay: City Structures by Development Stages

Profile Overlay: City Structures by Development Stages		
Indicative Development Stage:	General Description:	Key City Structure* or Cross Reference City Structure
Early Emerging:	City structures in their initial growth phase of development.	Bangalore , Jakarta; Johannesburg
Emerging:	City structures in their rapid growth phase of development.	Guangzhou, Sao Paulo; Mumbai; Dubai; Tel Aviv-Jaffa
Maturing:	City structures which have entered a moderate growth phase of development.	Early Maturing - Singapore; Auckland; Melbourne; Brisbane; Adelaide; Perth; Boston; Berlin Established Maturing - Sydney , Los Angeles; Moscow; Toronto; Hong Kong
Mature:	City structures approaching a growth plateau in development.	New York , Tokyo; Paris; London
Obsolescence - Decline:	City structures which have entered an obsolescence phase and/or are in development decline.	Detroit , Athens; Budapest; Manchester
Obsolescence - Re-Growth:	City structures which have entered an obsolescence-decline phase but have been re-invigorated and are in a re-growth phase.	Shanghai , Beijing
Note *: Key city structures highlighted in red coloured font & cross reference city structures highlighted in blue font		

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Table 4.1: Profile Overlay: City Structures by Development Stages

However, city structures could also be classified and evaluated by Geographic Region (Table 4.2):

Profile Overlay: City Structures by Geographic Region

Profile Overlay: City Structures by Geographic Region	
Indicative Development Stage:	Key City* or Cross Reference City
Australasian:	Sydney , Melbourne, Brisbane, Perth, Adelaide & Auckland
Pacific Asian:	Guangzhou, Shanghai , Beijing, Hong Kong, Jakarta, Singapore & Tokyo
Eurasian:	Moscow
South Asian	Bangalore & Mumbai
Middle East / North Africa:	Dubai & Tel Aviv-Jaffa
European	London, Manchester, Athens, Budapest, Paris & Berlin
Sub-Saharan	Johannesburg
Northern American	New York , Toronto, Boston, Detroit & Los Angeles
Latin American	Sao Paulo
Note *: Key cities highlighted in red coloured font. & cross reference cities highlighted in blue font	

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Table 4.2: Profile Overlay: City Structures by Geographic Region

DOCTORAL THESIS:

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

MICHELLE LEONG GLASTRIS

City structures could also be classified and evaluated by Primary Economic Industry (Table 4.3):

Profile Overlay: City Structures by Primary Economic Industry

Profile Overlay: City Structures by Primary Economic Industry		
Primary Economic Industry Classification	General Description:	Key City*, Cross Reference City or Example City
Agricultural:	Primarily driven by agricultural based industries.	Xianning (China's Hubei Province), Bordeaux (France) & Des Moines (Iowa USA)
Mining:	Predominantly driven by mining and resources sector.	Perth & Kinshasa (Democratic Republic of the Congo)
Traditional Industrial/Manufacturing:	Predominant industries are iron, steel based manufacturing.	Glasgow, Manchester , Detroit , Magoya, Chongqing
Logistics:	Driven by distribution centres and logistics based industries with strong transport hubs and infrastructure support.	Guangzhou , Shanghai , Mumbai , Kolkata, Chennai, Portland (Oregon USA) & Hong Kong .
Emerging Technologies, Education, R & D:	Driven by IT, telecommunications, bio-tech/pharmaceuticals, universities/education and high tech R & D based industries.	Boston (Route 128), San Jose (Silicon Valley), Oxford, Bangalore , Delhi, Chandigarh & Wuhan.
Global Financial City:	Regarded as a key global financial and business centre.	New York , Sydney , London & Tokyo
Cultural / Tourism:	Predominantly driven by cultural/tourist/film based industries.	Athens , Florence, Paris , St Petersburg & Los Angeles
Specially Created Capital City:		Canberra, Brasilia & Washington DC.

Note: Key cities highlighted in red coloured font, cross reference cities highlighted in blue font & example cities cited in black font.

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Table 4.3: Profile Overlay: City Structures by Primary Economic Industry

City structures could also be classified and evaluated by Globalization and World Cities (GaWC) City Classification (Globalization and World Cities (GaWC) Research Network 2010) (Table 4.4):

Profile Overlay: City Structures by GaWC City Classification

Profile Overlay: City Structures by GaWC City Classification		
GaWC City Classification	GaWC Definition:	2010 GaWC Ranking for Key City*, Cross Reference City or Example City
Alpha++:	"In all analyses, London and New York stand out as clearly more integrated than all other cities and constitute their own high level of integration".	New York & London
Alpha+:	"Other highly integrated cities that complement London and New York, largely filling in advanced service needs for the Pacific Asia".	Shanghai , Sydney , Dubai, Hong Kong, Paris, Singapore & Tokyo
Alpha & Alpha-:	"Very important world cities that link major economic regions and states into the world economy".	Alpha: Beijing, Toronto, Sao Paulo, Mumbai, Los Angeles, Moscow & Jakarta Alpha-: Melbourne, Boston & Johannesburg
Beta:	"These are important world cities that are instrumental in linking their region or state into the world economy".	Beta+: Bangalore , Berlin, Athens & Tel-Aviv Beta: Guangzhou , Budapest, Auckland & Manchester Beta-: Detroit , Brisbane & Perth
Gamma:	"These can be world cities linking smaller regions or states into the world economy, or important world cities whose major global capacity is not in advanced producer services".	Gamma+: Adelaide, Glasgow, Baltimore & Edinburgh Gamma: Phoenix, St Petersburg, Rotterdam & Pittsburgh Gamma-: Pune, Durban, Belfast, Nagoya & Wellington
Cities with Sufficiency of Services:	"These are cities that are not world cities as defined here but they have sufficient services so as not to be overly dependent on world cities. Two specialised categories of city are common at this level of integration: smaller capital cities, and traditional centres of manufacturing regions".	High Sufficiency: Brasilia, Salt Lake City, Bilbao, Liverpool, Canberra & Hartford Sufficiency: Florence, Christchurch, Bordeaux, Birmingham (US), Nanjing, Penang, Memphis, Kyoto, Sheffield & Harare

Note: Key cities highlighted in red coloured font, cross reference cities highlighted in blue font & example cities cited in black font.
Source: Globalization & World Cities (GaWC) Research Network: "The World According to GaWC 2010"

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Table 4.4: Profile Overlay: City Structures by GaWC City Classification

4.9 Chapter Conclusion

Chapter 4 Frames of Reference constructs a unique series of frames of reference to:

- **Position** a segment of knowledge within a wider body of knowledge (Key Protagonists and City Structure Information System);
- Act as a **repository** of knowledge (City Structure Universal Indicator Matrix); and/or
- **Filter** knowledge to distil key information from a wide body of knowledge (Scale of Significance and Profile Overlays).

The knowledge gained from this chapter will enable fellow researchers and practitioners to use these frames of reference as a useful construct to locate/position, assemble, order, filter and store knowledge relating to the development performance of city structures. These frames of reference are nested within a hierarchy and can be used for specific analytical purposes.

Chapter 5

Proof of Concept: Key Indicator Analysis



View of New York City Looking Towards Central Park

Source: Michelle Leong Glastris

“Like a piece of architecture, the city is a construction in space, but one of vast scale, a thing perceived only in the course of long spans of time...Every citizen has had long associations with some part of his city, and his image is soaked in memories and meanings.”

(Lynch 1960: 1)

5 Proof of Concept: Key Indicator Analysis

5.1 Chapter Outline

In **Chapter 3 Methodology and Data Collection**, the research design and methodological approach was discussed together with a discussion on data treatment and assumptions and limitations associated with the data. **Chapter 4 Frames of Reference** examined the contextual frameworks in which the knowledge considered within the research could be positioned, stored or filtered as part of a wide body of knowledge. As set out in the PhD Thesis Methodology chart (**Appendix 1 Key Reference Charts - PhD Thesis Methodology**), Chapters 5-8 comprise the proof of concept analyses. Chapter 5 Proof of Concept: Key Indicator Analysis is the first stage of Analysis A: City Structure Development Performance Trajectory Analysis (**Appendix 1 Key Reference Charts - Research Design: Conceptual Framework**). This chapter commences with a discussion on the process undertaken for the analysis and key considerations regarding assumptions and limitations of the analysis. The results and analysis are presented to highlight trends and the impacts on city structure development performance.

5.2 Process

5.2.1 City Structure Indicator Pathways and Application

The **City Structure Critical Indicator Matrix** comprises 25 key indicators which were shortlisted from the 76 indicators in the **City Structure Critical Universal Matrix** based on the indicator selection process and criteria discussed in sub section **3.4.1 Indicator Selection Process**.

These 25 critical indicators were then initially assessed against the two key types of analysis and outcomes required – **Analysis A: City Structure Development Performance Trajectory Analysis** and **Analysis B: Compositional Aspects of City Structure Population**. From there, the indicators were divided into segments for staged analysis i.e. tools used within Analyses A and B.

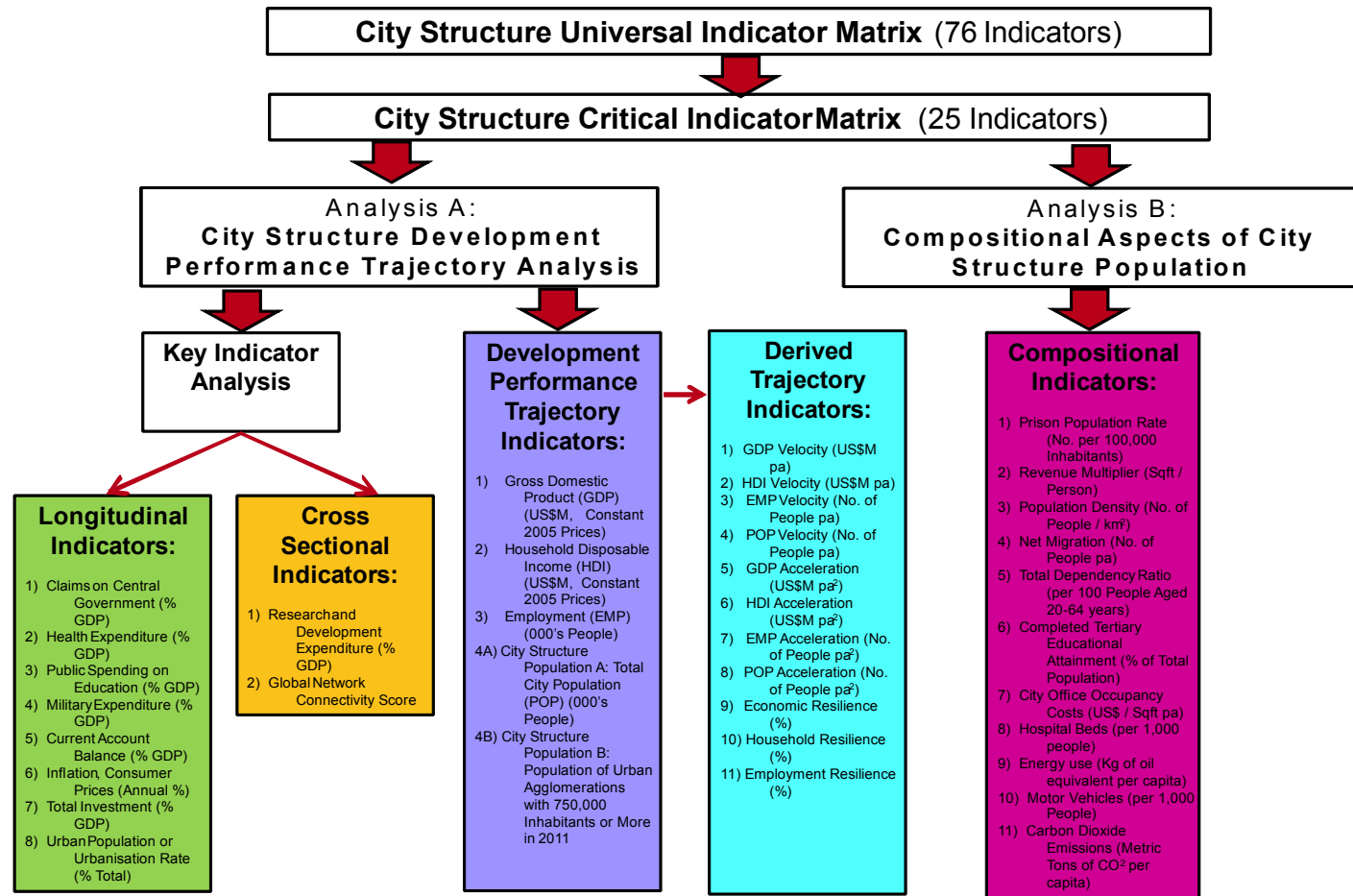
Out of the 25 critical indicators, 10 were identified for key indicator analysis, 4 indicators for development performance trajectory analysis and the outstanding 11 for describing the compositional aspects of city structure population. It should be noted a further 11 indicators were derived from the four development performance trajectory indicators – these four development performance trajectory indicators and 11 derived trajectory indicators will be discussed in the next two chapters (Chapters 6 and 7). The 11 compositional indicators will be discussed in Chapter 8.

Collectively these 25 critical indicators and 11 derived trajectory indicators along with the other analyses (as prescribed in **Appendix 1 Key Reference Charts - Research Design: Conceptual Framework**) have been used to explain the development performance of city structures. The indicators, their pathways and application are presented in the following flowchart (**Figure 5.1** and as an A3 chart in **Appendix 1 Key Reference Charts – iv) City Structure Indicator Pathways & Application**) and should be read in conjunction with the Research Design: Conceptual Framework chart (**Appendix 1**).

The ten key indicators undertaken in the Key Indicator Analysis were classified into longitudinal and cross sectional indicators based on the length of historical series within the data set. Generally, indicator datasets with 15 years or more of historical data were classified as longitudinal indicators because they were able to provide long term trend insights. In contrast, indicator datasets with less than 15 years data historical data were classified as cross sectional data and provided brief snapshot insights.

There is inherent value in investigating development patterns/trends as well as the impact of macro/global events and structural changes over a long term trend of 20-60 plus years. However, subject to data availability, there is also value in looking at data collected more recently that may point to an emerging trend, current event or structural change that impacts on a city structure's development performance. These brief snapshots are discussed in the cross sectional indicators in this chapter and in some of the compositional indicators (Chapter 8).

City Structure Indicator Pathways & Application:



Note: Chart should be read in conjunction with Research Design: Conceptual Framework chart

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Figure 5.1: City Structure Indicator Pathways & Application

As identified in **Figure 5.1: City Structure Indicator Pathways & Application**, the 10 key indicators that will be discussed are:

i) **Longitudinal Indicators:**

- Claims on Central Government (% GDP) - Governance sector;
- Health Expenditure (% GDP) - Governance sector;
- Public Spending on Education (% GDP) - Governance sector;
- Military Expenditure (% GDP) - Governance sector;
- Current Account Balance (% GDP) - Governance sector;
- Inflation (% GDP) - Economic sector;
- Total Investment (% GDP) - Economic sector and
- Urban Population or Urbanisation Rate (% of Total) - Social sector.

ii) **Cross Sectional Indicators:**

- Research and Development Expenditure (% GDP) - Governance sector and
- Global Network Connectivity Score (1.00 = London) - Governance sector.

The dominance of Governance indicators, highlight the importance of Governance aspects in the development performance of city structures. Whilst there appears to be a predominance of Governance indicators across the Longitudinal and Cross Sectional Indicators, indicators in other sectors are well represented elsewhere in the subsequent Development Performance Trajectory and Compositional Indicators Analyses. As discussed in section **3.4.1.5 Section of Indicators – City Structure Critical Indicator Matrix**, there was a reasonable cross representation for the Governance, Economic, Social and Environment sectors (as illustrated in **Figure 3.7: City Structure Critical Indicators: Sector Composition**).

In Chapter 3, the methodology for selecting the indicators, data treatment as well as the assumptions and limitations were discussed. The next stage in the process was to review the indicator data, construct graphs from the datasets to examine trends and undertake an analysis of these indicators in relation to what they can tell us about the development performance of these six key cities.

5.2.2 Validation of City Structure Critical Indicators

5.2.2.1 Background of GDP and City Structure Population as Key Drivers

Economic aspects form a fundamental cornerstone in driving the development performance of city structures (Beall & Fox 2009b; Kim & Short 2008; Montgomery 2007). Economic activity dominates the development of city structures where capital, resources and knowledge are concentrated offering inhabitants a greater number of jobs, higher wages, a wider and better range of infrastructure and amenity and other benefits (Allen 2004; Glaeser 2008). Gross Domestic Product (GDP) is a singular measure of economic drivers and is calculated by using a range of other economic indicators (International Monetary Fund 2012b; World Bank 2008, 2012c) such as economic growth, household disposable income, employment, investment activity and productivity.

GDP can be defined by The Economist as the “*total of all economic activity*” in a country (Stutely 2003: 41) and by the Wharton School, GDP “*measures how fast or slow the economy is growing... This is the mother of all economic indicators...*” (Baumohl 2005: 100). GDP can be calculated in three different but equivalent ways – Production Approach; Income Approach and Expenditure Approach. For the GDP indicator used in the analyses, Oxford Economics uses the more direct Production Approach (Baumohl 2005; Stutely 2003). Refer to Oxford Economics’ definition for GDP tabled in **Appendix 3: City Structure Critical Indicator Matrix**.

City Structure Population can be used as a strong indicator to quantify a city structure’s level of development rather than being primarily based on the concept of urbanisation. The disadvantage of using urbanisation is that once a city transitions into the later stages of the Urbanisation Curve, it approaches the terminal stage (around 70-75% of the total population) and significant growth is limited (Brunn, Williams & Zeigler 2003; Pacione 2003). Whilst the urbanisation levels measure the growth in urban areas relative to the total population, growth in city structure populations is a better indicator for city structure development because it explicitly tracks the number of inhabitants in city structures alone. City populations specifically reflect/influence responses to ready access to information and capital networks, opportunities and amenities which affect the development of city structure phenomena.

For the purposes of the research, it is worth noting the definitions of city population in light of the two datasets used from Oxford Economics which uses the term “city population” and the United Nations which uses the term “urban agglomeration”.

In recent correspondence between **Mr Anthony Light** (Head of International City Forecasting, Oxford Economics, London) and the Candidate, Oxford Economics define **City Population**: *“Total population of the city consists of all persons falling within the scope of the census. In the broadest sense, the total may comprise either all usual residents of the city or all persons present in the city at the time of the census. The total of all usual residents is generally referred to as the de jure population and the total of all persons present as the de facto population”* (Leong Glastris 2013b; Oxford Economics 2013: Methodology Notes).

The United Nations define an **Urban Agglomeration**: *“Refers to the de facto population contained within the contours of a contiguous territory inhabited at urban density levels without regard to administrative boundaries. It usually incorporates the population in a city or town plus that in the sub-urban areas lying outside of but being adjacent to the city boundaries”* (United Nations Department of Economic and Social Affairs 2011a: Glossary).

The calculation of urban agglomeration is distinct from the **City Proper** (*“A locality defined according to legal/political boundaries and an administratively recognized urban status that is usually characterized by some form of local government”*) because rather than being determined by legal and administrative criteria, it is determined by density (United Nations Department of Economic and Social Affairs 2011a: Glossary). The agglomeration ends where the density falls below some critical threshold (Beall, Guha-Khasnobis & Kanbur 2010). The critical threshold is generally the same across all cities and is based on a set number of people, in this instance 750,000 people – although **Monsieur Francois Pelletier**, (Chief, Population Estimates and Projections Section at the United Nations Population Division, New York) did confirm with the Candidate, that generally whilst this is the case there are exceptions where *“Our urban agglomeration estimates are not necessarily determined by a density criteria (may vary by country)”* (Leong Glastris 2013c).

Limitations regarding these geographic definitions for both the Oxford Economics and United Nations datasets are further discussed in the section **3.5.2 Limitations**.

5.2.2.2 Correlation Analysis between Key Drivers (GDP and City Structure Population) and the Other Critical Indicators

In the City Structure Critical Indicator Matrix (refer to Appendix 3), the relationship between key drivers City GDP and City Population and the other Critical Indicators was qualitatively gauged. This was also independently verified quantitatively by undertaking three separate correlation analyses on City GDP, City Population (United Nations urban agglomeration dataset) and City Population (Oxford Economics dataset) respectively with the other Critical Indicators.

A summary table is provided in **Figure 5.1: Summary Table of Correlation Analysis for the Key Cities** and further details from the correlation analysis are tabled in **Appendix 4: Tables of Correlation Tables for Six Key Cities – Critical Indicators**. The first correlation analysis was between GDP and the other critical indicators for each of the six key cities (yellow highlighted rows in the tables). The second correlation analysis was taken between Oxford Economics City Population and the other critical indicators for the key cities (turquoise blue highlighted rows in the tables). The third correlation analysis was taken between the United Nations City Population/Urban Agglomerations and the other critical indicators for the key cities (green highlighted rows in the tables).

Overall the majority of Critical Indicators showed a relatively strong correlation (i.e. greater than +/- 0.70) with all three GDP and Population (UN and OE) indicators with a few notable exceptions (Everitt 2010; Levine et al. 2008). Any correlations less than 0.7 were highlighted in red coloured text. These include **Current Account Balance** (Sydney); **Inflation - CPI Price** (Sydney, New York, Detroit, Guangzhou, Shanghai and Bangalore); **Motor Vehicles** (New York and Detroit); **Military Expenditure** (Guangzhou, Shanghai and Bangalore); **Population Density** (Guangzhou, Shanghai and Bangalore); **Total Office Occupancy Costs** (Bangalore).

It should be noted that the correlation analysis undertaken was for preliminary/indicative purposes. A detailed analysis was beyond the scope of this thesis given the limited historical data from Oxford Economics when five year interval snapshots were taken (to ensure a consistent comparison with the United Nations datasets). Furthermore a detailed analysis was not undertaken to explain why location specific circumstances impacted on the correlation and no leads or lags were built into the data series which may have provided a better fit i.e. stronger correlation.

5.2.2.3 Results and Application

Both **GDP** and **City Population** are:

- Proven universal indicators, cornerstones to city development and offer a quick cross section of the city structure's economic activities and composition of the population;
- Selected to provide a common platform for analysing and pulling together these critical indicators across the four sectors of Governance, Economic, Social and Environment within the City Structure Critical Matrix.

In light of the qualitative analysis undertaken which examined the links of each of the critical indicators to either and/or both GDP and City Population (refer to **Appendix 3: City Structure Critical Indicator Matrix**) along with the general findings from the quantitative preliminary correlation analyses, it was concluded that it was still valid to proceed with all 25 Critical Indicators.

Both the qualitative analysis of assessing the connection and relevance of GDP and City Structure Population and the other Critical Indicators (**Appendix 3: City Structure Critical Indicator Matrix**) and the quantitative correlation analyses (sub section **5.2.2. Validation of City Structure Critical Indicators**; **Table 5.1: Summary Table of Correlation Analyses for the Key Cities** and **Appendix 4: Correlation Tables – Critical Indicators**) demonstrated the strong, universal relationship between the Key Drivers and the other Critical Indicators.

Table 5.1: Summary Table of Correlation Analyses for the Key Cities

Note: Correlations of +/- 0.70 are strongly correlated.

NY=New York; DET=Detroit; SYD=Sydney; GUA=Guangzhou; SHA=Shanghai; BAN=Bangalore

Summary Table of Correlation Analyses for the Key Cities		
Sector & Critical Indicator:	Correlation to:	Correlation Range Across Key Cities:
GOVERNANCE		
Claims on Central Government (% GDP)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest: -0.04 (BAN); Highest -0.83 (SYD) Lowest: 0.10 (BAN); Highest 0.87 (SHA) Lowest: -0.06 (NY); Highest -0.96 (SYD)
Health Expenditure, Total (% of GDP)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest: 0.72 (GUA & SHA); Highest 0.98 (SYD) Lowest: -0.39 (BAN); Highest 0.99 (SYD) Lowest: -0.47 (BAN); Highest 0.98 (SYD)
Public Spending on Education, Total (% of GDP)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest 0.16 (DET); Highest 0.75 (GUA) Lowest 0.27 (DET); Highest 0.71 (NY) Lowest 0.06 (SHA); Highest 0.81 (NY)
Military Expenditure (% of GDP)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest -0.15 (SHA); Highest -0.83 (DET) Lowest -0.10 (NY); Highest -0.91 (DET) Lowest 0.05 (DET); Highest -0.85 (SYD)
Prison Population Rate (No. per 100,000)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest 0.71 (GUA); Highest 1.00 (SYD) Lowest 0.64 (GUA); Highest 0.99 (SYD & NY) Lowest 0.83 (SHA); Highest 0.99 (SYD)
Current Account Balance (% GDP)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest -0.21 (SYD); Highest -0.91 (BAN) Lowest -0.15 (SYD); Highest -0.74 (NY) Lowest -0.25 (BAN), Highest -0.63 & 0.63 (NY & SHA & GUA)
ECONOMIC		
"Key City" GDP (US\$M 2005)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest -0.63 (DET); Highest 1.00 (SYD, NY, GUA, SHA & BAN) Lowest -0.81 (DET); Highest 0.99 (SYD, GUA, SHA & BAN) Lowest 0.93 (DET); Highest 0.99 (BAN)

Figure 5.1: Summary Table of Correlation Analyses for the Key Cities

Note: Correlations of +/- 0.70 are strongly correlated

NY=New York; DET=Detroit; SYD=Sydney; GUA=Guangzhou; SHA=Shanghai; BAN=Bangalore

Sector & Critical Indicator:	Correlation to:	Correlation Range Across Key Cities:
ECONOMIC continued...		
"Key City" Household Disposable Income (US\$M 2005)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest 0.72 (DET); Highest 1.00 (GUA, SHA & BAN) Lowest -0.89 (DET); Highest 0.99 (SYD & SHA) Lowest 0.93 (DET); Highest 1.00 (GUA & SHA)
"Key City" Employment (000's)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest -0.15 (DET); Highest 0.99 (SYD) Lowest -0.32 (DET); Highest 1.00 (SYD) Lowest 0.79 (DET); Highest 0.99 (SYD)
Inflation - CPI Prices (Annual %)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest 0.03 (SYD & NY); Highest 0.91 (BAN) Lowest 0.03 (SYD); Highest -0.44 (SHA) Lowest 0.04 (BAN); Highest -0.55 (GUA)
Research & Development Expenditure (% GDP)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest 0.50 (NY); Highest 0.97 (SHA & GUA) Lowest 0.54 (NY); Highest 0.98 (SHA) Lowest 0.66 (NY); Highest 0.99 (GUA & SHA)
"Key City" Revenue Multiplier (GDP per Capita / Total Office Occupancy Costs)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest -0.63 (GUA & SHA); Highest -0.90 (SYD) Lowest -0.36 (GUA); Highest -0.89 (SYD) Lowest -0.55 (NY); Highest -0.92 (SYD)
Total Investment (% GDP)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest 0.50 (SHA & NY); Highest 0.88 (DET) Lowest 0.12 (NY); Highest 0.89 (GUA) Lowest 0.29 (SYD); Highest 0.90 (BAN)

Figure 5.1: Summary Table of Correlation Analyses for the Key Cities

Note: Correlations of +/- 0.70 are strongly correlated

NY=New York; DET=Detroit; SYD=Sydney; GUA=Guangzhou; SHA=Shanghai; BAN=Bangalore

Sector & Critical Indicator:	Correlation to:	Correlation Range Across Key Cities:
ECONOMIC continued...		
"Key City" Global Network Connectivity (GNC Proportionate Connectivity, 1.00=London)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest 0.70 (SYD); Highest -1.00 & 1.00 (DET & NY) Lowest 0.67 (SYD); Highest 0.99 (GUA) Lowest 0.69 (SYD); Highest 1.00 (DET)
SOCIAL		
Net Migration (Number of People)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest -0.71 (GUA); Highest -1.00 & 1.00 (DET & NY) Lowest 0.27 (NY); Highest -0.98 (BAN) Lowest 0.69 (SYD); Highest 1.00 (DET)
"Key City" Population Density (People per sq. km)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest -0.01 (DET); Highest -0.78 (SYD) Lowest 0.13 (DET); Highest -0.79 (SYD) Lowest 0.41 (BAN); Highest -0.78 (SYD)
Urban Population i.e. Rate of Urbanisation (% of Total Population)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest -0.75 (DET); Highest 0.99 (SYD) Lowest 0.78 (BAN); Highest 0.99 (SYD & SHA) Lowest 0.91 (DET); Highest 0.99 (GUA)
18A)"Key City" City POP (Oxford Economics)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest -0.62 (DET); Highest 0.99 (SYD, SHA & BANG) Lowest -0.80 (DET); Highest 1.00 (SYD, NY, SHA & BAN) Lowest -0.89 (DET); Highest 1.00 (SYD)
18B)"Key City" City POP (Urban Agglomeration, United Nations)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest -0.81 (NY); Highest 0.99 (GUA, SHA & BAN) Lowest -0.80 (NY); Highest 1.00 (SYD, GUA & BAN) Lowest -0.89 (DET); Highest 1.00 (SYD)
Total Dependency Ratio	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest -0.87 (SHA); Highest -1.00 & 1.00 (NY & DET) Lowest 0.72 (DET); Highest -1.00 (BAN) Lowest -0.20 (DET); Highest -0.90 (GUA)

Figure 5.1: Summary Table of Correlation Analyses for the Key Cities

Note: Correlations of +/- 0.70 are strongly correlated

NY=New York; DET=Detroit; SYD=Sydney; GUA=Guangzhou; SHA=Shanghai; BAN=Bangalore

Sector & Critical Indicator:	Correlation to:	Correlation Range Across Key Cities:
SOCIAL continued...		
Completed Tertiary Educational Attainment, 15+ years (% Total Population)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest 0.47 (NY); Highest 1.00 (GUA) Lowest -0.42 (DET); Highest 0.89 (SYD & GUA) Lowest 0.46 (DET); Highest 0.99 (SYD, GUA & SHA)
ENVIRONMENT		
Hospital Beds (per 1,000 people)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest 0.62 (BAN); Highest -0.88 (SYD & NY) Lowest 0.72 (SHA); Highest -0.99 (NY) Lowest -0.51 (DET); Highest -0.84 (NY)
"Key City" Total Office Occupancy Costs (Current US\$ per Sq ft pa)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest 0.10 (BAN); Highest 0.94 (SYD) Lowest -0.06 (BAN); Highest 0.91 (SYD) Lowest -0.01 (BAN); Highest 0.95 (SYD)
Motor Vehicles (per 1,000 people)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest 0.33 (DET); Highest 0.99 (SYD, GUA & BAN) Lowest 0.23 (DET); Highest 1.00 (BAN) Lowest -0.13 (NY); Highest 1.00 (BAN)
Energy Use (KG of Oil Equivalent per Capita)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest 0.64 (SYD); Highest 0.99 (GUA, SHA & BAN) Lowest -0.31 (NY); Highest 0.99 (SHA) Lowest 0.28 (DET); Highest 0.99 (BAN)
CO2 Emissions (Metric Tons per Capita)	"Key City" GDP "Key City" City POP (Oxford Economics) "Key City" City POP (Urban Agglomeration, United Nations)	Lowest 0.33 (SYD); Highest 0.98 (SHA) Lowest -0.24 (NY); Highest 0.98 (SHA) Lowest 0.19 (NY); Highest 0.99 (BAN)

The following sub section sets out some of the key assumptions and limitations involved with undertaking the Key Indicator Analysis.

5.3 Key Assumptions and Limitations

Definitions and the reasons for selection of each of the 25 indicators were discussed previously and have been tabled in **Appendix 3: City Structure Critical Indicator Matrix**.

5.3.1 Key Cities Overview

Before embarking on the analysis, it is prudent to have a fundamental understanding of the historical evolution of the six key cities examined. This overview information is tabled in **Appendix 5: Key Cities Overview** and identifies each key city's development stage and primary industries. It also highlights major factors in its evolution with respect to key events and structural changes and how the city has transitioned through its development stages.

5.3.2 Key Assumptions

It should be noted that in examining a City Structure Trajectory, reference is being made to where the development performance path or trajectory of an individual city structure is headed. When referring to a City Structure Development Trend, reference is being made to City Structures within a category (i.e. for the purposes of this thesis, development stages) that exhibit similar/common development performance characteristics and an overall pattern.

When evaluating development performance trajectories and trends, it is important to understand not only how a city has evolved but also to consider the major events and structural changes that impact city structures. Collectively this understanding provides a context for examining trajectories and trends and helps to better ascertain what happens when "blips" occur.

The concept of "*Failure of Invariance*" as "*only one of many heuristic biases (skewed modes of thinking or learning)*" regarding investor behaviour is useful to consider when viewing major events and structural changes and in particular, what Ferguson lists as 10 "*cognitive traps*" (Ferguson 2009: 347-348) – "*availability bias, hindsight - bias, the problem of induction, fallacy of conjunction, confirmation bias, contamination effects, affect heuristic, scope neglect, overconfidence in calibration and bystander apathy*". These cognitive traps illustrate how Key Protagonists and other stakeholders may perceive the affects and implications of major events and structural changes acting on city structures and how it can subsequently impact

their decisions on the evolution and development performance of city structures.

5.3.2.1 Major Events:

i) Macro/Global/Trans-Regional Events:

The first type of major event refers to **macro/global/trans-regional events** which lead to systemic ramifications globally/trans-regionally. These events affect the city structure's network of functional activities, relationships, capital and knowledge flows as well as the way it fundamentally relates to other cities globally/trans-regionally. Recent examples (post 1900s) include the:

- Great Depression (1930 - late 1930s/mid 1940s)
- World War I (1914 - 18);
- World War II (1939 - 45);
- Korean War (1950-53);
- Vietnam War (1956-75);
- Worldwide Economic Recession (1958);
- Oil Crises (1973 - 74, 1979 and 2003 - 08);
- Gulf War (1990 - 1) and Iraq War (2003 - 11);
- Asian Financial Crisis (1997-1998);
- Euro introduced to global financial markets (1999);
- Global War on Terrorism (2001-Present)
- Global Financial Crisis (2007 - 2009).

A preliminary analysis of the impact of the Global Financial Crisis (GFC) was undertaken using the City Structure Information System as a frame of reference. The GFC was selected as an example to illustrate the impact of a macro event and its subsequent cascade/ripple effects which causes systemic disruptions and distortions on a City Structure's key sectors. A GFC Timeline and a preliminary analysis of the impact of the GFC are tabled in **Appendix 6: Macro Event – Global Financial Crisis and its Impacts**. As stated earlier in Chapter 4 Frames of Reference, one of the primary sources for information was the Wikipedia article "*Financial Crisis of 2007-08*" and it is acknowledged that whilst it is not necessarily regarded as an authoritative text, the array of information, discussion areas and sources in the article were used to illustrate the ability of the City Structure Information System to capture data, information, signatures and handle contradistinctive issues. It was also used to illustrate the complexity, long ranging and ripple/systemic effects caused by the GFC on countries and their cities around the globe. Other references were also used to supplement the GFC analysis (Ferguson 2009; Soros 2008; Stiglitz 2002).

ii) Country/City Specific Events:

The second type of major event refers to **country/city specific events** such as government political regimes, major political/economic/social/environment upheavals or where location specific/localised events and natural disasters may impact on a city structure's ability to perform all or parts of its network of functional activities, relationships, capital and knowledge flows. Recent examples (post 1900s) include:

- Government social-political regimes – China's Cultural Revolution (1966-1976), China's Deng Xiaoping commences economic reforms "Reform and Opening Up" (1978), Apartheid in South Africa (1948-94), White Australia Policy (1901-1966), etc.
- Major wars, upheavals or movements – India's Civil Disobedience Movement (1930-32), Japanese invasion of Manchuria (1931), India's Independence and Partition (1947), Civil Rights Movement in the US (1954-1968), Indo China War (1962), Indo Pakistani War (1947, 1965, 1971 and 1999), Sino Vietnamese War (1979), democracy movement suppressed in Beijing's Tiananmen Square (1989), London Terrorist Attacks (1992); Manchester IRA Bombing (1996); September 11 Attacks on New York City and Washington DC (2001), Bangalore Terrorist Attacks (2008, 2010 and 2013), etc.
- Other location specific or localised events and natural disasters – Floating of the Australian Dollar (1983), Indian Ocean earthquake and Tsunami in India (2004 – otherwise known as the Sumatra-Andaman Earthquake and the Aceh Tsunami), Commonwealth games hosted in Delhi (2010), Hosting the Summer Olympic Games (Atlanta 1996, Sydney 2000, Athens 2004, Beijing 2008, London 2012), Guangzhou hosts the Asian games (2010), Shanghai hosts the World Expo (2010), etc.

In the following analyses, some of the macro/global/trans-regional events have been identified across the six cities through signature characteristics such as a large amplitude, aftershocks and/or lag responses.

Whilst identifying all country/city (unique/idiosyncratic) events for each city falls outside the immediate scope of this research, the key cities overview does provide a snapshot that highlights major key events and structural changes that have impacted each city's evolution (**Appendix 5: Key Cities Overview**).

5.3.2.2 *Structural Changes:*

Another consideration is the impact of underlying structural changes on the economy over a long period of time. These changes result in a long term shift in the fundamental structure of a city structure's network of functional activities, relationships, capital and knowledge flows as well as the way it relates to other cities. Recent examples (post 1900s) include the:

- Industry transitions from primary to secondary to tertiary production e.g. from subsistence to manufacturing, from manufacturing to a mixed economy or a knowledge based economy, etc.
- Waves of technological innovation e.g. use of the personal computer and internet;
- Impact of globalisation – this results in increased competition between firms and therefore cities through a range of channels i.e. *“international trade, foreign direct investment, financial integration and the ‘globalization’ of information, knowhow and technologies”* (Camagni 2001).

Evaluating structural change is important, particularly for government and policy strategists wanting to improve a city's output and productive capacity. However the downside of poor development performance has long term consequences. Ghost cities in China's Kangbashi New District and Ordos were constructed in order to drive economic and property development but currently do not have the underlying demand to support development sustainably in the short-medium term (Brown 2011, 2013; Miller 2012).

5.3.3 **Key Limitations**

The Critical Indicators provide snapshots of the state of the economy or city population at particular points in time to give some insights into how a city structure is evolving. Some of these snapshots are short term whilst others provide a longer term trend.

It should be noted the timeframe for the key indicator analysis varies significantly with some datasets extending from 1950 through to 2013 for the longitudinal analysis and covers recent events, structural changes as well as several business/economic cycles.

Whilst for the cross-sectional analysis, the Research and Development Expenditure indicator dataset extends back 14 years and the GaWC Global Network Connectivity Score indicator only has data for 2000, 2004 and 2008.

There were limited instances where a small amount data was unavailable or missing within a country's dataset. Where appropriate in the line graphs, where there are missing data points, existing data points have been connected using a straight line. These occurred and were duly noted in two graphs – Public Spending on Education (US, Australia, India and China) and Research and Development Expenditure (Australia only).

5.4 Results and Analysis: Outcomes for Key Cities

This section discusses the results and analysis from examining both the eight longitudinal indicators and the two cross sectional indicators. Both **Appendix 1: Key Reference Charts – City Structure Indicator Pathways and Application** and **Appendix 3: City Structure Critical Indicator Matrix** should be used as references to track the indicators and provide indicator definitions and reasons for selection.

5.4.1 Longitudinal Analysis

The longitudinal analysis comprises eight critical indicators where data typically extends more than 15 years. These indicators are:

- Claims on Central Government (% GDP);
- Health Expenditure (% GDP);
- Public Spending on Education (% GDP);
- Military Expenditure (% GDP);
- Current Account Balance (% GDP);
- Inflation, Consumer Prices (Annual %);
- Total Investment (% GDP); and
- Urban Population or Urbanisation Rate (% of Total).

The underlying trends, their associated reasons and the relevance of these indicators to city structure development performance are discussed in the following sub sections.

Other longitudinal indicators selected as compositional indicators are discussed in **Chapter 8 Compositional Aspects of City Population** include:

- Prison Population Rate (No. per 100,000 Inhabitants);
- Net Migration (No. of People per annum);
- Total Dependency Ratio (No Units);
- Completed Tertiary Educational Attainment (% of Total);
- Hospital Beds (Per 1,000 People);
- Energy Use (Kg of Oil Equivalent per capita); and
- Carbon Dioxide Emissions (Metric Tons of CO₂ per capita).

5.4.1.1 *Claims on Central Government*

a) Data Explanation

Claims on Central Government (% GDP) measures the extent a country's government is in debt (total loans to Central Government minus deposits) relative to its economic growth. It reflects the country's sovereign debt and therefore the central government's creditworthiness. It reflects how fiscally responsibly the central government is operating and because it constitutes public debt, it is "*financed mainly by its citizens and may be seen as a transfer between generations*" (Stutely 2003: 82). So whilst central governments may increase public expenditure through increased loans to temporarily boost economic activity in the short-medium term, unless it is paid off, it places an increasing financial burden on the country's population and their successive generations who will have to eventually pay off the principal and accumulated interest. The level of claims on central government also affects the level and cost of debt funding within the economy and government bond yields – this impacts debt funding used for private, corporate and public expenditure and investment.

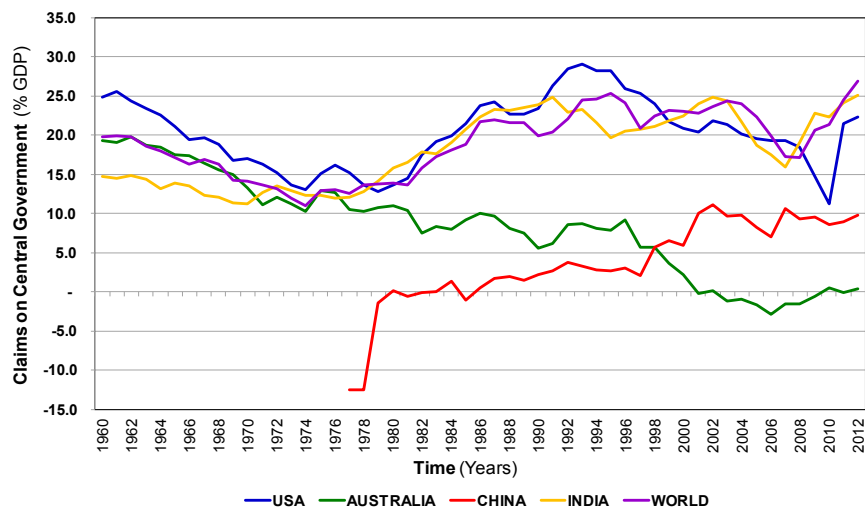
Whilst there is no prescribed optimum level of public debt relative to GDP, it is instructive to look at the overall trend in public debt levels for each country where "*a country with an ever-rising debt ratio is clearly heading for trouble*" (Stutely 2003: 83). However a number of countries have a self imposed debt ceiling i.e. a maximum amount of money a country can borrow and increases in the ceiling limit must be amended/passed through Parliament/Congress. Since the 1960s, the US debt ceiling has been increased over 70 times and as of November 2013, Congress only recently agreed to raise the debt ceiling from US\$16.3T to US\$16.7T in spite of much debate which also caused market uncertainty globally (Wikipedia 2013~). In Australia, the debt ceiling was introduced in 2008 and was subsequently increased three times. In November 2013, the Australian Federal Parliament debated raising the debt ceiling from AU\$300B to AU\$500B and has since struck a deal to remove the debt ceiling altogether (Griffiths 2013a).

Figure 5.2 charts the public debt levels for the countries in which the six cities under analysis reside (India, China, Australia and the USA) and also provides an aggregated public debt level for the World as a cross reference (World Bank 2013c). From around 2002-2006 and prior to the Global Financial Crisis (GFC), these four countries and most of the world claims on central government were declining, however during and post GFC, all governments globally found it necessary to apply economic stimulus programs within their respective countries to stave off significant economic deterioration. Some countries such as Greece,

Ireland, Portugal, etc required an economic bailout(s) from the International Monetary Fund.

With the exception of Australia, the overall trend for claims on government is rising for the World, USA, India and China. From 1960-2008 India, USA and the World net public debt levels moved in relative tandem within a band of around 10-30% where they collectively troughed between 1974 – 1976/79 as the Oil crises took hold and peaked around the early-mid 1990s. As at 2012, claims on public debt were USA 22.4%, India 25.1% and World 26.9%.

Governance: Claims on Central Government



Source: World Bank

Figure 5.2: Claims on Central Government

A notable decline in the claims on the government for the US occurred from 2007-2010 as the central government lent bail out money to a number of global investment banks and large automotive companies during the Global Financial Crisis (GFC). However public debt quickly rose as the US further affected a number of economic stimulus programs. It was recently reported in November 2013 that the Federal Reserve Bank's US\$85B per month asset purchasing program could not be continued indefinitely (International Monetary Fund 2013c; Wikipedia 2013~).

In India, to counter the effects of the GFC on the economy, the central government applied three economic stimulus packages *"in the form of tax relief to boost demand and increased expenditure on public projects to create employment and public assets. India's central bank - the Reserve Bank of India... took a number of monetary easing and liquidity*

enhancing measures to facilitate flow of funds from the financial system to meet the needs of productive sectors” (Bajpai 2011).

Australia is the only country out of the four to have steadily decreased its level of public debt and dipped for a prolonged period 2003-09 into net surplus territory. Post 2007, public debt levels have risen in light of the economic stimulus programs required as part of the GFC fallout. As at 2012, claims on Australia’s central government were 0.4% of GDP. Over the last 50 years Australia has maintained strong fiscal discipline in reducing its public debt, but as outlined previously, the Federal Parliament were considering raising the debt ceiling to AU\$500B but have subsequently struck a deal to remove the debt ceiling altogether (Griffiths 2013a: ABC News online article, *"Government Strikes Deal with Greens to Scrap Debt Ceiling"*).

China recorded a significant jump in claims on government where it rose from negative 12.5% (i.e. net deposits/savings) immediately after the Cultural Revolution to negative 1.4% in 1979. In the same year, China had also entered into the Sino Vietnamese War. China’s public debt steadily rose as the country entered a period of re-structuring and economic reform which buoyed public debt levels as the government stimulated economic activity. As of 2012, China’s claims on central government are 9.8% of its GDP.

b) Implications

Where a country’s claims on central government become too high, it raises the financial burden the population and its future generations must repay. It also impacts the cost of funds, government bond yields and consequently the investment and business climate a country and its cities provide to attract further business and investment opportunities which in turn raises economic and city structure development activities.

Each country and city should have the ability to tap into public debt particularly where there are instances which warrant economic stimulus programs during adverse macro events such as the GFC. But the debt ceiling has to be managed responsibly to ensure the shorter term benefits and financial costs arising from using public debt do not significantly outweigh the longer term benefits and public debt levels do not compromise the ability of the country/city to create an attractive investment climate that can provide strong employment, investment and development opportunities.

5.4.1.2 Health Expenditure

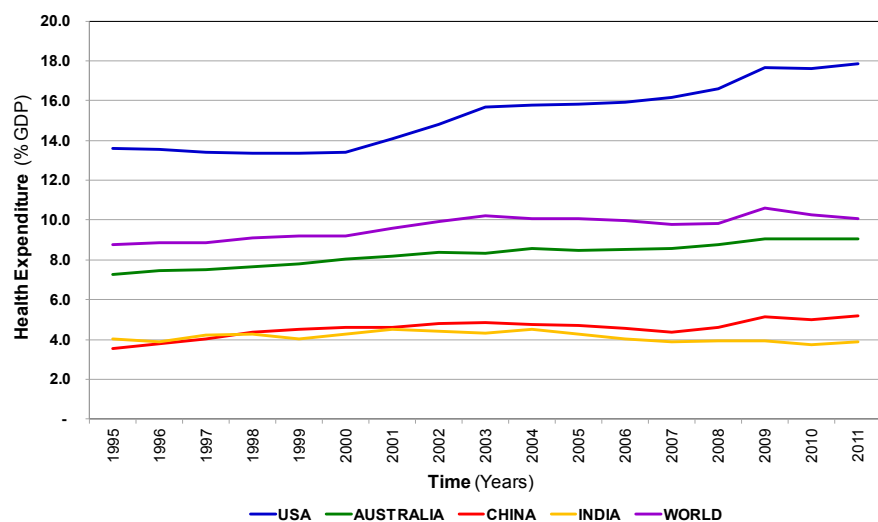
a) Data Explanation

Health Expenditure (% GDP) measures the total amount of public and private expenditure spent on the provision of health and other related services within a country relative to GDP. It reflects the Government's leadership vision and the financial priority it gives to the health sector as well as the amount of money expended by the private sector. It impacts the country and also a city's ability to provide adequate access to health care infrastructure and services to its workers, residents and visitors.

As an overall trend health expenditure levels for the four countries and the world have been gradually rising over the past 17 years within a band range of 3.5% (China) to 17.9% (USA) (World Bank 2013c). Refer to **Figure 5.3**.

This reflects the increasing financial costs/expenditure associated with an ageing population and in particular as the Post World War II Baby Boomers demographic segment transitions into retirement and requires a greater level of health care infrastructure and services.

Governance: Health Expenditure



Source: World Bank

Figure 5.3: Health Expenditure

India recorded the lowest health expenditure of the four key countries. It also highlighted the need for increased spending on health and when this is read in conjunction with other indicators (refer to **Appendix 2: City Structure Universal Indicator Matrix**) where the country has the

highest fertility rate at 2.6 births per woman but the lowest life expectancy at birth of 66.3 years compared to the other three countries. This preliminary comparison would signal the growing need to spend a greater amount of money on hospitals, health clinics, health services, etc to raise access to adequate health provisions and improve the general health of the population.

b) Implications

Whilst this indicator measures health expenditure at a country level, it also provides an indicative trend for cities. Whilst there are regional hospitals and clinics outside of the major cities, the majority of health infrastructure such as hospitals and clinics and the provision of those health services tend to be provided in city locations where there is a critical mass of population and a concentration of specialised medical knowledge. Many of the large public and private hospitals tend to have teaching as well as research and development affiliations with major universities, medical and pharmaceutical industry clusters. These tend to agglomerate in or close to major cities.

Health expenditure typically increases in line with a country's ageing population and other health aspects (e.g. average life expectancy; child and life mortality rates; infectious, cardiovascular, respiratory and other diseases; cancer occurrences, levels of obesity, diabetes, etc.). This is expected to impact a city structure's development of its health care sector in terms of economic activity, provision of health care infrastructure and services and its medical and health knowledge building capacity. This is illustrated with the concept of the Preston Curve which establishes a causal relationship between an increase in life expectancy and an increase in GDP per capita – this is particularly the case for low GDP per capita in developing countries where there are significant benefits with greater family income but has diminishing returns life expectancy benefits for highly developed/mature countries with high levels of GDP (Wikipedia 2013w).

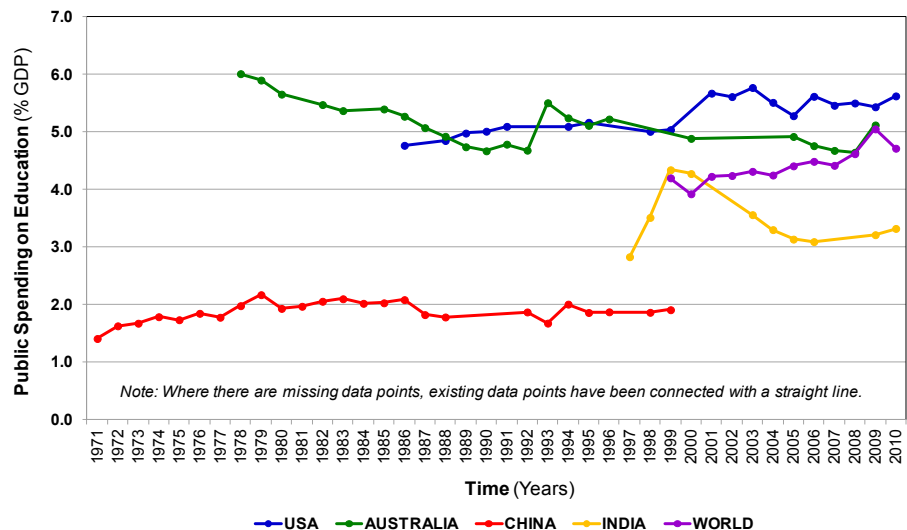
5.4.1.3 Public Spending on Education

a) Data Explanation

Public Spending on Education (% GDP) measures the total amount of government spending on primary, secondary and tertiary (public and private) institutions, education administration and related services as well as subsidies spent on the country's education sector. It reflects the Government's leadership vision and the financial priority it gives to the education sector and provides a good indicator of the country's future economic productivity and knowledge building capacities.

Figure 5.4 charts the level of government spending on education for each of the four countries and the world average (World Bank 2013c). Whilst Australia and India recorded an overall decline in government spending, China, USA and the World recorded an overall increase in government spending in education. Note in **Figure 5.4**, where there is missing annual data, existing points have been connected with a straight line – this is evident when there are missing data points in the line graphs e.g. China has missing data between 1988-1992 and a straight line has been used to connect the two data points. No further data was available for China post 1999.

Governance: Public Spending on Education



Source: World Bank

Figure 5.4: Public Spending on Education

As at 1999, China's public expenditure on education was 1.91% in line with its 29 year historical average of 1.87%. As at 2009, the Australian government spent around 5.12% on education compared to the USA (5.43%) and the World average (5.05%).

b) Implications

When read in conjunction with other indicators such as Completed Secondary and Tertiary Educational Attainment levels; people employed in the industry and services sector; and GDP per Capita, a better understanding is obtained of how well a government expenditure or investment in the populations' young generation has paid off. This is discussed more fully under the compositional indicator Completed

Tertiary Educational Attainment in **section 8.4.1 Compositional Indicators** in **Chapter 8: Proof of Concept: Compositional Aspects of City Structure Population**.

Similar to the Health Expenditure indicator, the Public Spending on Education indicator provides a barometer at a country level for the future productive capacity of its younger generation. Given the vast majority of the population agglomerates in its cities where the greatest employment opportunities and higher paying jobs are located, this also provides an indicative trend for its major cities.

In increasing its expenditure/investment in providing a better education for its population, it enables the younger generations to be better positioned to successfully complete tertiary education, to become highly skilled workers and to obtain more knowledge and higher skilled intensive jobs that enhance a city's productive capacity. This in turn fosters further knowledge creation by bringing investors, corporations, workers, etc together which generates and enhances the knowledge and capital flows and networks of functional educational and applied knowledge based activities and relationships. This also attracts a critical mass of educators and researchers to generate centres of excellence and innovation both within the educational sector and in its work with industry.

5.4.1.4 Military Expenditure

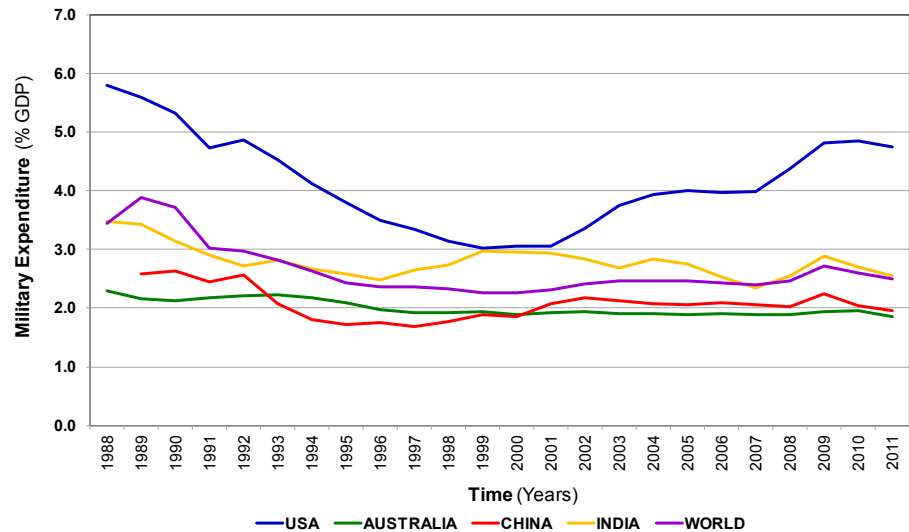
a) Data Explanation

Military Expenditure (% GDP) measures public and private spending on military and defence related infrastructure, procurement, research and development and related services. Military Expenditure reflects the Government's leadership vision and the financial priority it gives to the military and defence sector as well as the amount of money expended by the private sector. It impacts the country and also a city's ability to ensure political stability, to provide an attractive investment climate and it reflects the country's collective social values on peace keeping and defending the nation in relation to other key priorities and social trade-offs (i.e. military money that could otherwise be directed towards health, education, social housing, etc).

Compared to a country's respective health and education spending, military spending is a lower proportion of GDP.

Since 1988 and as an overall trend, military expenditure has declined over the past 24 years across the four countries and the world average (World Bank 2013c). Refer to **Figure 5.5**.

Governance: Military Expenditure



Source: World Bank

Figure 5.5: Military Expenditure

The US recorded the most significant movement – declining from 5.8% of GDP in 1988 to a trough of around 3.0% in 1999-2001 before rising to 4.8% in 2011. The trough period in military expenditure is accounted for by the military lull between the Gulf War and the Global War on Terrorism. In 2011, total US Military spending totalled around US\$711B and represented 41% of global military spending (Stockholm International Peace Research Institute 2011).

India's military expenditure rose to 3.0% and plateaued in 1999-2001 as it re-commenced its war with Pakistan. According to the 2011 official Indian Defence Budget, military expenditure accounted for US\$36B and according to the World Bank military expenditure in 2011 was 2.5% of GDP.

Australia has played more an allied or supportive role rather than instigating direct conflict in recent years and has been involved in armed conflict in East Timor, Solomon Islands and Afghanistan as well as UN and regional peacekeeping and disaster relief. Consequently, Australia's military expenditure has been relatively stable averaging around 2.0% of GDP in 1988-2011. Defence spending accounted for around AU\$25.7B in the 2010-2011 federal budget. As at 2011, military expenditure represents 1.9% of GDP.

China's military expenditure has risen since 2000 as the government focused on modernising its air and ground forces. According to the Chinese government, China's military expenditure in 2012 totalled US\$100B and as at 2011, accounted for 2.0% of GDP.

b) Implications

Military Expenditure is important when evaluating a city's development performance because it gives an indication of the political stability within a country and its cities. This is a primary concern when overseas companies and investors are looking to invest in a city – they want to know there is political stability i.e. the country is not at war and it has an attractive investment climate with no civil unrest to compromise day to day business operations. It also reflects the collective social values the country places on defending the nation, regional peace keeping and disaster relief with respect to other key priorities and tradeoffs. There has been a growing frustration and increased demands placed on accountability by residents and lobby groups about the human toll and considerable amount spent on defence and military infrastructure and operations. In particular - whether a country's resources should be more prudently directed at economic and social reforms that boost employment, health, education and other sectoral opportunities particularly in light of the economic hardships experienced during and post GFC.

In spite of this, expenditure on the military and defence sector does promote and develop expertise knowledge and defence related industry development in providing military infrastructure (fighter jets, stealth aircraft, nuclear submarines, drones, missile capabilities, etc) and the knowledge base (weapons technology, aeronautical and naval engineering, medical, military schools and training camps, etc) and networks (specialised military research and development networks/clusters, regional/global military contracts and procurement and intelligence and logistics networks, etc) supporting endeavours in this sector. Industries that support the military/defence sector such as research and development arms within universities, private corporations and laboratories/testing facilities also form focal points for innovation in many key cities.

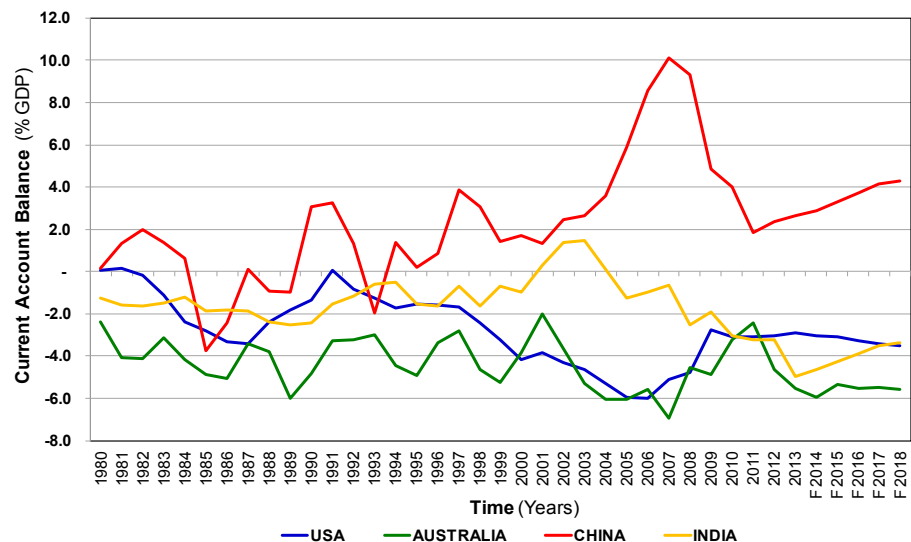
5.4.1.5 Current Account Balance

a) Data Explanation

The Current Account Balance (% GDP) measures net current payments by taking the difference between national savings and investment and is a broad measure of a country's trade with the rest of the world. It is significant because it reflects the Government's fiscal management, how well the economy is operating and whether earnings from exports and remittances exceed spending on imports. This in turn impacts on creating a conducive investment/business climate and can provide the country and its cities with a comparative advantage over others when competing for business and investment.

Between 1980-2013, the USA, India and Australia have exhibited an overall downwards trend or current account deficit fluctuating within a range of 0.2% to negative 7.0% (International Monetary Fund 2013d; World Bank 2013c). Refer to **Figure 5.6**.

Governance: Current Account Balance



Source: World Bank & International Monetary Fund

Figure 5.6: Current Account Balance

India's ballooning current account deficit has resulted from global uncertainty which has translated into weaker global demand for its exports and investment uncertainty caused by government policymaking and short-sighted decisions. This has been significantly exacerbated by India's large import demand for gold – the government

and Reserve Bank of India have taken precautions to curb gold imports by levying a 10% import duty on gold (Bajpai 2011). As at 2013, India's current account balance stood at negative 5.0% and is projected to improve to average negative 3.9% in 2014-2018.

During and post GFC, the US made inroads in reducing its current account deficit. The economic stimulus programs and austerity measures have helped to generate economic activity which has boosted exports and generated a larger income surplus. However where the US economic growth is outpacing Europe and parts of Asia and the US\$ is appreciating against most world currencies, this is expected to curb demand for its exports and there will be a reliance on foreign investment financing domestic demand. As at 2013, America's current account deficit stood at negative 2.9% and is projected to widen to average negative 3.3% in 2014-2018.

Of the four countries, Australia has the narrowest export base which has traditionally relied on natural resources/commodities, has strengthened its services sector but has a limited export capacity from its relatively small manufacturing sector. Whilst government has been generally supportive of manufacturing industries e.g. Ford, Holden and Toyota car manufacturers, the problem lies in a lack of international competitiveness (e.g. high labour rates, high transportation costs) and a heavy reliance on capital goods from overseas (i.e. tangible assets a manufacturer uses to produce goods or services e.g. equipment and machinery). Consequently many manufacturers have relocated their manufacturing facilities overseas where the labour rates and cost of capital goods are significantly cheaper. In addition to a limited capacity to generate goods as exports, the current account deficit has also been exacerbated by low savings levels resulting from excessive expenditure which in turn reduces the amount of funds available for loan. Consequently this forces the private sector to borrow funds from overseas – this not only widens the deficit but also increases the cost of debt and therefore the cost of doing business. As at 2013, Australia's current account deficit stood at negative 5.5% and is estimated to average negative 5.6% in 2014-2018.

China has bucked the trend because it has been a huge exporter of manufactured goods globally. It hit a pre-crisis peak of 10.1% in 2007 before falling dramatically to 1.9% in 2011 as the GFC substantially weakened demand for its exports. It was reported by the IMF that machinery and equipment exports to the US accounted for 10-15% of China's overall export growth in the early 2000s but has currently fallen to 5% (Singh 2012). As at 2013, the current account balance stood at

negative 2.6% and is projected to average 3.7% over the next five years.

Whilst China is increasingly becoming a consumer of imported goods, imports of machinery and equipment still outstrip domestic demand for imported consumer goods. China's 12th Five Year Plan focuses on increasing household income and domestic consumption and expanding the service sector. So whilst domestic consumer demand is expected to gradually rise, it is not expected to outstrip its export levels in the medium term.

b) Implications

The Current Account Balance indicator provides a broad measure of a country's trade status with the rest of the world. In evaluating current account balance trends and the rationale, it provides a better understanding of the mechanisms that generate economic activity e.g. excessive consumption of imported goods and services versus low value add sales of natural resources/commodities versus high export levels of manufactured goods and professional/knowledge based services. This impacts the development performance of cities because in providing the technical know-how to enable the export of commodities, manufactured goods and services this enables the city to evolve, innovate, adapt and become resilient to global and domestic market forces. Cities are paramount in developing and channelling knowledge and capital networks, creating markets, acting as employment magnets to attract skilled workers and in providing the requisite infrastructure and service provisions to facilitate the city's productive capacity.

A good example is how China has used its cities to develop a strong trade interdependence on China to support other Asian economies and has successfully developed its trade networks to export to global markets. This is illustrated by the IMF:

"China today accounts for more than 50% of all intraregional intermediate goods imports, twice its share in the mid 1990s, and making it the center of Asia's supply chain. As a result of greater vertical integration, Asian economies' exports to China have been increasingly driven by the success of China's exports in world markets...If the rapid growth of Chinese exports slows, Asian trading partners would also face significant headwinds. These headwinds would become stronger if China were to "on-shore" a larger chunk of the regional supply chain".

(Singh 2012).

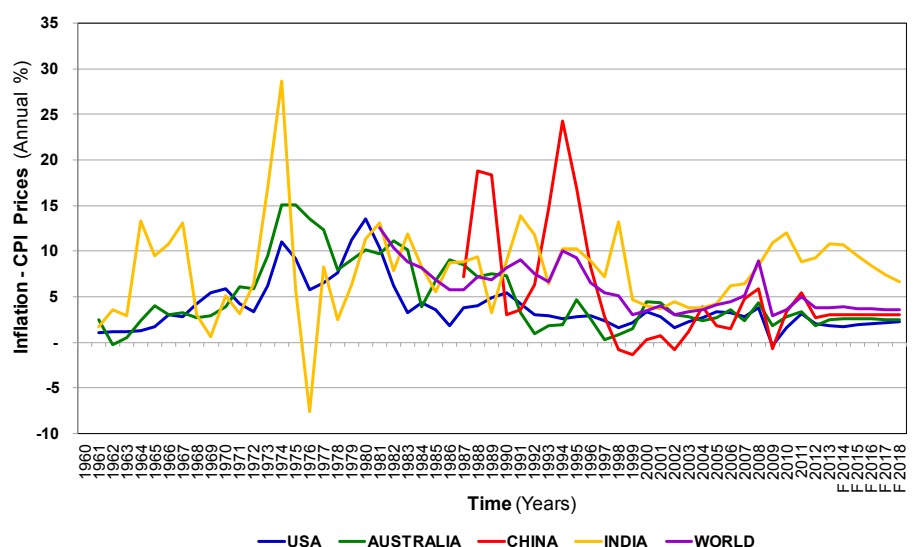
5.4.1.6 Inflation – Consumer Prices

a) Data Explanation

The Inflation based on Consumer Prices (Annual %) indicator measures inflation through the consumer/household buying a basket of goods and services. It is significant because it impacts on the cost of living for households. This has flow on consequences for rental/housing affordability, household wealth, disposable income and a household's general quality of life. Rising inflation also increases pressure on wage growth expectations in order to keep up with higher costs of living which subsequently affects labour contracts, the costs of doing business and central banks' monetary policies.

Figure 5.7 charts the inflation trends for the four countries and world average (World Bank 2013c). Between 1960 and 2013, the USA, Australia and the World average have kept within a band of negative 0.3% to 15.1%. High population and recent high economic growth countries such as India and China had higher inflationary pressures recording more extreme amplitude ranges in India between negative 7.6% to 28.6% and in China negative 1.4% to 24.2%. In comparison, inflation amplitude ranges for the USA (negative 0.4% to 13.5%) and Australia (negative 0.3% to 15.1%) have been relatively moderate due to their respective central bank keeping a more judicious and steady influence on the supply of money via their monetary policies.

Economic: Inflation – Consumer Prices



Source: World Bank

Figure 5.7: Inflation – Consumer Prices

For example, in mid 1993 the Reserve Bank of Australia (RBA) introduced an inflationary target band of 2-3% on average over a typical economic/business cycle. According to the RBA *“this is a rate of inflation sufficiently low that it does not materially distort economic decisions in the community. Seeking to achieve this rate, on average, provides discipline for monetary policy decision-making, and serves as an anchor for private-sector inflation expectations”* (RBA website 2013).

By employing expansionary monetary policy to reduce unemployment in a recession by lowering interest rates and therefore inflation, this increases easy credit that can be used to encourage businesses to expand and therefore stimulate economic activity. In contrast, contractionary monetary policy can be used to rein in rising inflation to prevent sharp spikes and an undermining in asset values.

Post 2000, as the financial markets have been increasingly operating as a global market, this has helped regulate/moderate excessive fluctuations in inflation. Given the current global economic uncertainty, Central banks will continue to closely monitor economic growth and inflation. According to the World Bank, inflation is expected to remain relatively stable over the next five years and average 8.6% India, 3.7% World, 3.0% China, 2.5% Australia and 2.0% USA.

It is interesting to note that for a macro event such as the GFC, there was a synchronised rise in inflation where the USA, China, Australia and the World average showed an increasing asset price bubble peak within a range of 3.8% (USA) to 9.0% (World) in 2008 followed by a synchronised sharp drop in inflation which troughed in 2009 within a range of negative 0.7 (China) to 2.9% (World). However India appears be slightly out of synchronisation with a two-year lag compared to its counterparts – recording a peak of 12.0% in 2010 and a trough of 8.9% in 2011. This could be attributed to the momentum from India’s strong economic growth over the last two decades - primarily due to structural changes in industrial, trade and financial areas and sectoral reforms which significantly contributed to higher economic productivity. The lag may have also been partly attributed to India’s financial market not being as fully developed/mature and therefore not as closely aligned/integrated with the leading financial markets in other countries resulting in a slower response time/lag.

b) Implications

Inflation based on Consumer Prices provides a measure of inflation experienced by the consumer/household. Inflation impacts on city structure development because it affects the costs of living and doing business; consumer and investor confidence; investment intentions and activity; inventory and production levels; wage expectations and employment prospects. Whilst inflation is expected to rise and decline with broader economic cycles there is the market expectation that central banks will prudently manage excessive inflationary movements through monetary policies. If inflationary pressures get out of hand, there is a tendency for costs of living and asset values to overshoot consumer and investor expectations and adverse consequences follow e.g. escalating wage pressures, higher levels of unemployment, housing unaffordability, slowdown in aggregate demand, etc. Inflation impacts on city structure development for the reasons outlined above and subsequently has the ability to encourage or curb economic activity.

5.4.1.7 Total Investment

a) Data Explanation

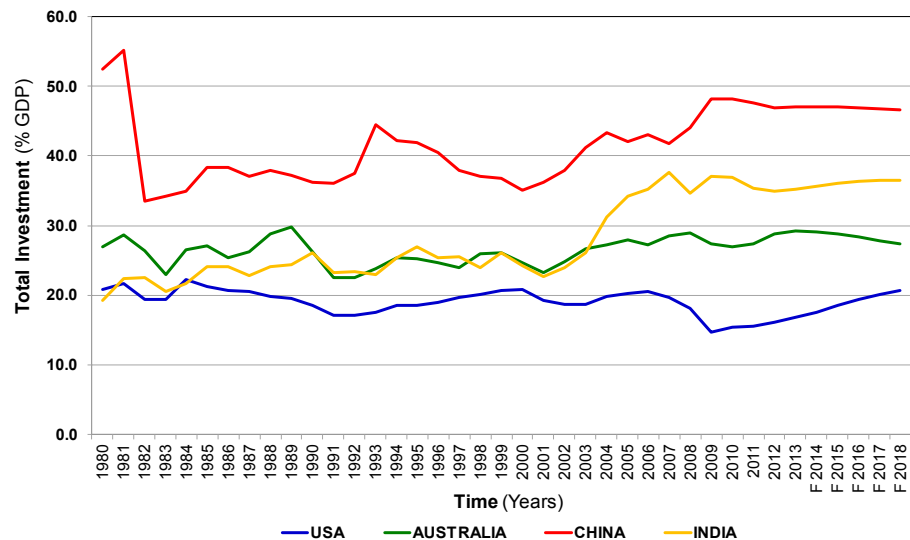
Total Investment (% GDP) measures the total amount of money invested in a country with respect to its economic growth. It is significant because it represents an outlay for future production of a country and its cities. It should be noted that an investment is regarded as spending by a business on physical assets with a life of more than one year – it is distinguished from financial transactions (what is considered colloquially as “investments”) as this is regarded as savings. Investment is also not considered consumer/household consumption as it does not contribute towards the production of future output in the same way a business might utilise an asset.

Between 1980-2013, total investment in the USA, Australia and China has ranged between a band of 14.7 % (USA) to 37.0% (India) of GDP (World Bank 2013c). Refer to **Figure 5.8**.

As a percentage of GDP, total investment in the USA has been comparatively low averaging 19.0% of GDP over the past 34 years (1980-2013, 34 year Historical Average (HAv)) and is expected to trend nominally above at 19.3% of GDP over the next five years (2014-2018, 5 year Forecasted Average (FAv)). However when compared to other mature cross reference countries, USA total investment levels as a percentage of GDP were higher than the UK (17.4% 34HAv and 16.8% 5FAv) but lower than France (20.0% 34HAv and 21.4% 5FAv) and Japan (26.4% 34HAv and 21.1% 5FAv).

Like the USA, Australia's total investment levels as percentage of GDP have been relatively stable in light of a reasonably open and well regulated market economy, stable political environment and mature investment/business climate. Over the past 34 years, Australia's total investment as a percentage of GDP has averaged a moderate 26.3% and is expected to rise to 28.3%.

Economic: Total Investment



Source: International Monetary Fund

Figure 5.8: Total Investment

Since 1985, India was experiencing balance of payment difficulties which culminated in a serious economic crisis in 1991 – “*The government was close to default, its central bank had refused new credit and foreign exchange reserves had been reduced to such a point that India could barely finance three weeks’ worth of imports which resulted in India having to airlift its gold reserves as a pledge with the International Monetary Fund (IMF) for a loan*” (Wikipedia 2013o). Key factors responsible for the crisis was an over valuation of the currency, an increasing and substantial current account deficit and decreasing level of investor confidence. This arose from a series of events such as the Gulf War, an ever increasing oil import bill, a slump in exports, less available credit/debt funding and waning investor confidence with a withdrawal in investment funds. These circumstances drove the Government to open up its economy to encourage foreign trade and direct investment into India. The IMF provided an emergency loan of \$2.2B to India requiring 67 tons of India’s gold reserves as collateral. This enabled the incoming government to initiate a series of economic

reforms by the former Finance Minister, Manmohan Singh, to open up the country to foreign investment and greater business competition. Since 2001, India's investment levels have risen from 22.6% (2001) to a peak of 37.7% of GDP in 2007. Based on the IMF indicator dataset collected over a 34 year time frame, investment levels have averaged 27.2% and are expected to rise to 36.2% over the next five years.

In overall terms, most Asian countries in the cross reference sample using the same IMF dataset tended to have relatively higher total investment levels of 25% or more – Singapore (31.9% 34Hav) and Indonesia (32.1% 34Hav) were notable examples (International Monetary Fund 2013d). But none of the key or cross reference countries surpass China's investment levels as a percentage of GDP.

Post Cultural Revolution (1976), Deng Xiaoping's economic reforms led to a market oriented economy and opened the country to greater foreign trade and investment opportunities. This in turn led to the creation of Special Economic Zones where China's investment and export led sectors have substantially driven economic growth since 2000. Between 1980-2013, China's historical average investment level has been significantly high at 40.9% of GDP and is expected to rise even further as China ramps up its investment efforts to average 46.9% of GDP in 2014-2018.

As China continues to target high economic growth, it has placed considerable pressure on its cities and provinces to maintain their respective economic growth targets – some of which are unsustainable due to a lack of demand and a significant battle between farmers and developers over land (Miller 2012). Underlying this is the question of ongoing sustainability of economic growth and at what price and will this lead to an asset pricing bubble. It was recently reported in Bloomberg Financial News that a dozen Chinese developers were looking to invest billions of dollars outside of China because of regulatory restrictions and concerns the Chinese property market is overheating (Brandt, Carmiel & Levy 2013). According to the article, these Chinese developers were willing to trade a much more predictable but lower *"internal rate of return of about 15% on US projects, less than the 30 percent to 50 per cent more common in China"* for the relative stability and predictable population growth in major US cities, parts of Europe and Australia (Brandt, Carmiel & Levy 2013: Bloomberg News, online article: "Chinese Steer Billions Abroad in Quest for Safety"). The market dynamics and lack of market transparency has caused investment uncertainty where one developer, Qian, commented *"These types of returns are going to end in China... They will have to level out at some point. But it's hard to predict and, it*

makes business-planning for the future difficult in China" (Brandt, Carmiel & Levy 2013: Bloomberg News online article "Chinese Steer Billions Abroad in Quest for Safety").

b) Implications

Total Investment is a significant measure of the total amount of money invested in a country relative to its economic growth as it provides an indication of the future outlay for the future production of a country and its cities. As discussed, investment levels have been strongly influenced by factors which include sovereign/political stability; regulatory and business/investment climate; level of market maturity; investor confidence; productivity capacity levels; investment returns and future investment prospects. Total investment impacts on city structure development because it reflects the efficiency of a city's supply and demand market dynamics and it has the direct ability to stimulate or discourage future productivity outlays through investment expenditure. Consequently this influences the type and nature of investment activity that a city attracts e.g. knowledge based services versus manufacturing versus residential, etc and the subsequent governance, economic, social and environment activities that are generated and that drive a city structure's development.

5.4.1.8 Urban Population or Urbanisation Rate

a) Data Explanation

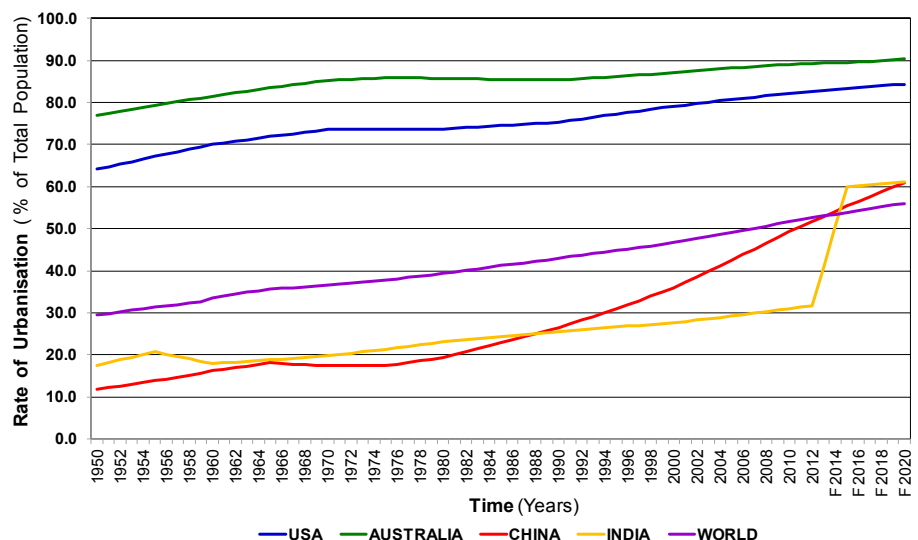
The Urban Population or Urbanisation Rate (% Total) measures the number of people within the country who agglomerate around urban areas as a percentage of the total population.

It is significant because it reflects the government's ability to provide a supportive regulatory and fiscal policy framework for increased urbanisation, comparative productivity levels, skilled migrant labour, cultural & religious diversity, community & cultural identity, migration trends and social trade-offs/benefits. Increased urbanisation levels also impact the built environment (more housing, schools & infrastructure required), transport system, consumption of water and energy, generation of pollution, etc.

In terms of early developing and developing countries, the urbanisation rate is still rapidly increasing where there is a significant push for rural and outer suburban workers to move to the cities to access greater employment and education opportunities, health and other infrastructure support. Both China and India's urbanisation rates rose from 11.8% and 17.5% in 1950 to 53% and 41.1% respectively in 2013

(United Nations 2012; World Bank 2013c). Refer to **Figure 5.9**. This is approximately in line with the World average which rose from 29.4% to 53.0% over the same timeframe. It should be noted that China's rate of urbanisation growth rose post 1980s as the new economic reforms pushed a large proportion of rural workers into city factories to raise economic productivity. Interestingly whilst the United Nations project India urbanisation rate (59.9%) will overtake China's (55.4%) in 2015, both countries urbanisations levels will rise to around 61% by 2020.

Social: Urbanisation Rate



Source: World Bank & United Nations

Figure 5.9: Urbanisation Rate

As relatively developed countries, both the USA and Australia have held high urbanisation rates since the 1950s at 64.2% and 77.0% respectively. Australia notably has a higher urbanisation rate where by virtue of its geography (a large part of which is inland desert), around three quarters of its total population live in metropolitan cities and coastal areas. As at 2013, the urbanisation rates for the USA and Australia are respectively 82.9% and 89.4% and are projected to nominally rise to 84.4% and 90.4% respectively by 2020.

b) Implications

As mentioned previously as a country or city transitions along the later stages of the Urbanisation Curve (e.g. Australia, USA, Canada, Europe and Russia), it approaches the terminal stage of around 70-75% of the total population and further growth in the urbanisation rate is minimal/slows and competition between cities to attract inhabitants heightens (Brunn, Williams & Zeigler 2003). When the urbanisation curve approaches a ceiling of around 80%, the curve begins to flatten and this is *“the level at which rural and urban populations appear to reach a functional equilibrium”* (Pacione 2003: 78). This is exemplified in the minimal growth in the urbanisation rate projected to occur in the USA and Australia in 2014-2020.

Whilst the urbanisation levels measure growth in urban areas relative to the total population, growth in city structure populations is a better indicator for city structure development because it explicitly tracks the number of inhabitants in city structures alone. However urbanisation rates are still a useful yardstick when comparing countries across vastly different stages of development and where they are positioned along the urbanisation curve.

Higher urbanisation levels also provide insights into city structure development with respect to the concentration of available and better/higher skilled workers and residents as well as higher levels of cultural and religious diversity. Higher urbanisation levels enable a greater volume of activity generation and relationships as well as the increased transfer of capital and knowledge flows. Higher urbanisation levels also impose greater housing, social and transport infrastructure, water and energy consumption requirements which steer city structure development in various directions to meet rising demand as limited resources and funding are allocated. There are also tradeoffs to increased urbanisation levels where if they are not properly managed/resolved can lead to increased traffic congestion, air pollution (which in turn impacts health e.g. greater respiratory illnesses), greater income and social inequities, increased crime and urban sprawl.

5.4.2 Cross Sectional Analysis

The cross sectional analysis comprises two critical indicators where data extends less than 15 years. These indicators are:

- Research and Development Expenditure; and
- Global Network Connectivity Score.

The underlying trends, their associated reasons and the relevance of these indicators to city structure development performance are discussed in the following sub sections.

Other cross sectional indicators that have been selected as compositional indicators are discussed in **Chapter 8 Compositional Aspects of City Population** and include:

- Revenue Multiplier(Sq ft / Person);
- Population Density (No. of People / km²);
- City Office Occupancy Costs (US\$ / Sq ft pa); and
- Motor Vehicles (per 1,000 People).

5.4.2.1 Research and Development Expenditure

a) Data Explanation

Research and Development Expenditure (% GDP) measures the amount of public and private sector capital spent on basic and applied research and experimental development. It is significant because it reflects the extent the government and private sector drives the development of intellectual capital. This in turn provides a country and its cities specialising in these fields of knowledge, a leading edge by creating, developing and/or improving future goods and services. By developing such competitive advantages, this further enhances the country and its cities' future productivity and capacity for its investment and business sectors. Through the transfer of this knowledge and technological progress, this educates a city's workers which further enhance their knowledge base and productive capacity.

According to the "*The Global Competitiveness Report 2013-2014*" (World Economic Forum 2013), both the USA and Australia are classified as "Innovation Driven" economies (i.e. the most highly developed competitive economies which are able to focus on business sophistication and innovation). China is classified as an "Efficiency Driven" economy (i.e. the intermediate stage of competitive economies which tend to focus on efficiency aspects to enhance their competitiveness). India is classified as a "Factor Driven" economy (i.e.

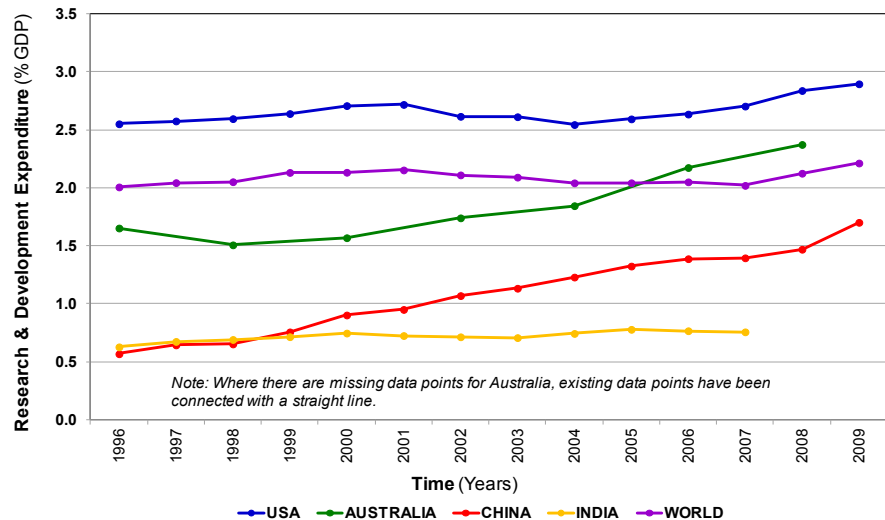
the least competitive economies that tend to focus on basic requirements e.g. developing institutions, infrastructure, macroeconomic environment, health and primary education). The Innovation ratings ascribed to these key cities range from 3.6 (India) to 5.4 (USA) out of a ranking of 1 (lowest) to 7 (highest). These innovation rankings also support the indicator findings discussed for research and development expenditure and the number of patent applications lodged by residents.

Between 1996-2007/08/09, there has been an overall increase in the amount spent on research and development (International Monetary Fund 2013d). Refer to **Figure 5.10**. Expenditure on research and development in innovation driven countries such as the USA and Australia have trended above less advanced/developing countries such as China and India, however it is interesting to note that China is rapidly closing this gap.

The most recent figures from the International Monetary Fund report research and development expenditure for the USA is around 2.9% of its GDP and for Australia 2.4% compared to China at 1.7% and India at 0.8% (International Monetary Fund 2013d). As pointed out earlier regarding the “*The Global Competitiveness Report 2013-2014*” (World Economic Forum 2013), the USA and Australia are at an advanced competitiveness stage where they are more readily able to focus on developing their innovation through endeavours such as research and development which gives them a significant competitive advantage. When read in conjunction with other Universal Indicators such as the number of Patent Applications lodged by Residents, it further shows how the level of intellectual capital has grown. The number of patent applications grew in the USA from 63,090 (1960) to 247,750 (2011) and in Australia it rose from 3,978 (1963) to peak at 7,170 (1984) and declined to 2,383 (2011).

In recent research undertaken on benchmarking the competitiveness of Sydney and Melbourne (Hu, Blakely & Zhou 2013), it was noted that further improvement needed to be made in the areas of “*Governance, Connectivity and Enterprise Hub*”. Anecdotally, part of the criticism levelled at Australia’s inability to more fully capitalise on its research and development is the lack of government and infrastructure support; limited manufacturing capacity to test and refine prototypes to complement the research and development; and relatively shallow entrepreneurial and venture capital markets to transition the research into commercial scale applications.

Economic: Research & Development Expenditure



Source: International Monetary Fund

Figure 5.10: Research & Development Expenditure

By way of comparison, other “Innovation Driven economies” such as the UK and Japan recorded R & D expenditure of 1.8% and 3.5% respectively where patent applications lodged by residents in 2011 declined to 15,490 (compared to 24,300 in 1963) in the UK and rose to 290,081 (53,876 in 1963) in Japan.

For India, research and development expenditure has been relatively stable ranging from 0.6 to 0.8% of GDP. In terms of patent applications lodged, this has grown from 721 (1960) to 8,841 (2011) and has been spurred on in recent years by transnational corporations making strong headway in India’s telecommunications, automotive and pharmaceutical industries. One key example is the Mumbai based multinational conglomerate Tata Group that has developed business arms in communications and information technology; engineering; materials; services; energy; consumer products and chemicals (Tata Group 2013).

With China’s push for high economic growth and its relatively high total investment levels, its research and development expenditure stands at 1.7% of its GDP. The number of patent applications lodged by its residents has grown phenomenally from 4,065 (1985) to 293,066 (2010) to 415,829 (2011). The significant uplift in 2010-2011 could be attributed to the groundswell in manufacturing and as other countries invest in China to manufacture their goods more cheaply, they also share/transfer the research and development and manufacturing

knowledge to Chinese companies and workers. This in turn enhances the knowledge and skills of China's city workers and enables its cities to gain critical traction in further developing their innovation capacity.

The World's total research and development expenditure has been relatively stable and currently stands at 2.2% of GDP. Patent applications lodged has grown from 455,957 (1985) to 1,264,981 (2011) patents. Interestingly China's total number of patents lodged in 2001 accounts for one third of the World's total number of patents lodged followed by the USA with around 20%.

b) Implications

Research and Development Expenditure is an important indicator of the amount of capital the public and private sector spend on developing research and experimental development capabilities. When read in conjunction with other indicators such as the Global Competitiveness Index and the number of Patent Applications lodged by Residents, it begins to build a picture of the development of a country and its cities' intellectual capital and how this knowledge can be used to enhance its innovation and competitiveness globally.

More importantly greater research and development expenditure greatly facilitates the innovative capability of cities to create regions of innovation excellence; create systems of innovation; develop strategic economic intelligence; enable technology transfer and acquisition; facilitate innovation through collaboration; and promote localities, products and services globally (Komninos 2008). This directly impacts City Structure development performance in terms of how these centres of innovation excellence, knowledge networks and innovation systems develop through industry clusters and other networks where knowledge, innovation and technology is transferred and synthesised both explicitly and tacitly. A successful city structure enables knowledge and capital (financial, labour, intellectual, resources, etc) channels or networks to form and which can be further complemented by universities, research centres, laboratories, etc to produce further knowledge and co-operation networks. These networks of knowledge clusters and technology then form the bridge between industry, R & D institutions, government and other key stakeholders.

5.4.2.2 GaWC Global Network Connectivity Score

i) Data Explanation

The Globalisation and World Cities (GaWC) Research Network undertook work on ranking world cities within an interlocking network (at network, nodal and sub nodal levels) according to the connectivity amongst a sample of advanced producer service firms (financial services, accountancy, advertising, law, management consultancy and media) across a wide range of cities. The GaWC Connectivity Score (1.00 = London) tracks the number of global service firms that have office locations in cities internationally and how these firms operate through these cities by interlocking/connecting through their “*multi-city office networks*”. The score is calculated by measuring “*potential intra-firm flows; information and knowledge linking offices within a firm*” and estimates for these firms “*an indirect measure of total flows between every pair of cities*” where “*an individual city’s potential working flows*” relative to every other city is calculated as an estimate of network connectivity (Taylor 2004a; Taylor 2004b; Taylor et al. 2011). This score is then relatively ranked and expressed in a proportional form from 0 to 1 where the highest proportional score is London which equals “1” (Taylor 2004b).

The GaWC Network Connectivity Score is significant because it tracks knowledge and information flows within firms across cities to identify which cities have the highest connectivities. It also recognises that “*world cities constitute a complex network rather than a simple hierarchy. Although the first two ranks stand out (London and New York), ...when aggregated, the result is a world city network*” (Taylor 2004b).

The GaWC Network Connectivity Proportionate Connectivity Score indicator data was calculated as four year snapshots in 2000, 2004 and 2008 (Taylor 2000, 2004a; Taylor et al. 2011). In each of these scores, the cities were benchmarked against London which had the highest score of “1.0”. Refer to **Figure 5.11**.

In 2008, New York advanced its proportionate connectivity score to 1.0 from 0.98 (2000 and 2004) and tends to dominate/over shadow other US cities. Detroit considered a global car capital, has been showing signs of waning connectivity as firms choose to relocate out of Detroit due to its increasing economic woes – its score has gradually declined from 0.25 (2000) to 0.22 (2008).

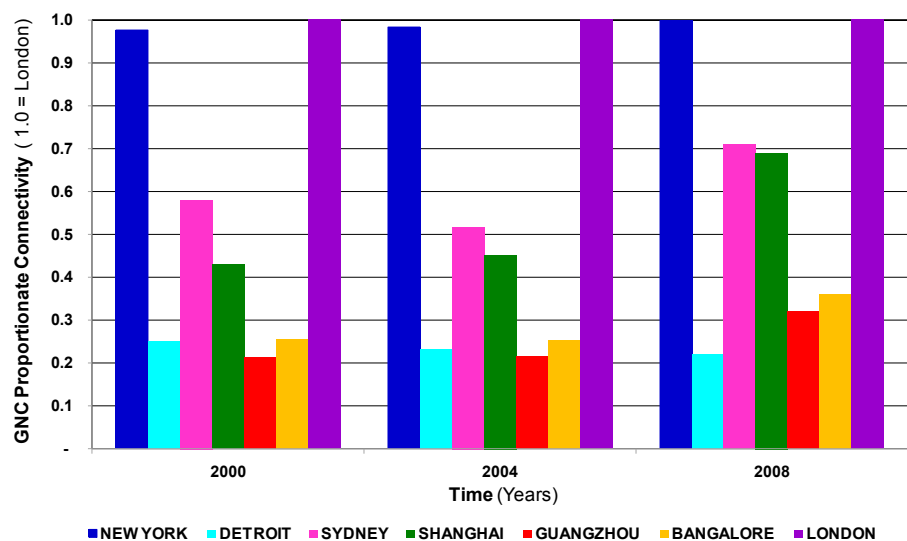
As at 2000, Sydney’s proportionate connectivity score was 0.58 before recording a minor setback where the score slipped to 0.52 (2004) before resurging to 0.71 in 2008. Sydney continues to exercise its

dominance over other capital cities and was noted as “by far the most ‘outward-looking’ city in Australia” (Taylor et al. 2011). By way of comparison, in 2008 Melbourne ranked a score of 0.44, followed by Brisbane 0.28, Perth 0.24, Adelaide 0.20, Canberra 0.16 and Hobart 0.06.

Both Shanghai and Guangzhou’s proportionate connectivity scores have been steadily rising. Most notably Shanghai’s score rose from 0.43 (2000) to 0.69 (2008) as the Government actively promotes Shanghai as “*China’s gateway to the world economy*” (Taylor et al. 2011) and raises its profile as a global city. Guangzhou’s score rose from 0.21 (2000) to 0.32 (2008). By way of comparison, in 2008 the scores for Beijing were 0.68, Hong Kong 0.83, Singapore 0.75 and Tokyo 0.74.

Bangalore’s proportionate connectivity score also rose from 0.25 (2000) to 0.36 (2008) as Bangalore’s IT sector develops. Overall, the majority of Indian city connectivity scores were relatively low and again the “*The Global Competitiveness Report 2013-2014*” classifying India as a “Factor Driven” economy underscores the priority the country has given to basic requirements such as developing infrastructure, macroeconomic environment, etc. In comparison, the 2008 connectivity score was highest for Mumbai at 0.60 followed by Delhi 0.41 where Bangalore ranked third at 0.36, Calcutta was 0.24 and lower tier cities such as Hyderabad and Pune scored 0.19 and 0.13 respectively.

Economic: GaWC Global Network Connectivity Score



Source: Globalization and World Cities (GaWC) and Taylor et al (2011)

Figure 5.11: GaWC Global Network Connectivity Score

ii) Implications

The GaWC Network Connectivity Proportionate Connectivity Score measures how well connected a city is within the world city network in terms of connectivity to "Advanced Producer Services". This reflects the development of intellectual capital, pace of innovation and technology transfers, what sort of comparative and competitive advantages the city provides to its investment and business sectors and the impact it may have on advancing the knowledge and skills of a city's knowledge workers.

Like the previous indicator, research and development expenditure, the GaWC Connectivity Score provides insights into how knowledge networks and innovation systems develop and evolve to provide an intricate and complex underlying support structure. This enables a city structure to develop its functional networks (i.e. governance, economic, social and environment activities) as well as its productivity, capacity and resilience levels.

5.5 Chapter Conclusion

Chapter 5 Key Indicator Analysis is the first of the proof of concept chapters (chapters 5-8). The chapter provides the basis (process, key assumptions and limitations) on which the longitudinal and cross sectional analyses have been undertaken together with the results and analysis.

The knowledge gained from this chapter provides significant insights, it:

- Identifies and categorises 25 Critical Indicators, 11 Derived Trajectory Indicators and how these indicators can be used for analysis;
- Provides data analysis of the first ten Critical Indicators and an evaluation of the longitudinal and cross sectional indicators and the implications for the development of city structures;
- Highlights the importance of considering Major Events (Macro Events and Country/City Specific Events) and Structural Changes when assessing these indicators and how this impacts on the fundamental development of a city structure's network of functional activities, relationships, capital and knowledge flows and how it relates to other city structures.

Chapter 6

Proof of Concept: City Structure Development Performance Trajectory Analysis



Bird's Eye View of New York City from the Empire State Building

Source: Michelle Leong Glastris

"Cities are vulnerable forms of human organisation. But... they have also proven remarkably resilient, recovering fast from devastation... the extraordinary growth of cities throughout the world seems set to override catastrophes, losses, indignities and woundings, no matter whether externally visited or self-inflicted".

(Schneider & Susser 2003: David Harvey The City As a Body Politic Ch 2:25)

6 Proof of Concept: City Structure Development Performance Trajectory Analysis

6.1 Chapter Outline

In **Chapter 5 Proof of Concept: Key Indicator Analysis**, the process; key assumptions and limitations were discussed. An analysis of collectively 10 longitudinal and cross sectional indicators was also undertaken in relation to their significance as critical indicators, their trends and impact on city structure development. As mentioned previously, Chapters 5-8 comprise the proof of concept analyses. **Chapter 6 Proof of Concept: City Structure Development Performance Trajectory Analysis** is the second stage of Analysis A: City Structure Development Performance Trajectory Analysis (**Appendix 1 Key Reference Charts - Research Design: Conceptual Framework**). This chapter begins with a discussion of the process undertaken for the analysis and key considerations regarding assumptions and limitations of the analysis. The results and analysis are presented to highlight trends and the key impacts on city structure development performance.

6.2 Process

As discussed in section **5.2 Process**, the 25 critical indicators were assessed in terms of the two key types of analysis and outcomes required – **Analysis A: City Structure Development Performance Trajectory Analysis** and **Analysis B: Compositional Aspects of City Structure Population**. Indicators were then divided into segments for staged analysis i.e. tools used in Analyses A and B. Refer to **Appendix 1: Key Reference Charts – Research Design: Conceptual Framework** and *City Structure Indicator Pathways & Application* charts.

For the purposes of the second stage undertaking of **Analysis A: City Structure Development Performance Trajectory Analysis**, indicators at a city level were required.

As discussed in the **Chapter 3 Methodology and Data Collection**, economic and population data was used as it was universal data and most readily available with a consistent, longer historical time series. Furthermore, this was the only type of city level data that the other institutional data providers and in particular, Oxford Economics provided i.e. they did not have other sectoral (Governance, Social or Environment) indicators available at a city level.

The four critical indicators selected from Oxford Economics were (Oxford Economics 2013):

- **City Structure Population A:** City Population (POP), (000's People).
- **Gross Domestic Product (GDP),** (US\$M, Constant 2005 Prices);
- **Household Disposable Income (HDI),** (US\$M, Constant 2005 Prices);
- **Employment (EMP),** (000's People);

It should be noted, that the City Structure Population was compared with the United Nations equivalent for cross reference purposes (United Nations 2013):

- **City Structure Population B:** Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011 (POP), (000's People).

This was also a useful gauge in instances where Oxford Economics were unable to disaggregate state level population data for Indian cities Bangalore and Mumbai.

Also mentioned in **Chapter 3 Methodology and Data Collection sub-section 3.4.1.5 Selection of Indicators – City Structure Critical Indicator Matrix**, was the preliminary/indicative correlation analysis between a city's GDP and Population (both the United Nations and Oxford Economics datasets) with the other critical indicators. Overall, there were strong correlations (i.e. greater than +/- 0.70). Refer to **Figure 5.1: Summary Table of Correlation Analyses for the Key Cities** and **Appendix 4: Correlation Tables – Critical Indicators** for each of the six key cities.

From the four Development Performance Trajectory Indicators selected, 11 indicators were subsequently derived to examine rates of change. These 11 Derived Trajectory Indicators are:

- POP Velocity (No. of People per annum);
- POP Acceleration (No. of People per annum²);
- GDP Velocity (US\$M per annum);
- GDP Acceleration (US\$M per annum²);
- HDI Velocity (US\$M per annum);
- HDI Acceleration (US\$M per annum²);
- EMP Velocity (No. of People per annum);
- EMP Acceleration (No. of People per annum²);
- Economic Resilience (%);
- Household Resilience (%);
- Employment Resilience (%).

These derived trajectory indicators were developed by incorporating Physics “laws of motion principles” (e.g. displacement, velocity, acceleration and time) and building on the research undertaken by Turok & Mykhnenko (2007) and Shen, Peng, Zhang & Wu (2011) by applying a rate of change approach to city population (POP) and the three economic indicators (GDP, HDI and EMP) at a city structure level.

The formulae for calculating these derived trajectory indicators and explanation for what they measure are presented in **Table 6.1: City Structure Development Performance Trajectory Formulae**.

The first order indicators are the four critical indicators (GDP, HDI, EMP and POP). From there second order derived indicators were developed (GDP, HDI, EMP and POP Velocities). Third order derived indicators were also developed to further determine if these rates of change were accelerating or decelerating and to examine inflection points (GDP, HDI, EMP and POP Accelerations).

The final three derived indicators examined the resilience. The resilience calculations were assessed on the basis of GDP, HDI or EMP Velocity relative to POP Velocity to ascertain the responsiveness of these economic indicators with respect to city population.

Once the indicator data was reviewed and these calculations were undertaken, the rates of change results represented in graphs constructed from the datasets and the key cities representing each city structure development were compared.

The next step was to compare the overall development trajectories and trends for these city structures through development performance derivations (velocity, acceleration, resilience, etc) with respect to GDP and city population to better understand these rates of change. Reference was made to Turok and Mykhnenko’s Population Growth Trajectories of Individual European Cities as a indicative comparison (Turok & Mykhnenko 2007). This is discussed further in the next **section 6.3.2 Key Assumptions**.

As undertaken in the Key Indicator Analysis, macro events (but not necessarily all location specific events) and structural changes were taken into account when evaluating these critical and derived indicators and their city structure development trajectories during the specified timeframe indicated on each graph.

The key results were charted in a series of graphs to facilitate comparisons between the six key cities. An analysis of the six different development stages that each key city represents was undertaken with respect to city structure development.

In the following section key assumptions and limitations involved with undertaking the City Structure Development Performance Trajectory Analysis are discussed.

6.3 Key Assumptions and Limitations

Definitions and the reasons for selection of each of the four critical indicators were discussed previously and have been tabled in **Appendix 3: City Structure Critical Indicator Matrix**.

6.3.1 Key Cities Overview

As stated in the previous chapter, a brief overview of the historical evolution of the six key cities was examined. This overview information is tabled in **Appendix 5: Key Cities Overview**.

6.3.2 Key Assumptions

In undertaking the Development Performance Trajectory Analysis, the same key assumptions discussed in **5.3.2 Key Assumptions** apply to Major Events and Structural Changes when evaluating development trends.

The timeframe for the analyses extends to 33 years (based on available data) and covers recent events, structural changes as well as several business/economic cycles post 1960s. Subsequently development performance determinants such as velocity, acceleration and economic resilience can more accurately gauge a city's response to macro/global events, city/country specific events and assess longer development trajectories.

In assessing longer development trajectories, future performance can be benchmarked against historical performance and provide a better understanding of the impact of future macro/global events on a city structure's future development performance.

DOCTORAL THESIS:

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

MICHELLE LEONG GLASTRIS

City Structure Development Performance Trajectory Formulae			
Indicator:	Velocity (Vel):	Acceleration (Accel):	Resilience (Resil):
Gross Domestic Product (GDP):	GDP Velocity: $GDP\ Vel = (GDP_{Time2} - GDP_{Time1}) / (Time_2 - Time_1)$	GDP Acceleration: $GDP\ Accel = (GDP\ Vel_{Time2} - GDP\ Vel_{Time1}) / (Time_2 - Time_1)$	Economic Resilience: Economic Resil = GDP Vel / Pop Vel
Household Disposable Income (HDI):	HDI Velocity: $HDI\ Vel = (HDI_{Time2} - HDI_{Time1}) / (Time_2 - Time_1)$	HDI Acceleration: $HDI\ Accel = (HDI\ Vel_{Time2} - HDI\ Vel_{Time1}) / (Time_2 - Time_1)$	Household Resilience: Household Resil = HDI Vel / Pop Vel
Employment (EMP):	EMP Velocity: $EMP\ Vel = (EMP_{Time2} - EMP_{Time1}) / (Time_2 - Time_1)$	EMP Acceleration: $EMP\ Accel = (EMP\ Vel_{Time2} - EMP\ Vel_{Time1}) / (Time_2 - Time_1)$	Employment Resilience: Employment Resil = EMP Vel / Pop Vel
Population (POP):	POP Velocity: $POP\ Vel = (POP_{Time2} - POP_{Time1}) / (Time_2 - Time_1)$	POP Acceleration: $POP\ Accel = (POP\ Vel_{Time2} - POP\ Vel_{Time1}) / (Time_2 - Time_1)$	-
Measures:	Velocity measures the change in City Structure GDP, HDI, EMP or POP over time. A negative sign denotes a slowing down in the GDP, HDI, EMP or POP growth.	Acceleration measures the rate of change in City Structure GDP, HDI, EMP or POP Velocity over time. A negative sign denotes a slowing down in the GDP, HDI, EMP or POP Velocity. Each change in the slope of the velocity curve relates to an inflection point on the acceleration curve.	Measures the responsiveness of City Structure Economic prosperity, Household prosperity or Employment opportunity relative to City Structure Population. It is the capacity of a City Structure Population to absorb elastic deformation or big impacts i.e. Boom/bust forces and external macro events e.g. GFC. A negative sign denotes a slowing down in the rate of GDP, POP, EMP and/or POP velocity and therefore the City Structure's resilience is under strain and/or declining/weakening.
Unit:	GDP Vel: US\$M per annum HDI Vel: US\$M per annum EMP Vel: No. of People per annum POP Vel: No. of People per annum	GDP Accel: US\$M per annum ² HDI Accel: US\$M per annum ² EMP Accel: No. of People per annum ² POP Accel: No. of People per annum ²	Economic Resil: % Household Resil: % Employment Resil: %

Table 6.1: City Structure Development Performance Trajectory Formulae

To facilitate the evaluation of development trajectories, the graph constructed by Turok and Mykhnenko on typical population growth trajectories was referenced as a indicative comparison to gauge typical growth trajectories (Turok & Mykhnenko 2007). This graph is presented in **Figure 6.5: Population Growth Trajectories of Individual European Cities**.

6.3.3 Key Limitations

There were three key limitations/considerations in undertaking the city structure development performance trajectory analysis. The first involved reading the growth trajectories chart (**Figure 6.5: Population Growth Trajectories of Individual European Cities**). The second and third major limitations/considerations stemmed from any significant differences between the United Nations and Oxford Economics city population datasets.

In assessing the population growth trajectories, it should be noted that the Turok and Mykhnenko (Turok & Mykhnenko 2007) chart (**Figure 6.5**) was only used as an indicative guide. When assessing key and cross reference cities, the majority of cities did not follow one single trajectory but often were a combination of two or more trajectory paths (refer to **Figure 6.4: Key City Structures: Population Velocity Trajectories**).

This was the case when tracking trajectories over a longer period of time (i.e. up to 50 years historically and 25 years forecasted). Also the time frequency of the data points should be noted – in Turok and Mykhnenko's chart (Turok & Mykhnenko 2007) these population growth trajectories were plotted at 10 year intervals. However in the population velocity trajectories undertaken for this research, the population growth trajectories were plotted at 5 year intervals. This provided greater refinement in evaluating the trajectory paths and identified more precisely when inflection points occurred or will occur. In this instance United Nations data was used because a longer time series was available for each city i.e. urban agglomeration.

There were two major limitations/considerations regarding any significant differences between the United Nations and Oxford Economics datasets. The first relates to the time frequency between city population data points. The United Nations city urban agglomeration data has a historically longer time series that dates back to 1950 and extends to 2025 in five year intervals: Oxford

Economics provides city population data from 1980 to 2000 (and depending on the city) through to 2025 on an annual basis. For comparative purposes when undertaking correlation analyses and charts comparing the two datasets, the time frequency used was the five year interval which limited the number of Oxford Economics data points e.g. in some instances there were only three or four historical data points to use for historical comparative analysis. It is acknowledged this proved an unavoidable data limitation when undertaking correlation analyses as the sample was small or limited.

To provide a cross check, a comparison was also undertaken of populations at a country level for each of the four countries in which the key cities were based. Oxford Economics population data tended to have a longer historical series, so it was able to provide a more reasonable cross check against the United Nations country population data. A graphical analysis of both the United Nations and Oxford Economics country and city structure population data sets showed overall the two data sets at both city and country levels were closely correlated. Refer to **Figure 6.1: City and Country Correlations between United Nations and Oxford Economics Datasets**.

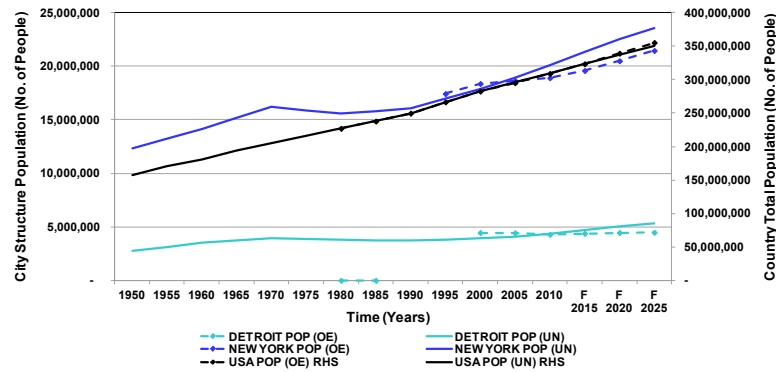
For **Figure 6.1**, on the left hand side of each graph are the populations for the cities, the right hand side of the graphs provide the total country's population (the black dashed and solid lines). The dashed lines with data points represent the Oxford Economics dataset whilst the solid lines represent the United Nations dataset (Oxford Economics 2013; United Nations 2013).

For the Chinese cities Guangzhou and Shanghai, there were some initial differences in the historical populations (particular for Shanghai around 1980) which could be attributed to slight differences in geographical boundary definitions for the cities. However this differential narrows, particularly as the population moves into the forecasted years post 2010.

Consequently for the purposes of this research and where there was limited city level data for Bangalore and Mumbai and/or where a longer historical development trend was required, it was found valid to compare and use the United Nations urban agglomerations dataset. In these instances, this was specified on the charts, tables and analyses.

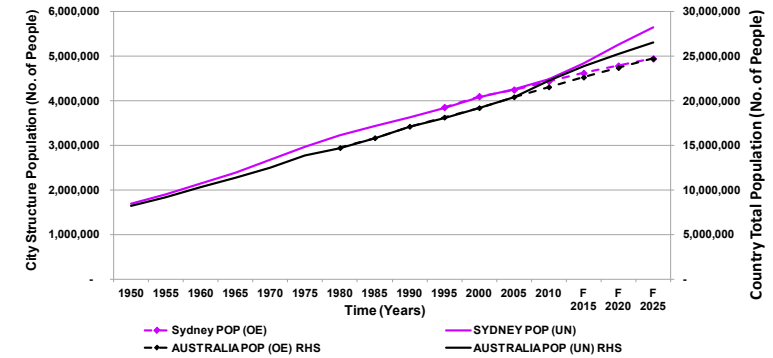
Figure 6.1: City and Country Correlations between United Nations and Oxford Economics Datasets

USA, New York & Detroit City Structure Population Correlation



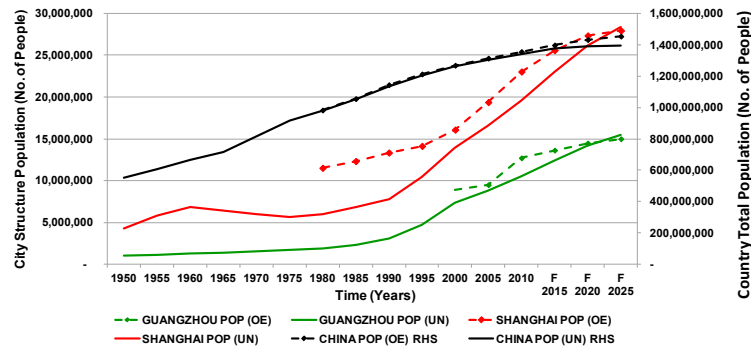
Source: Oxford Economics & United Nations

Australia & Sydney City Structure Population Correlation



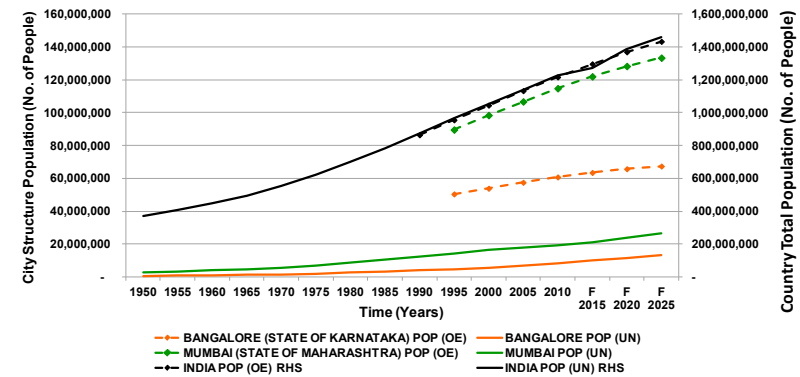
Source: Oxford Economics & United Nations

China, Guangzhou & Shanghai City Structure Population Correlation



Source: Oxford Economics & United Nations

Indian Cities: City Structure Population Correlation



Source: Oxford Economics & United Nations

The two notable exceptions were for the Indian cities, Bangalore and Mumbai. Mumbai was included in the graph with Bangalore so the two United Nations city/urban agglomeration population datasets could be compared to the Oxford Economics state population datasets. As mentioned in **Chapter 3 Methodology and Data Collection**, whilst the United Nations were able to provide city population data at an urban agglomeration level, Oxford Economics could only provide population and economic data (GDP, HDI and EMP) at a state level for Bangalore (i.e. Karnataka) and Mumbai (i.e. Maharashtra). So it is acknowledged this limitation shows up as a discernible difference in the population levels between the two datasets.

The third major limitation stems from the data observation that in some instances, there tended to be divergence post 2010 for the forecasted data. This was attributed to the different growth assumptions adopted and factored into the forecasts by both organisations. One example was Detroit where it was surmised that the quickly deteriorating economic conditions that recently resulted in the City of Detroit filing for bankruptcy and declines in city population may have been factored into Oxford Economics' regular quarterly updates but may not have been factored in the United Nations' World Urbanisation Prospects biennial revisions. The 2011 Revision was released in April 2012 and was the data used for this research - the 2013 release will not be available until the first half of 2014 (United Nations 2012).

Therefore only historical data was used in the trajectory calculations and in calculating the historical averages. Forecasted data was used when looking at future trends/trajectories and when benchmarking future trajectory performance against historical trajectory performance.

Also, to ensure consistency and for the purposes of the velocity, acceleration and resilience calculations, the Oxford Economics dataset was used unless otherwise specified. In particular this was the case where data for the five critical economic indicators for Indian cities, Bangalore and Mumbai, were provided at state level to ensure consistency across trajectory calculations (e.g. resilience calculations), the Oxford dataset was used.

6.4 Results and Analysis: Outcomes for Key Cities

In this section, the four critical indicators Population (POP); Gross Domestic Product (GDP), Household Disposable Income (HDI) and Employment (EMP) and their respective derivations are discussed. Because these indicators and their derivations are at a city level and the analysis has progressed into examining development performance trajectories, the key cities will be evaluated in terms of the development stages they each represent. **Table 6.1: City Structure Development Performance Trajectory Formulae** should be used as a reference for derived indicator definitions and formulae.

Both **Appendix 1: Key Reference Charts – City Structure Indicator Pathways and Application** and **Appendix 3: City Structure Critical Indicator Matrix** should be used as references to track the indicators and provide indicator definitions and reasons for selection.

6.4.1 City Structure Population (POP) and its Derivations

- a) Data Explanation
 - i) First Order: POP A

Both City Structure Population A (provided by Oxford Economics (Oxford Economics 2013)) and City Structure Population B (provided by the United Nations (United Nations - Habitat 2012)) form the first order. The definitions given by their respective data source providers have been previously discussed (refer to Sub-section **3.4.1.5 Selection of Indicator – City Structure Critical Indicator Matrix** and **Appendix 3: City Structure Critical Indicator Matrix**). Broadly speaking, a city structure population measures the number of inhabitants that reside in its city.

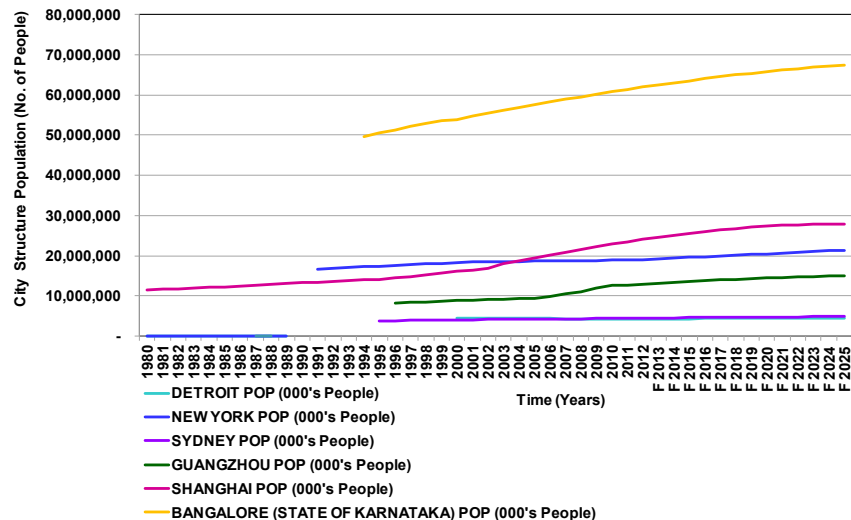
The second order, the change in population and an analysis of the population trajectories will be discussed in detail in the following sub-section.

However what should be noted for the first order are the relative population levels. As at 2013, the Oxford Economics city populations stand at:

- **Bangalore's State of Karnataka** 62.51M (Bangalore 8.28M UN in 2010) - Early Emerging stage (refer to **Table 3.3: City Structure Development Stages: Key City Structures** for indicative development stage definitions);

- **Shanghai** 24.60M (19.55M UN in 2010) - Obsolescence - Re-Growth stage;
- **New York** 19.25M (20.10M UN in 2010) - Mature stage;
- **Guangzhou** 13.22M (10.49M UN in 2010) - Emerging stage;
- **Sydney** 4.55M (4.48M UN in 2010) – Maturing stage;
- **Detroit** 4.35M (4.36M United Nations (UN) in 2010) - Obsolescence – Decline stage.

City Structure Population



Source: Oxford Economics Research, Methodology and Analysis Developed By: Leong Glastris

Figure 6.2: City Structure POP A

It should be noted that whilst India's State of Karnataka has the highest 2013 population level at 62.51M on the chart (**Figure 6.2**), when you look at the city population of Bangalore as cited by the UN, Bangalore's city population represents 8.28M or around 13.2% of the Karnataka state's population.

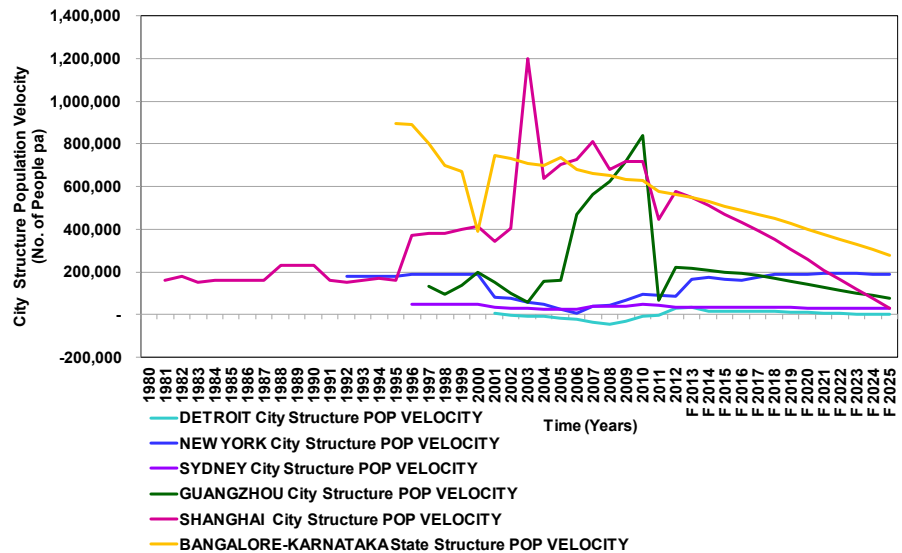
In light of this, Shanghai has the largest city population of the six key cities studied, respectively followed by New York and Guangzhou. In comparison, Sydney and Detroit city populations are the smallest.

ii) Second Order: POP Velocity

Population Velocity is defined as the change in City Structure Population over time. For this analysis it is simply taking the annual difference in city population between year one and year two. This second order derivation looks at the actual change in city population levels i.e. growth or decline. A negative POP Velocity denotes a slowing down or decline in the POP growth. **Figure 6.3 City Structure POP A Velocity** maps the POP Velocities for the key cities.

Figure 6.3 indicates the largest fluctuations occurred in Bangalore (Early Emerging stage), Guangzhou (Emerging stage) and Shanghai (Obsolescence - Re-Growth stage). The overall city population velocities have trended upwards for Guangzhou and Shanghai as urbanisation levels rise and more people flock to the cities for better employment and standard of living prospects – POP Velocities in 2013 stand at 218,300 (Guangzhou) and 548,700 (Shanghai) people per annum (pa). Bangalore-Karnataka state has shown an overall downward trend as Bangalore's dominant IT sector comes into maturity and strong growth and employment prospects ease for residents and workers – however its POP Velocity is the highest of the key cities at 549,000 people pa. New York (Mature stage) has seen a prolonged dip/hollowing out in its population velocity (2000-13) attributed to existing residents and workers and new migrants locating to other cities for better employment opportunities – this was further exacerbated by the employment fallout from the GFC. New York's POP Velocity in 2013 stands 163,900 people pa. Sydney has exhibited a relatively stable city population trend due in part to the less adverse GFC impacts sustained and current levels stand at 33,400 people pa. For cities in Obsolescence - Decline, Detroit's population velocity has been in the death knell zone recording negative velocities – Manchester and Budapest exhibited a similar trend. The city of Detroit recently filed for bankruptcy and with diminishing employment opportunities and city service provisions, many people are leaving to pursue better opportunities elsewhere. As at 2013, Detroit's POP Velocity stands at 33,500 people pa.

City Structure Population A Velocity Trajectories



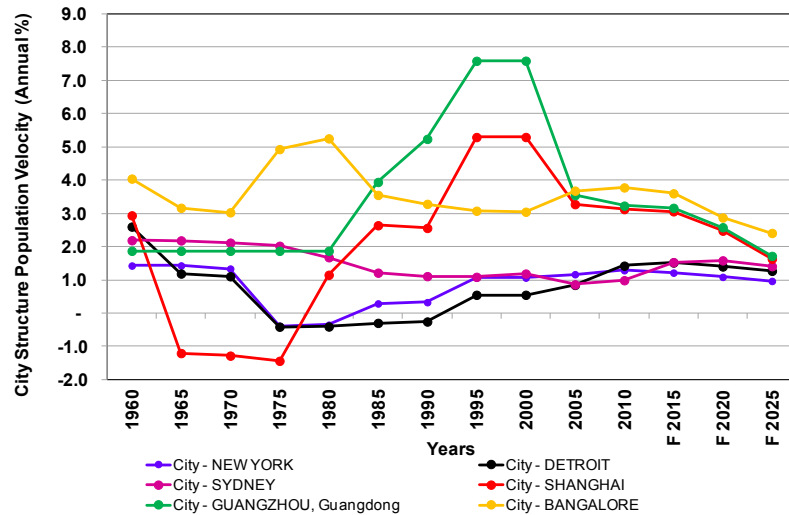
Source: Oxford Economics Research, Methodology and Analysis Developed By: Leong Glastris

Figure 6.3: City Structure POP A Velocity

As a general trend, early emerging and obsolescence-re-growth cities recorded relatively high population velocities in light of their early growth/re-growth phases. The more developed maturing and mature cities had lower population velocities with the exception of mega cities such as New York and Tokyo with their significantly large population size. Obsolescence-Divide cities tended to record the lowest population velocities. Again, this trend generally held true when tested across a wide range of cross reference cities and the population velocities tended to be more pronounced when comparing mega cities (e.g. New York and Shanghai) of over 20M people. As previously discussed (in Sub section **3.4.2 City Selection**) the proposed research and evaluation metrics were successful in identifying indicative development stages for all key and cross-reference city structures – including identifying the need to re-classify Budapest’s current development stage from Early Emerging to Obsolescence-Divide.

A further exercise was undertaken regarding the population velocity trajectories using the longer term dataset (1960-2010-2025) from the United Nations (**Figure 6.4**).

Key City Structures: Population Velocity Trajectories



Source: United Nations

Research, Methodology & Analysis
Developed By: Leong Glastris

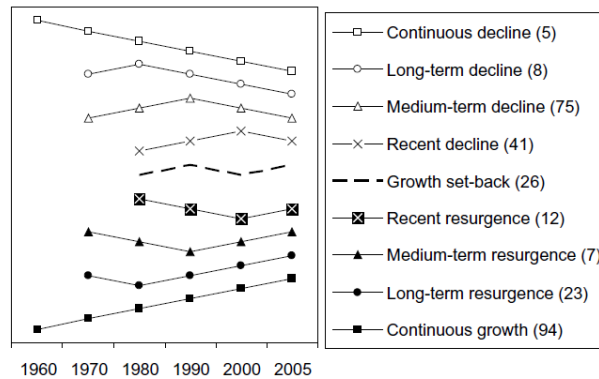
Figure 6.4: Key City Structures: Population Velocity Trajectories

As mentioned in the **6.1.3 Key Limitations** section, the Turok and Mykhnenko (2007) population growth trajectories chart was used as an indicative guide (**Figure 6.5: Population Growth Trajectories of Individual European Cities**). What became apparent when tracking trajectories over a longer period of time (i.e. 50 years historically and 25 years forecasted), all of these cities took on a combination of these trajectories referenced in the Turok and Mykhnenko population growth trajectories chart (refer to **Figure 6.4: Key City Structures: Population Velocity Trajectories**). This further demonstrated the dynamic nature of city structure development.

The trajectory paths charted for the key cities are typical for the city population velocity trajectories across cities in the same development stage category (**Figure 6.4 Key City Structures Population Velocity Trajectories**).

When all key and cross reference city structure (Sub section **3.4.2 City Selection**) population velocities were classified and plotted by their indicative development stages, they generally exhibited similar population velocity trajectories. Whilst some cities were out of sync in terms of the troughs and peaks and some cities had deeper amplitudes, generally the shape of the trajectory path was similar within each development stage category. Refer to **Figures 6.6 – 6.12 City Structures Population Velocity Trajectories by Development Stages**.

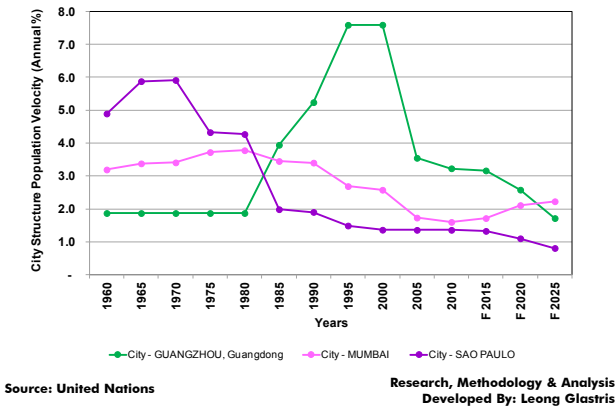
Population Growth Trajectories of Individual European Cities: 1960-2005



Source: Turok and Mykhnenko (2007)

Figure 6.5: Population Growth Trajectories of Individual European Cities

Emerging City Structures: Population Velocity Trajectories

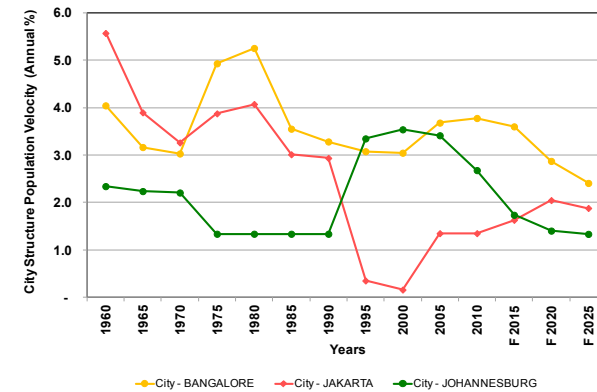


Source: United Nations

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Figure 6.7: Emerging City Structures: POP Velocity Trajectories

Early Emerging City Structures: Population Velocity Trajectories

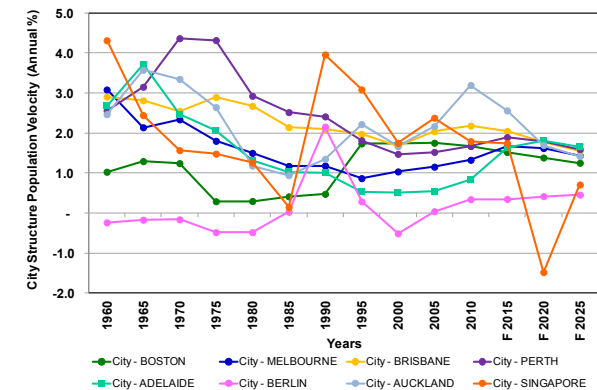


Source: United Nations

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Figure 6.6: Early Emerging City Structures: POP Velocity Trajectories

Maturing (Early) City Structures: Population Velocity Trajectories

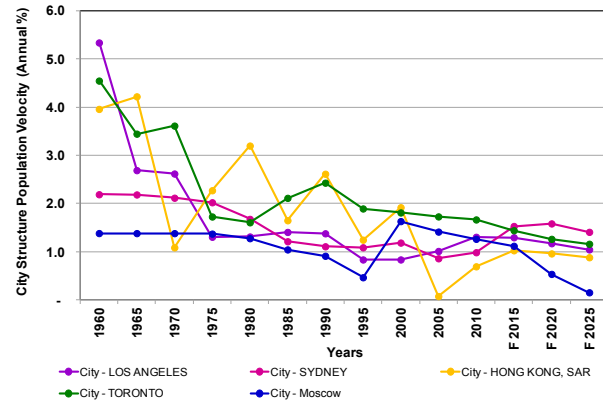


Source: United Nations

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Figure 6.8: Maturing (Early) City Structures: POP Velocity Trajectories

Maturing (Established) City Structures: Population Velocity Trajectories

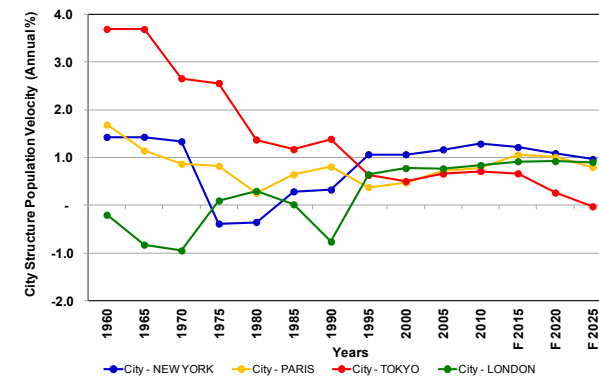


Source: United Nations

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Figure 6.9: Maturing (Established) City Structures: POP Velocity Trajectories

Mature City Structures: Population Velocity Trajectories

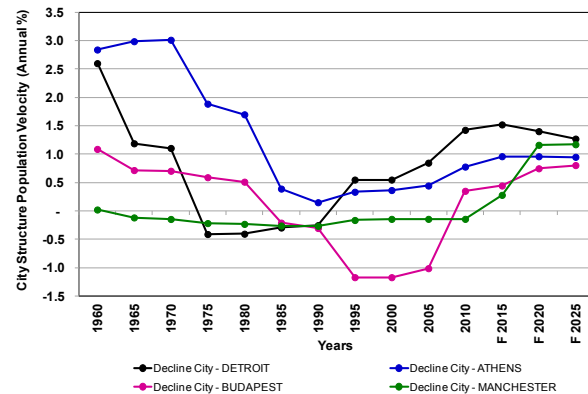


Source: United Nations

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Figure 6.10: Mature City Structures: POP Velocity Trajectories

Obsolescence-Decline City Structures: Population Velocity Trajectories

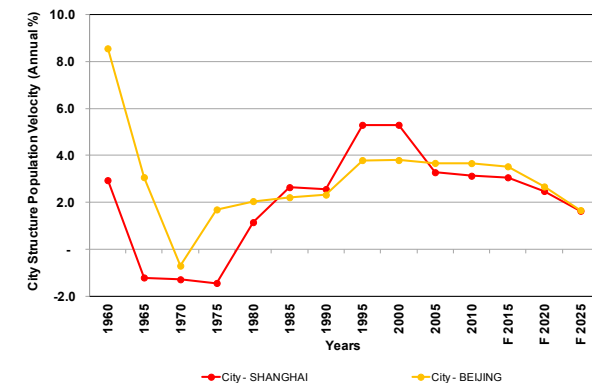


Source: United Nations

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Figure 6.11: Obs. - Decline City Structures: POP Velocity Trajectories

Obsolescence-Re-Growth City Structures: Population Velocity Trajectories



Source: United Nations

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Figure 6.12: Obs. - Re-Growth City Structures: POP Velocity Trajectories

Based on the key and cross reference city structures analysed, the annual growth rates can be broadly inferred for each development stage. **Refer to Table 6.2 City Structure Population Velocities (Annual %).**

City Structure Population Velocities

Indicative POP Velocity (Annual %)	
City Structure Development Stage:	
Early Emerging	0% to 6%
Emerging	0% to 8%
Maturing (Early)	Negative 2% to 5%
Mature (Established)	0% to 6%
Mature	Negative 1% to 4%
Obsolescence - Decline	Negative 1.5% to 3%
Obsolescence - Re-Growth	Negative 2% to 10%

Source: United Nations

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Developed By: Leong Glastris

Table 6.2: City Structure Population Velocities (Annual %)

The annual Population Velocity growth rates are consistent with the relative 2013 Population Velocities cited in the analysis of **Figure 6.3: City Structure POP A Velocity**. For example, the top three highest ranges in Population Velocity growth rates cited in **Table 6.2 City Structure Population Velocities** are Early Emerging Bangalore (0 to 6%), Obsolescence-Re-Growth Shanghai (negative 2 to 10%) and Emerging Guangzhou (0 to 8%) are relatively on par with the 2013 Population Velocities of 549,000, 548,700 and 218,300 people pa respectively.

It should be noted that because the category of “Maturing” cities was large, it was divided into “Maturing (Early)” and “Maturing (Established)” sub-categories to facilitate comparative analysis. But when the trajectories cities for both sub-categories were overlaid (ignoring the out of synchronisation effects or leads/lags), the trajectory path was similar showing an overall decline with some curved hollowing out in the population velocity over a 20-40 year

timeframe e.g. Auckland, Boston, Melbourne, Perth compared to Los Angeles and Sydney.

However for Sovereign City States (Singapore) and cities with a high degree of sovereign autonomy (Hong Kong), the population velocities were more erratic, showing greater amplitudes and more frequent inflection points. Part of this could be attributed to the declining fertility rates and larger fluctuations in net migration (Critical Indicator) which in turn impacts the city population velocities. For example, the fertility rate (Universal Indicator) in 1955 was 6.6 births per woman in Singapore and 4.4 births per woman in Hong Kong but like other cities in developed countries, the fertility rates have steadily declined and as at 2013 stand at 1.3 and 1.1 births per woman respectively. To redress the natural decline in population, both governments encourage migration. According to Wikipedia, as at 2009, foreigners accounted for around 40% of Singapore's residents (Wikipedia 2013f) and around 45,000 immigrants from mainland China migrate to Hong Kong each year which is a "*significant contribution to its population growth*" (Wikipedia 2013n). However unlike other cities located in large countries, there is limited opportunity for the new migrants to disperse into other cities i.e. there is no gradual dispersion via intra-migration between other cities. Consequently the population velocities for Singapore and Hong Kong tend to exhibit more erratic swings in population levels and hence population velocities.

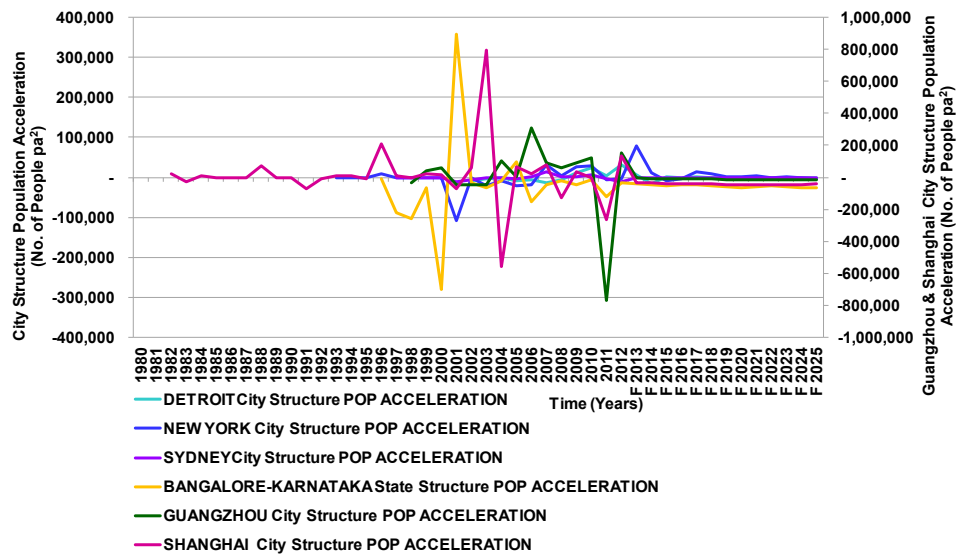
iii) Third Order: POP Acceleration

Population Acceleration is defined as the change in Population Velocity or the rate of change in City Structure Population. For the purposes of this analysis, POP Acceleration was calculated by taking the annual difference in Population Velocity between year one and year two. In this third order derivation, the rate of change in City Structure Population Velocity over time. A negative POP Acceleration denotes a slowing down or decline in the POP Velocity. **Figure 6.13: City Structure POP Acceleration** charts the POP Accelerations for the key cities.

What is interesting about **Figure 6.13: City Structure POP Acceleration**, is that it tracks changes in the rate of growth in POP Velocity where each change in slope on the POP Velocity curve corresponds to an inflection point on the POP Acceleration graph. Note the right hand vertical axis scale on the POP Acceleration graph should be used for Guangzhou and Shanghai whilst the left hand side scale should be used for all other key cities. This enables trends for

city structures on a smaller scale (left hand side) to be read more easily when comparing trends for city structures with significantly larger movements (right hand side).

Key City Structures: Population Acceleration



Source: Oxford Economics Research, Methodology and Analysis Developed By: Leong Glastris

Figure 6.13: City Structure POP Acceleration

The greatest amplitude fluctuations tended to occur in the Bangalore-Karnataka State (Early Emerging), Shanghai (Obsolescence - Re-Growth) and Guangzhou (Emerging) where these higher population growth cities are still attracting critical mass.

As at 2013, both Guangzhou and Shanghai POP Accelerations were trending below their 23 year historical averages (23Hav): Guangzhou at negative 3,800 people pa^2 (23Hav: 6,000 people pa^2) and Shanghai at negative 31,200 people pa^2 (23Hav: 15,200 people pa^2). Sydney POP Acceleration of negative 900 people pa^2 in 2013 is on trend with its 23Hav.

In contrast, the remaining key cities' 2013 POP Accelerations are all trending above their respective historical averages (1990-2012): Bangalore-State of Karnataka at negative 16,500 people pa^2 (23Hav: negative 19,300 people pa^2); Detroit at 5,100 people pa^2 (23Hav: 2,000 people pa^2) and New York at 78,500 people pa^2 (23Hav: negative 4,600 people pa^2).

b) Implications

It should be noted that a fourth order was not derived for Population i.e. Population Resilience as population velocity is used as a common denominator when deriving and evaluating Economic Resilience, Household Resilience and Employment Resilience in the subsequent sub-sections.

The significance of using City Population has been discussed previously. However as a Key Driver and Critical Indicator, it should be highlighted that in measuring a city structure's population, it reflects the government's ability to provide a supportive policy framework and regulatory framework to encourage city population growth.

This impacts city structure development because higher levels of city population with the appropriate level of housing, employment, amenity and infrastructure support has the potential to substantially boost economic productivity and capacity levels and increase efficiencies in resource allocation (e.g. concentrated populations around transport and social infrastructure hubs, etc).

This is particularly true for cities (e.g. Singapore, Hong Kong, etc) where declining fertility rates (World Bank 2013c) and an increasing dependency ratio (United Nations 2013) has prompted Governments to encourage increased net migration levels (World Bank 2013c) to boost workforce capacity and productivity levels.

With increased education and tertiarisation levels this enhances the expertise of knowledge workers within the workforce composition to better position a city's productive capacity and global competitiveness. New migrants also add to the cultural, religious and ethnic diversity and richness of a city's population.

This in turn enhances a city's cosmopolitan feel/attractiveness and helps promote a better sense of community and cultural identity. Collectively these engaging attributes further attract other prospective residents, workers and visitors to a city.

It can be seen from the analysis, that evaluating second (POP Velocity) and third order (POP Acceleration) derivations of POP provides useful insights on trajectory paths but also provides an evaluative framework to quantitatively assess rates of growth, inflection points, an ability to compare cities at different development stages and benchmark their POP development trajectory performance.

6.4.2 Gross Domestic Product (GDP) and its Derivations

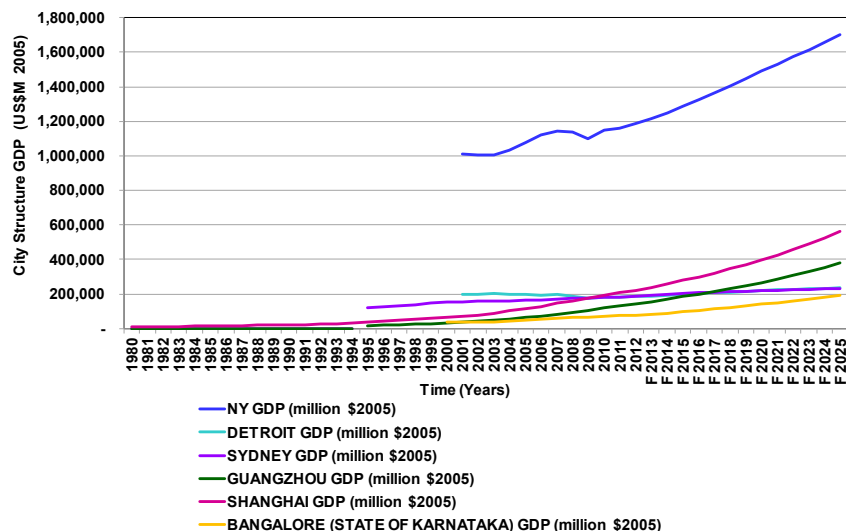
a) Data Explanation

i) First Order: GDP

The definition of Gross Domestic Product (GDP) has been previously discussed (refer to Sub-section 3.4.1.5 **Selection of Indicator – City Structure Critical Indicator Matrix** and **Appendix 3: City Structure Critical Indicator Matrix**). GDP generally measures the total economic activity of a city and reflects how well its economy is growing.

Figure 6.14: City Structure GDP charts the GDP in US\$ monetary terms for the key cities (Oxford Economics 2013).

City Structure Gross Domestic Product



Source: Oxford Economics Research, Methodology and Analysis Developed By: Leong Glastris

Figure 6.14: City Structure GDP

The second order GDP Velocity and its GDP trajectories will be discussed in detail in the following sub-section.

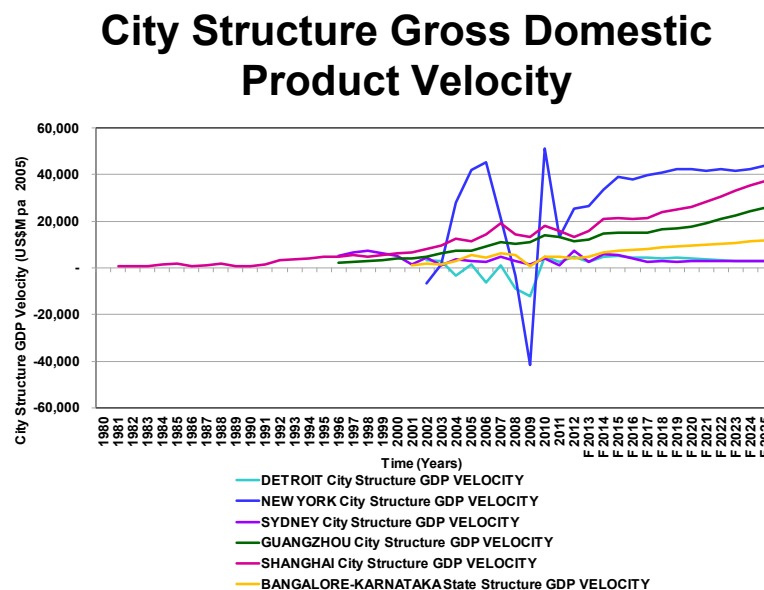
It is however useful to note with GDP as the first order, the relative GDP levels. New York's GDP far eclipses those of the other key cities whilst the GDP levels for Shanghai, Guangzhou and Bangalore-Karnataka state (albeit at a comparatively lower growth rate) have risen dramatically over recent decades – Shanghai outstripped Sydney and Detroit's GDP levels in 2010.

As at 2013, the Oxford Economics City GDP levels (constant 2005 prices) stand at:

- **New York** US\$1,213,200M (Mature stage);
- **Shanghai** US\$236,500M (Obsolescence - Re-Growth stage);
- **Sydney** US\$191,600M (4 Maturing stage);
- **Detroit** US\$188,700M (Obsolescence – Decline stage);
- **Guangzhou** US\$155,300M (Emerging stage).
- **Bangalore's State of Karnataka** US\$83,300M (Early Emerging stage).

ii) Second Order: GDP Velocity

GDP Velocity is defined as the change in City Structure GDP over time. For this analysis it is simply taking the annual difference in city GDP between year one and year two. This second order derivation looks at the actual change in city GDP levels i.e. growth or decline. A negative GDP Velocity denotes a slowing down or decline in the GDP growth. **Figure 6.15: City Structure GDP Velocity** charts the key city GDP Velocities.



Source: Oxford Economics Research, Methodology and Analysis Developed By: Leong Glastris

Figure 6.15: City Structure GDP Velocity

GDP Velocities varied markedly across the sample of key cities. Key cities were all adversely affected by the Global Financial Crisis (2007-2009). A notable example - New York is a global financial centre and took the hardest GFC hit with the tumble of major global investment banks where GDP velocity was severely impacted. Over a longer timeframe (1980-2012), New York's GDP velocity has historically averaged US\$16,000M pa. Detroit with its dwindling car

manufacturing base and economic woes has struggled along with the lowest average velocity of US\$900M pa. Sydney with its diversified financial base and its well regulated banking system has been relatively stable with an average velocity of US\$4,000M pa. In Bangalore, GDP velocities followed closely with an average of US\$3,600M pa. Not surprisingly, Chinese high economic growth cities such as Guangzhou (the main manufacturing hub of the Pearl River Delta and a leading commercial and manufacturing region) recorded an average velocity of US\$7,400M pa and Shanghai (mainland China's key financial and commercial centre as well as a major industrial centre and the one of the largest international shipping ports) an average velocity of US\$8,800M pa.

From the analysis of these key and cross reference cities over a 33 year timeframe, emerging, early emerging and obsolescence-re-growth cities tended to have relatively higher GDP velocities which reflect their early growth/re-growth stages. In comparison, the more developed maturing and mature cities had lower economic growth rates and relatively lower GDP velocities whilst obsolescence-decline cities had low economic growth and tended to have the lowest GDP velocities.

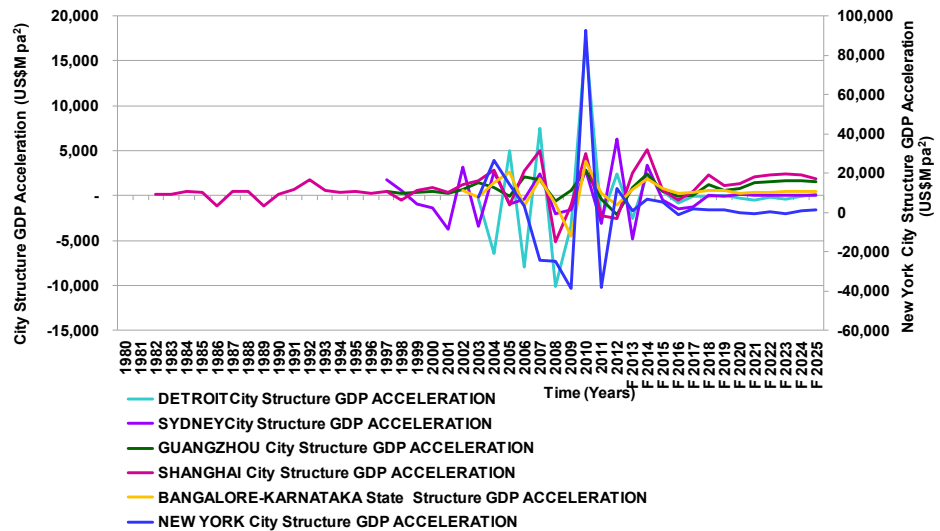
iii) Third Order: GDP Acceleration

GDP Acceleration is measured as the change in GDP Velocity. It is calculated by taking the annual difference in Population Velocity between year one and year two. As a third order derivation, this represents the rate of change in City Structure GDP Velocity over time. A negative GDP Acceleration denotes a slowing down or decline in the GDP Velocity. The GDP Accelerations for the key cities are presented in **Figure 6.16: City Structure GDP Acceleration**.

Similar to the POP Acceleration graph, the GDP Acceleration graph indicates changes in the rate of growth in GDP Velocity. A change in slope on the GDP Velocity curve corresponds with an inflection point on the GDP Acceleration graph.

The largest GDP Acceleration fluctuation occurred for New York as GDP Velocity recorded a marked improvement in 2009-2010 in the aftermath of the GFC. Note the larger scale for New York is on the right hand side of the GDP Acceleration graph – for all other city structures the smaller scale on the left hand side of the graph should be used.

Key City Structures: Gross Domestic Product Acceleration



Source: Oxford Economics Research, Methodology and Analysis Developed By: Leong Glastris

Figure 6.16: City Structure GDP Acceleration

Historically the remaining five cities exhibited GDP acceleration volatility to a lesser extent – Guangzhou and Shanghai exhibited comparatively lower volatilities.

Both American cities are still feeling the reverberations from the GFC – in particular New York which was “Ground Zero” for the initial outbreak of the GFC. In 2013 Sydney, New York and Detroit recorded GDP Accelerations that trended below their 23 year historical averages (23Hav – based on customised historical data from Oxford Economics): Sydney at negative US\$4,800M pa² (23Hav: US\$100M pa²); Detroit at negative US\$2,500M pa² (23Hav: US\$200M pa²) and New York at US\$1,200M pa² (23Hav: US\$3,200M pa²).

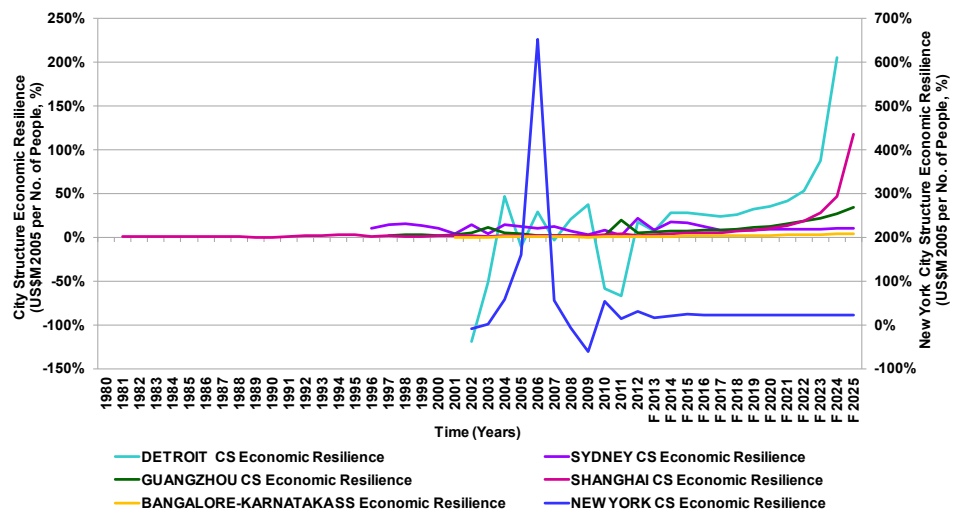
In contrast, the developing key cities recorded GDP Accelerations which trended above their respective historical averages: Bangalore-State of Karnataka at US\$700M pa² (23Hav: US\$300M pa²); Guangzhou at US\$900M pa² (23Hav: US\$600M pa²) and Shanghai at US\$2,600M pa² (23Hav: US\$500M pa²).

iv) Fourth Order: Economic Resilience

Economic Resilience measures the responsiveness of a City Structure's Economic prosperity relative to its City Population (i.e. GDP Velocity / POP Velocity) at any one point in time. **Figure 6.17: City Structure Economic Resilience** graphically presents the economic resilience trajectories for the key cities.

During 1980-2013, the analysis showed **Obsolescence - Decline** cities e.g. Detroit, Manchester and Athens tended to exhibit greater fluctuations, a slower response/lag time and prolonged periods of negative economic resilience when impacted by a macro event such as the GFC – these cities demonstrated low / negative resilience historical averages.

Key City Structures: Economic Resilience



Source: Oxford Economics Research, Methodology and Analysis Developed By: Leong Glastris

Figure 6.17: City Structure Economic Resilience

In contrast, cities regarded as **Maturing** (Sydney, Berlin and Toronto) and **Mature** (New York, London, Paris and Tokyo) tended to have higher/high resilience and were able to more rapidly bounce back from the GFC – here amplitudes tended to be relatively large and periods of negative resilience tended to be shorter/short.

As at 2013, the Economic Resilience calculated for the key cities were:

- **New York** 16.3% (Mature stage);
- **Sydney** 7.7% (4 Maturing stage);
- **Detroit** 7.2% (Obsolescence – Decline stage);
- **Guangzhou** 5.6% (Emerging stage).
- **Shanghai** 2.9% (Obsolescence - Re-Growth stage);
- **Bangalore's State of Karnataka** 0.9% (Early Emerging stage).

b) Implications

GDP as a Key Driver and Critical Indicator has been previously discussed. However it should be reinforced that as it measures all facets of a city's economic activity, like City Population it tends to be an "All pervasive" indicator which casts its "tentacles" on a number of a city structure's network of functional activities; relationships; capital and knowledge flows. Examples of this were discussed in **Chapter 5 Key Indicator Analysis** with regards to how some of the longitudinal and cross sectional critical indicators are tied to City Structure GDP and Population.

GDP directly impacts city structure development because if there is limited economic activity, this adversely curtails business investment and the ability for a city to generate economic income/returns and employment for its residents. The city then atrophies into various forms of economic, functional and social obsolescence. Residents and companies permanently leave/re-locate out of the city and the city ultimately transitions into Obsolescence-Decline e.g. Detroit.

Economic growth has multiplier effects – strong economic growth has the potential to create increased employment opportunities, greater investment wealth, raises household wealth and domestic consumption, provides greater funding capacity to build more and better transport and social infrastructure, etc.

According to Leigh and Blakely (Leigh & Blakely 2013) in their discussion on the concept of resilience and building local economic development, the authors cite four key findings from a wider body of work undertaken by Hill et al (Leigh & Blakely 2013: Citation of Hill et al (2011): p 425-6); these include: i) economies with a greater exposure to durable manufacturing goods are more susceptible to economic downturns, are less shock resistant and demonstrate resilience more quickly; ii) economies that have a more diverse export and industrial base are more shock resistant; iii) less shock

resistant economies have a lower high school education level; iv) economies that have a greater degree of income inequality tend to experience more downturns and take a longer time to recover.

At a city structure level these findings also hold true for the Economic Resilience, Household Resilience and Employment Resilience undertaken for this research. Economies that are more reliant on manufacturing discretionary based goods (e.g. fashion clothing, entertainment based goods and electronics) tend to be impacted first when households rein in their consumption of discretionary goods and services. Given the highly competitive nature of these types of industries, the supply and demand dynamics tend to respond more quickly to market demands.

In particular, cities with a wider economic industry base are less susceptible to sharp adverse shocks if there is a downturn in any one particular sector (e.g. Mining and natural resources or the banking and finance sector).

As discussed with some of the Critical Indicators (e.g. Public Spending on Education; Research and Development Expenditure and Completed Tertiary Education Attainment), the level of tertiary education and ability to transition workers from manufacturing and low level service jobs to highly skilled knowledge based jobs considerably enhances a city's productive capacity and makes it less susceptible to external shocks and events when the economic industry base is both broadened and greater market depth is developed.

As a final response to Hill et al's (2011) cited key findings (Leigh & Blakely 2013), whilst a detailed analysis of income inequality falls outside the scope of this research, it is acknowledged there are measures such as Gini Coefficients for Income Disparity, Education, Opportunity and Income Mobility which examine different levels of inequality (Leigh & Blakely 2013). It is also acknowledged that large differentials in income and social inequality directly impacts the development of city structures where there is greater polarisation across socio-demographic stratum in the city's business, working and residential communities. An inability to share economic wealth, knowledge, information and to be able to interact across all levels of society inhibit the intellectual, physical, social, cultural and functional relationships and interactions that enable a city to make strong evolutionary progress. It also makes sense that a disenfranchised city with a high level of inequality would be less likely to respond promptly and successfully to macro events, location specific events and or structural changes.

The analysis demonstrated that both GDP and its derivations provide further valuable insights on city structure development performance in terms of GDP Velocity, Acceleration and Economic Resilience. These indicator measures also provide a set of evaluative tools with which to consistently compare cities quantitatively in an integrated manner.

6.4.3 Household Disposable Income (HDI) and its Derivations

a) Data Explanation

i) First Order: HDI

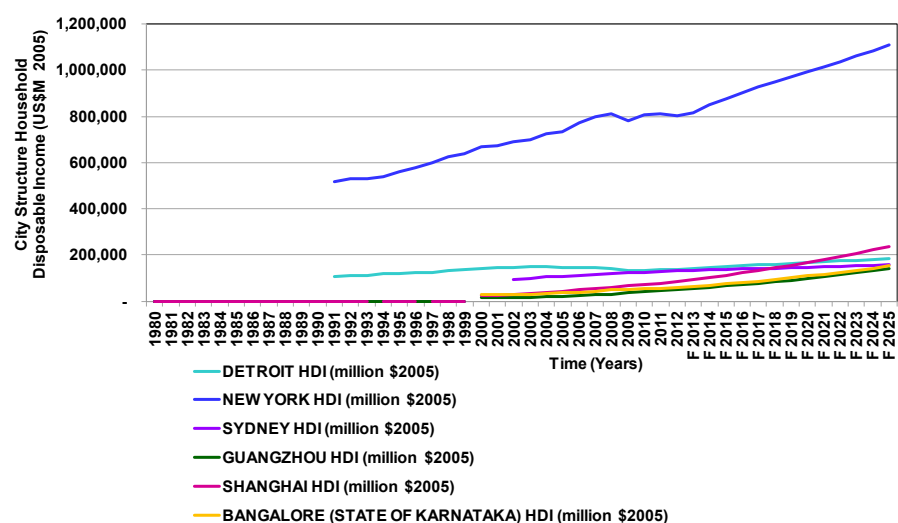
Household Disposable Income (HDI) measures the amount of disposable net income households have available to save, invest and spend and reflects the level of household discretionary wealth.

HDI is intrinsically tied to GDP - as GDP levels rise this generally translates into greater city population economic and household prosperity particularly for those employed.

The HDI for the key cities are presented in **Figure 6.18: City Structure HDI**.

The change in HDI (second order HDI Velocity) and key city trajectories will be discussed in the following sub-section.

City Structure Household Disposable Income



Source: Oxford Economics Research, Methodology and Analysis Developed By: Leong Glastris

Figure 6.18: City Structure HDI

It is useful to note first order HDI levels amongst the key cities. The HDI chart echoes the GDP chart where New York HDI outperforms the other five key cities whilst Shanghai, Guangzhou and Bangalore have been gaining strong traction in recent years.

In 2013, Oxford Economics reported the HDI levels (constant 2005 prices) were:

- **New York** US\$817,200M (Mature stage);
- **Detroit** US\$139,500M (Obsolescence – Decline stage);
- **Sydney** US\$133,400M (Maturing stage);
- **Shanghai** US\$95,000M (Obsolescence - Re-Growth stage);
- **Bangalore's State of Karnataka** US\$62,800M (Early Emerging stage).
- **Guangzhou** US\$56,000M (Emerging stage).

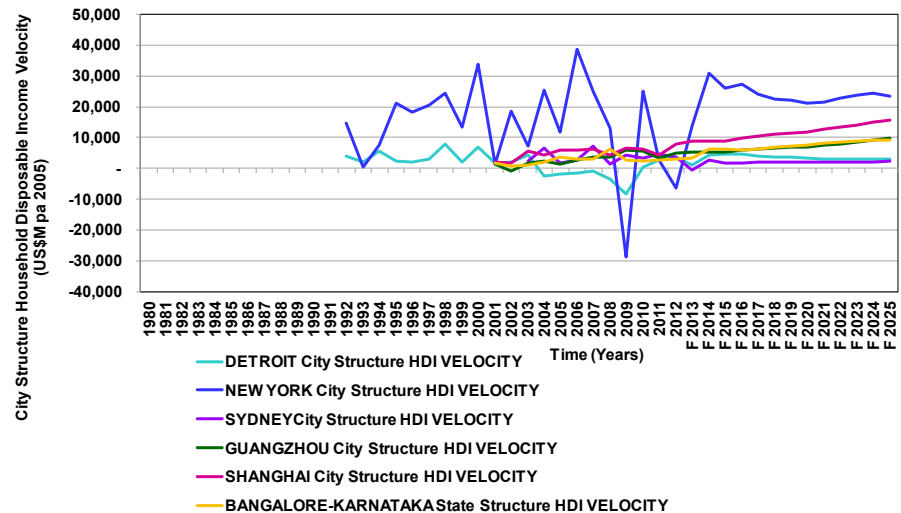
What was also interesting was undertaking a calculation which looked at the HDI as a percentage of GDP for each city. It revealed this percentage to be around 70%: 67% for New York; 74% for Detroit; 70% for Sydney; and 75% for Bangalore-State of Karnataka. The exceptions were the two Chinese cities with a significant lower weighting i.e. 36% for Guangzhou and 40% for Shanghai.

ii) Second Order: HDI Velocity

HDI Velocity is defined as the change in City Structure HDI over time. In this analysis, it is calculated by taking the annual difference in city HDI between year one and two. As a second order derivation, HDI Velocity tracks the change in city HDI levels. Key city HDI Velocities are presented in **Figure 6.19: City Structure HDI Velocity**.

HDI velocities for the key cities also exhibited a similar trend when compared to their GDP velocity counterparts. New York and Detroit recorded the greatest fluctuation and amplitude variations in Household Disposable Income Velocities as the GFC heavily impacted both employment and income levels. Given New York's global financial centre status, HDI velocities dived in 2007-2009 given the substantial exposure its workers had to the banking and finance sector and other businesses that supported the sector. Velocities in other cities recorded less volatility and amplitude variation and generally were below US\$10,000M pa.

City Structure Household Disposable Income Velocity



Source: Oxford Economics Research, Methodology and Analysis Developed By: Leong Glastris

Figure 6.19: City Structure HDI Velocity

HDI velocities for the key cities also exhibited a similar trend when compared to their GDP velocity counterparts. New York and Detroit recorded the greatest fluctuation and amplitude variations in Household Disposable Income Velocities as the GFC heavily impacted both employment and income levels. Given New York's global financial centre status, HDI velocities dived in 2007-2009 given the substantial exposure its workers had to the banking and finance sector and other businesses that supported the sector. Velocities in other cities recorded less volatility and amplitude variation and generally were below US\$10,000M pa.

Over a longer timeframe (1980-2012), historical averages for HDI velocities exhibited similar trend patterns to their GDP velocity counterparts. As at 2013, both Detroit and Sydney recorded average HDI velocities that trended below their respective 23 year historical averages (23Hav): Detroit at US\$900M pa (23Hav: US\$1,500M pa) and Sydney at negative US\$400M pa (23Hav: US\$3,800M pa). In 2013, New York recorded an average HDI velocity of US\$13,700 pa which was on trend with its historical average.

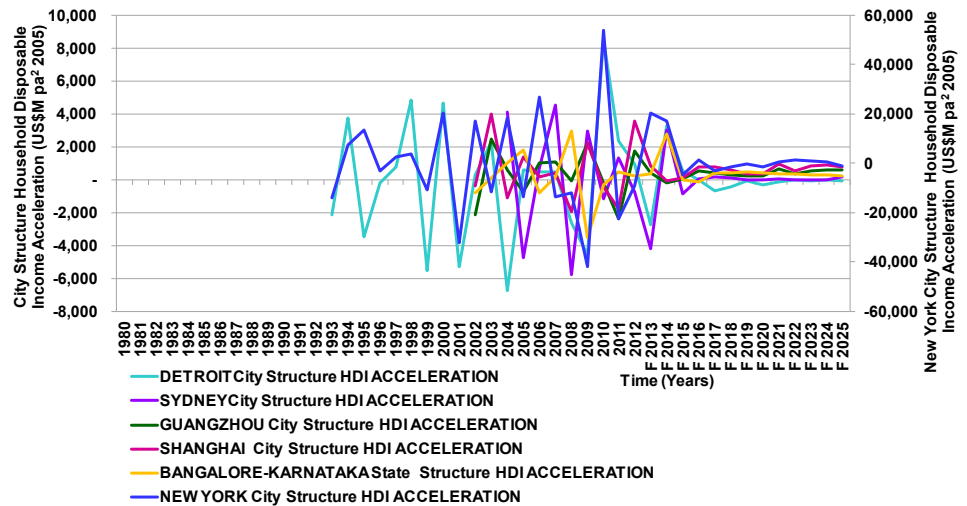
In contrast, developing key cities recorded 2013 HDI velocities that trended above their historical averages: Bangalore-Karnataka state at US\$3,300M pa (23Hav: US\$2,700M pa); Guangzhou at US\$5,400M pa (23Hav: US\$2,900M pa) and Shanghai at US\$8,900M pa (23Hav: US\$5,100M pa). This was attributed to their relatively higher GDP and subsequently increased HDI growth rates in recent years.

iii) Third Order: HDI Acceleration

HDI Acceleration measures the change in HDI Velocity over time. In the analysis, HDI Acceleration was calculated by taking the annual difference HDI Velocity between year one and year two. A negative HDI Acceleration translates as a slowing down or decline in the HDI Velocity and a change in slope on the HDI Velocity graph corresponds to an inflection point on the HDI Acceleration graph. HDI Acceleration trajectories for the six key cities are graphically presented in **Figure 6.20: City Structure HDI Acceleration**.

Compared to the POP and GDP Acceleration graphs, the key cities all exhibited a greater degree of fluctuation in the HDI Acceleration graphs. This can be attributed to the scale it measures i.e. household prosperity within a city and therefore there is a greater sensitivity/responsiveness when individual households face adverse economic situations or financial distress. Unlike population and GDP changes which take a longer time for its effects to be felt, if a breadwinner within a household faces employment uncertainty or loses his/her job, the household feels its financial effects quickly. Similarly if interest rates rise and/or inflation rises, the impact on low to middle income household disposable income is felt as the household attempts to rein in discretionary spending to cover the increased home mortgage/rental costs and non discretionary costs of living.

Key City Structures: Household Disposable Income Acceleration



Source: Oxford Economics Research, Methodology and Analysis Developed By: Leong Glastris

Figure 6.20: City Structure HDI Acceleration

Both Detroit and Sydney recorded a 2013 slowdown in HDI growth and both cities current HDI Accelerations trended below their respective 32 year historical averages. In Detroit this has been out of necessity where employment has declined as companies retrench workers and/or relocate to other cities. In Sydney, whilst the city workforce underwent a number of rounds of retrenchments during the GFC (although not as savage as the cuts taken in London and New York), the “job freeze” and “wage freeze” were undertaken in light of continuing global and regional/local economic uncertainty prospects and a slowdown in Australia’s resource boom. To date these freezes have been motivated more as a precautionary/prudent measure rather than out of sheer necessity given the current moderate economic growth and low inflation environment.

As at 2013, the HDI Accelerations (constant 2005 prices) for the key cities stood at:

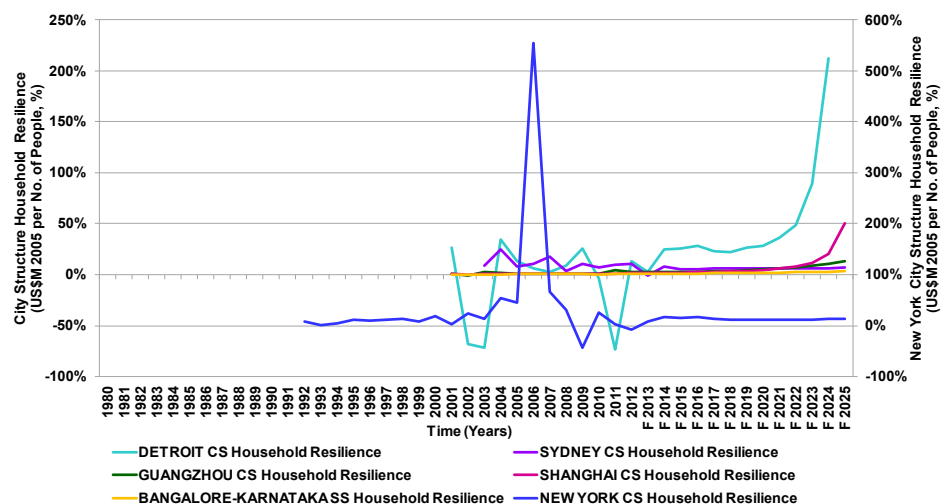
- **New York** US\$20,200M pa² (Mature stage);
- **Detroit** negative US\$2,700M pa² (Obsolescence – Decline stage);
- **Sydney** negative US\$4,200M pa² (Maturing stage);
- **Shanghai** US\$900M pa² (Obsolescence - Re-Growth stage);

- **Bangalore's State of Karnataka** US\$300M pa² (Early Emerging stage).
- **Guangzhou** US\$400M pa² (Emerging stage).

iv) Fourth Order: Household Resilience

Household Resilience measures the responsiveness of a City Structure's Household prosperity relative to its City Population. It is calculated by dividing the HDI Velocity by the POP Velocity at any one point in time. The Household Resilience trends for the key cities are presented in **Figure 6.21: City Structure Household Resilience**.

Key City Structures: Household Resilience



Source: Oxford Economics Research, Methodology and Analysis Developed By: Leong Glastris

Figure 6.21: City Structure Household Resilience

It should be noted that because of the difference in scales, the scale for New York is on the right hand side of the chart and the scale for the other key cities is on the left hand side of the chart.

Given the strong link between HDI and GDP, City Structure Household Resilience exhibited similar trends compared to the Economic Resilience across the six categories of city development.

During 1980-2013, based on the key and cross reference cities analysed, Obsolescence – Decline cities tended to exhibit the most

extreme signs. Key characteristics generally included a greater number of fluctuations, larger amplitude movements, slower response/lag times and exposure to longer periods of negative HDI resilience when impacted by a macro event (e.g. the GFC). Manchester was the most extreme case where the Household Resilience fluctuated between a trough of negative 1,704% to a peak of 243% between 1980-2013. For Other Obsolescence – Decline cities (Athens, Detroit and Budapest) the Household Resilience for these cities was more moderate, fluctuating between negative 189% (Athens) to 34% (Detroit).

Household Resilience for Maturing and Mature cities also exhibited higher/high resilience and showed greater fortitude in bouncing back from the GFC. Whilst amplitudes tended to be relatively large, the periods of negative resilience were relatively short.

Early Emerging, Emerging and Obsolescence-Regrowth cities showed comparatively fewer fluctuations and limited amplitude swings as they slowly developed greater Household Resilience.

As at 2013, the Household Resilience calculated for the key cities stood at:

- **New York** 8.3% (Mature stage);
- **Sydney** negative 1.3% (4 Maturing stage);
- **Detroit** 2.7% (Obsolescence – Decline stage);
- **Guangzhou** 2.5% (Emerging stage).
- **Shanghai** 1.6% (Obsolescence - Re-Growth stage);
- **Bangalore's State of Karnataka** 0.6% (Early Emerging stage).

b) Implications

HDI measures how much a household has to spend in disposable net income and reflects the level of household discretionary wealth. HDI and its derivations are significant because they track the extent to which household consumption (and household debt) will drive economic activity. It gauges the city/country's general level of household prosperity i.e. generally the higher the disposable income, the more developed and prosperous the household.

Like GDP, HDI has multiplier effects – higher HDI for households translates into more net income to invest, save and spend with flow on effects which have the potential to create further employment, investment, consumption and other economic opportunities. This

directly impacts the “wiring and building” of a city structure’s functional networks.

The analysis of HDI and its derivations also provided useful insights on how household wealth impacts on city structure development. Both HDI and EMP (the next critical indicator to be discussed) are critical indicators at a more discrete level than city population and GDP (which take a longer time for the effects to dissipate). Both indicators collectively measure either a household or an individual’s responsiveness across a city. Therefore it is possible to see how certain events and structural changes might play out sooner by virtue of being in the “direct line of fire” i.e. there is a greater immediacy - this was demonstrated in the analysis which discussed a greater number of fluctuations and larger amplitude swings in HDI Velocity, Acceleration and Resilience.

6.4.4 Employment (EMP) and its Derivations

- a) Data Explanation
 - i) First Order: EMP

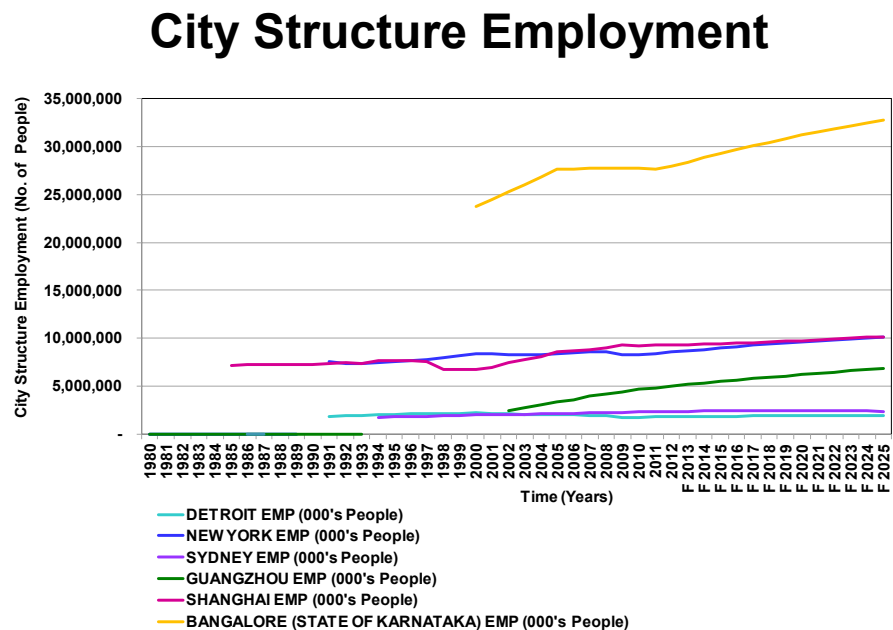
Employment (EMP) measures the level of employment within a city and can be seen as capital in the form of labour. A more definitive definition of EMP is provided by Oxford Economics (refer to **Sub-section 3.4.1.5 Selection of Indicator – City Structure Critical Indicator Matrix** and **Appendix 3: City Structure Critical Indicator Matrix**).

Both Employment and Unemployment are regarded as highly cyclical and move in tandem with economic and business cycles. When demand for goods and services rises, companies increase overtime and if longer term demand is sustainable, companies hire more employees. However when demand for goods and services declines, staff hours are cut and then as a second cost cutting measure, the number of jobs are reduced.

Like HDI, this indicator is pegged at a more discrete individual level and therefore exhibits greater susceptibility and responsiveness to a range of events and structural changes. However EMP is also intrinsically tied to GDP and POP as it relies on strong economic growth to support high employment levels and it is generally expressed as a percentage of the total population who are available to work or are gainfully seeking employment.

The second order, the change in employment and an analysis of the employment trajectories will be discussed in detail in the following sub-section.

The EMP levels for the key cities are presented in **Figure 6.22: City Structure EMP** (Oxford Economics 2013).



Source: Oxford Economics Research, Methodology and Analysis Developed By: Leong Glastris

Figure 6.22: City Structure EMP

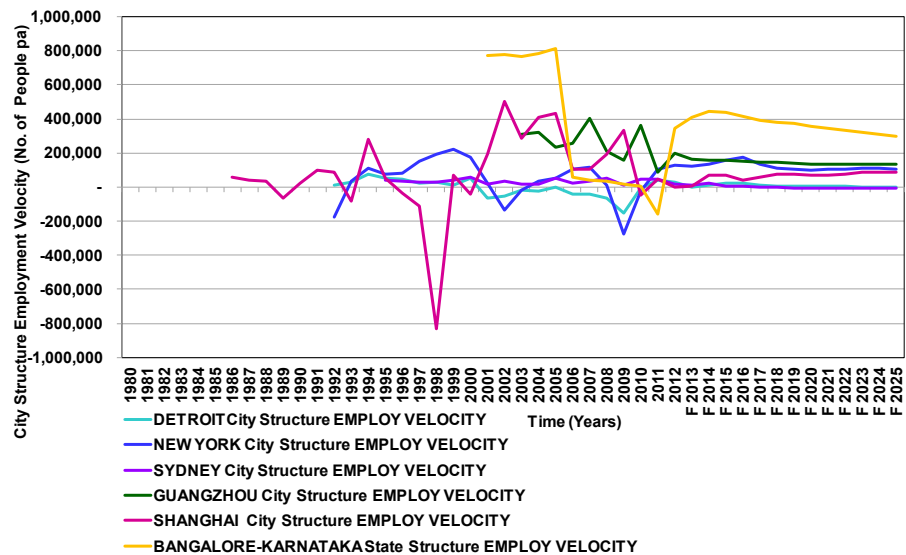
As at 2013, the Oxford Economics employment levels stand at:

- **Bangalore's State of Karnataka** 28.37M (Early Emerging stage);
- **Shanghai** 9.30M (Obsolescence - Re-Growth stage);
- **New York** 8.66M (Mature stage);
- **Guangzhou** 5.17M (Emerging stage);
- **Sydney** 2.37M (Maturing stage);
- **Detroit** 1.81M (Obsolescence – Decline stage).

ii) Second Order: EMP Velocity

EMP Velocity is defined as the change in City Structure EMP over time. In this analysis, it is calculated by taking the annual difference in city EMP between year one and two. As a second order derivation, EMP Velocity tracks the change in city EMP levels. **Figure 6.23: City Structure EMP Velocity** charts key city EMP Velocities.

City Structure Employment Velocity



Source: Oxford Economics Research, Methodology and Analysis Developed By: Leong Glastris

Figure 6.23: City Structure EMP Velocity

Both Shanghai and Bangalore recorded the largest amplitude swings – in particular Bangalore-Karnataka state's number of people employed per annum stepped down from a peak of 810,800 (2005) to negative 161,000 (2011). Shanghai's precipitous drop in EMP Velocity coincided with the Asian Financial Crisis in 1997-98. Whilst New York typically oscillated between a band of +/- 200,000 people pa, Detroit operated in a narrower band and Sydney velocities were relatively steady.

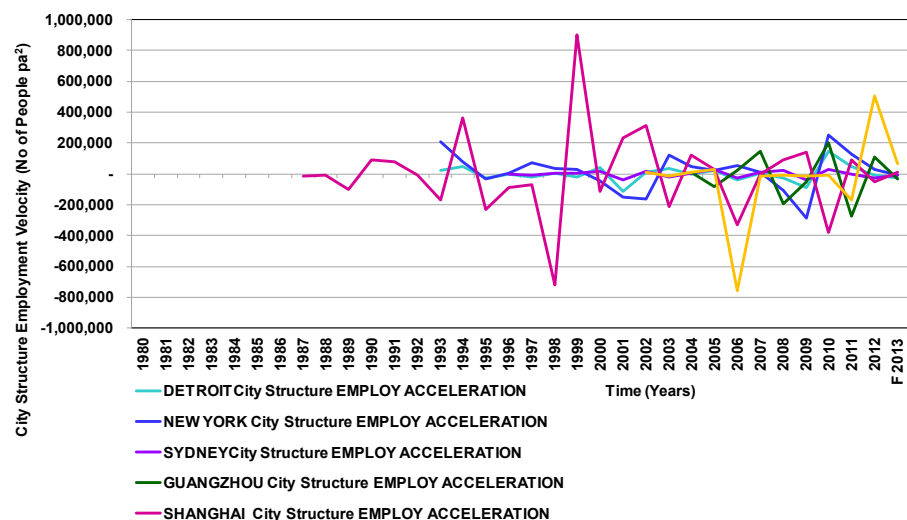
As at 2013, Bangalore-Karnataka state, Guangzhou and New York recorded the highest EMP Velocities respectively at 410,100; 163,300 and 120,400 employed people per annum. Whilst Detroit and Shanghai recorded the lowest EMP Velocities at 1,800 and 5,600 employed people per annum respectively. Only Detroit, New York and Bangalore-Karnataka state have EMP velocities that are currently trended above their respective 23 year historical averages.

iii) Third Order: EMP Acceleration

EMP Acceleration is defined as the change in Employment Velocity and in this analysis, is calculated by taking the annual difference in Employment Velocity between year one and year two. A negative EMP Acceleration denotes a slowing down in or a decline in the EMP Velocity i.e. rate of growth in employment. A turning/inflection point on the EMP Acceleration graph occurs when there is a change in the rate of growth in the EMP Velocity.

The Employment Acceleration trajectory for each of the key cities is presented in **Figure 6.24: City Structure EMP Acceleration**.

Key City Structures: Employment Acceleration



Source: Oxford Economics Research, Methodology and Analysis Developed By: Leong Glastris

Figure 6.24: City Structure EMP Acceleration

EMP Velocity trends for both Shanghai and Bangalore recorded the largest amplitude fluctuations. All key cities showed some volatility, however the effects were comparatively muted for Sydney where the effects and aftermath of the GFC did not significantly impact employment levels i.e. the rates of change in EMP Velocities were more moderate.

Only Shanghai and Bangalore – Karnataka state EMP Velocities are currently trending above their historical average at respectively 7,800 (23Hav: 2,800) and 66,800 (23Hav: negative 38,900) number of people employed per annum². This can be attributed to employment

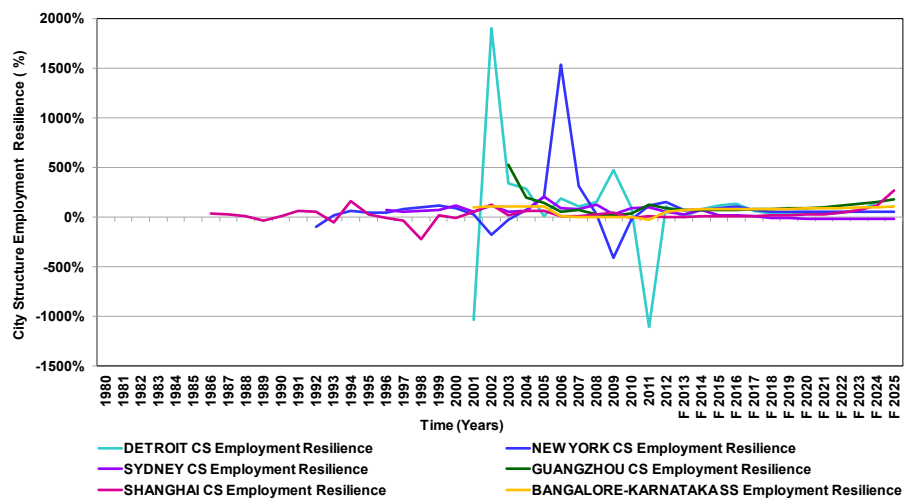
acceleration being buoyed by the strong economic velocities springing from both of these cities.

EMP Accelerations for the other cities in 2013 stand at: Guangzhou negative 36,100; Detroit negative 28,800; Sydney negative 10,400 and New York negative 10,200 people per annum².

iv) Fourth Order: Employment Resilience

The fourth order derivation for EMP is Employment Resilience which measures the responsiveness of a City Structure's Employment Population relative to its City Population (i.e. EMP Velocity / EMP Velocity) at any one point in time. **Figure 6.25: City Structure Employment Resilience** illustrates the employment resilience trajectories for the key cities.

Key City Structures: Employment Resilience



Source: Oxford Economics Research, Methodology and Analysis Developed By: Leong Glastris

Figure 6.25: City Structure Employment Resilience

Both American cities Detroit and New York showed the greatest Employment Resilience with the largest amplitude swings. But when a macro event occurs such as the GFC, New York is faster to return to a historical average or equilibrium point whereas Detroit, requires more time to adjust with lags to work through aftermath reverberations.

As at 2013, the EMP Resilience levels calculated for the six cities were:

- **Guangzhou** 74.8% (Emerging stage);
- **Bangalore's State of Karnataka** 74.7% (Early Emerging stage);
- **New York** 73.4% (Mature stage);
- **Sydney** 27.0% (Maturing stage);
- **Detroit** 5.5% (Obsolescence – Decline stage);
- **Shanghai** 1.0% (Obsolescence - Re-Growth stage).

With the exception of Bangalore-Karnataka state, all other key city EMP Resiliencies in 2013 are currently trending below their 23 year historical averages.

b) Implications

Employment is a significant measure of a city structure's productive capacity because it tracks labour as a valuable form of capital. The manner in which higher employment levels are pursued by government in the economic development policies e.g. tackling underlying structural employment, creating economic zones/corridors and employment growth centres, etc as well as the support government gives to training workers in industries undergoing structural change are key examples of the importance it places on encouraging a skilled and active workforce.

Employment also reflects a city's market maturity with respect to the proportion of workers employed in knowledge based jobs, the economic comparative advantage a city may have over others in terms of a skilled workforce, their productive capacity and the labour wages/salaries its workers command. Employment also plays an important role in determining household disposable income levels within an economy as well as impacting investor, household and consumer confidence.

Higher levels of employment also impact the levels of technology transfer and infrastructure support needed to support and educate the workforce. As discussed earlier, the level of tertiary education attainment and ongoing training is crucial in better positioning workers in knowledge and other skills based jobs in order to diversify the economic and industry base of a city structure and to build economic, household and employment resilience.

Like Household Disposable Income, Employment is an indicator which examines impacts on a more discrete or individual scale. Employees and households are the first to feel the direct impacts of retrenchments, interest rate hikes, inflation, housing shortages and affordability, etc. Because of this immediacy, both HDI and EMP are more responsive to external influences and macro events. This was illustrated when the Derived Trajectory Indicators (Velocity, Acceleration and Resilience) showed how each key city coped with the impact of a macro event such as the GFC and its aftermath where signature characteristics emerge for the six different development stages.

EMP and its derivations also provide a useful set of evaluative tools to assess development performance phenomena of city structures in a consistent, integrated and quantitative manner.

6.4.5 Chapter Conclusion

Chapter 6 City Structure Development Performance Trajectory Analysis is the second of the proof of concept chapters (chapters 5-8). In constructing a methodological basis (process, key assumptions and limitations), an analysis of the results was undertaken. Using a common, integrated evaluative framework and tools, enabled a like-for-like quantitative comparison across city structures in different development stages and geographic regions.

The knowledge gained from this chapter provides fellow researchers and practitioners with the following insights:

- Identifies 4 Critical Indicators and a further 11 Trajectory Indicators were derived;
- Uniquely derives a set of Formulae for Development Performance Trajectory Indicators to calculate POP, GDP HDI and EMP permutations for Velocity, Acceleration and Resilience;
- Data analysis of these indicators and an evaluation of the 4 Critical Indicators and 11 Derived Development Performance Trajectory Indicators and how this impacts the development of city structures;
- Provide an evaluative platform and tools to undertake both a qualitative and quantitative analysis and like-for-like comparison across a range of city structures that are developmentally and geographically diverse.

Chapter 7

Proof of Concept: City Structure Development Stages and Points of Confluence



Guggenheim Museum – Architect: Frank Lloyd Wright

Source: Michelle Leong Glastris

"Cities are crucibles through which radical experiments become convention. They are concentrated environments in which people adapt and their resilience is tested. They are the world's incubators of innovation - made possible by critical mass, diversity, and rich interaction. And cities have steadily grown over the centuries to fulfill that role."

(Savitch & Kantor 2002: 3)

7 Proof of Concept: City Structure Development Stages and Points of Confluence

7.1 Chapter Outline

As mentioned previously, Chapters 5-8 comprise the proof of concept analyses. In **Chapter 5 Proof of Concept: Key Indicator Analysis**, the first stage of Analysis A was undertaken which comprised an analysis of 10 longitudinal and cross sectional indicators to determine their significance as critical indicators, their trends and impact on city structure development. The second stage of Analysis A was undertaken in **Chapter 6 Proof of Concept: City Structure Development Performance Trajectory Analysis**. This involved the evaluation of four critical indicators at a city level which were then used to derive subsequent trajectory indicators which looked at rates of change (Velocity, Acceleration and Resilience) for a City structure's Population, GDP, Household Disposable Income and Employment. These critical and derived trajectory indicators provided part of a useful evaluative framework and tools to assess how city structures develop and evolve.

Chapter 7 Proof of Concept: City Structure Development Stages and Points of Confluence is the third and final stage of Analysis A (**Appendix 1 Key Reference Charts - Research Design: Conceptual Framework**). The chapter commences with a discussion on the process undertaken for the analysis and key considerations regarding assumptions and limitations of the analysis. The results and analysis are presented to highlight trends and the impacts on city structure development performance.

7.2 Process

The purpose of the third stage of Analysis A is to build on the analysis work of the development performance trajectory analysis. Refer to **Appendix 1: Key Reference Charts – Research Design: Conceptual Framework** and *City Structure Indicator Pathways & Application charts*.

The previous stage (chapter 6) introduced the concept of a “rates of change” approach and the significance of the four critical indicators and their respective derivations.

Six key cities were selected for analysis to represent each of the development stages in the evolution of a city structure. From the development performance trajectory analysis undertaken in Chapter 6, certain characteristics started to emerge that were evident for cities in certain development stages.

In order to more fully investigate those common characteristics, an analysis will be undertaken of those Derived Trajectory Indicators across a wider sample of 29 cities i.e. both the key and cross reference cities. In this instance both Dubai and Tel Aviv-Jaffa dropped out of the four critical Development Performance Trajectory Indicators and 11 Derived Trajectory Indicators Analysis as Oxford Economics were unable to provide POP, GDP, HDI and EMP data at a city level for those two cities.

The same development performance trajectory calculations and analysis undertaken in the previous chapter was applied to the cross reference cities.

The results for both the key and cross reference cities were then assembled and analysed in two parts:

The first part involved the compilation of a series of comparative tables and graphs that categorised the development trajectory indicator results by development stage. This involved taking historical averages (based on available data) to ascertain equilibrium points to gauge historical performance and to facilitate comparison between cities at different development stages and within the same development stage.

This was developed further by determining indicative ranges for these Derived Trajectory Indicators for each development stage.

The second part was to assess points of confluence by examining different combinations and subsets of these Derived Trajectory Indicators to see where there may be further instructive insights in determining common characteristics of cities within certain categories of development stages. This analysis was undertaken using a series of graphs.

7.3 Key Assumptions and Limitations

The definitions and the reasons for selection of each of the four critical indicators were discussed previously and have been tabled in **Appendix 3: City Structure Critical Indicator Matrix**. The formulae for generating the Derived Trajectory Indicators are tabled in **Table 6.1: City Structure Development Performance Trajectory Formulae**.

7.3.1 Key Cities Overview

To assist in the understanding of the key cities, a brief overview of the historical evolution of these six cities was examined and tabled in **Appendix 5: Key Cities Overview**.

7.3.2 Key Assumptions

In undertaking the Development Stages and Points of Confluence Analysis, the same key assumptions discussed in **5.3.2 Key Assumptions** apply with regards to taking into account Major Events and Structural Changes when evaluating development trends. This was particularly the case when the City POP indicator and its associated derivation POP Velocity and three types of Resilience were calculated for London and Manchester. It should be noted that both cities were independently targets of terrorist attacks (i.e. location specific events – major city upheavals). In contrast, other Terrorist targeted cities such as Bangalore (two terrorist attacks in 2008 and 2010 (Wikipedia 2013)) and Mumbai (nine terrorist attacks between 1993 and 2011 (Wikipedia 2013)) did not show a significant change in actual POP or GDP figures or in their respective Velocities that signalled anything abnormal outside their overall trend i.e. no significant/abnormal blips. This was in stark contrast to the London and Manchester Terrorist attacks which did significantly impact their respective City Structure Population and had knock on effects on their POP Velocity and resiliencies. The Terrorist attacks, the impact on London and Manchester City Structure Populations and their knock on effects will be discussed in the following paragraphs.

Since the 1970s, by virtue of its global city profile, London has been a prime target for terrorist attacks prior and during World War II and since the 1970s from the Irish Republican Army (IRA) and more recently from the Middle East (e.g. Assassination of Israeli Ambassador in 1982 and bombings (1983 and 1994). During the 1980-2012 timeframe analysed, the series of IRA terrorist attacks in 1991-1993 resulted in a discernible decline in the rate of City POP growth (i.e. POP Velocity): 47,200 (1990 – Pre-Terrorist attacks), 30,500 (1991- Start of Terrorist attacks), 100 (1992), 15,100 (1993 – Towards the end of the Terrorist attacks) and 29,000 (1994) number of people pa which had an adverse effect on GDP Velocity with negative 9,392 (1991) and negative 2,120 (1992) US\$M pa. Subsequently this significantly impacted the 1992 resilience figures: negative 2,120% (Economic Resilience); 4,103% (Household Resilience) and negative 131,850% (Employment Resilience).

A similar impact occurred in Manchester with the Manchester IRA Bombing in 1996. The event exacerbated a POP Velocity already in

decline but given the comparatively smaller city, the economic and population fallout took two to three years to manifest itself. The POP Velocities for Manchester were: negative 5,563 (1995 - Pre-Terrorist attack), negative 8,637 (1996 – Terrorist attack), negative 9,414 (1997 – post Terrorist attack), negative 86 (1998 – post event) and negative 6,463 (1999 – post event). This adversely affected GDP Velocity where it declined from 1,837 (1996) to 340 (1997) before resuming higher economic growth. This in turn significantly affected the 1998 resilience figures: negative 3,228% (Economic Resilience); negative 1,148% (Household Resilience) and negative 49,027% (Employment Resilience).

In comparison, the 2001 September 11 Terrorist attacks that targeted the Twin Towers in New York, the Pentagon and the White House in Washington also had devastating effects on human life, city infrastructure and disruptions to economic/commercial and administrative activity. The most immediate and worst effects were felt in the three to four years immediately following the attacks. Whilst Oxford Economics were unavailable to provide GDP data prior to 2002, it has been estimated that New York city's GDP declined by \$27.3B in the last three months of 2001 and throughout 2002 (Wikipedia 2013x). By 2002, the effects recorded were: GDP Velocity negative US\$6,646M pa; POP Velocity 78,444 people pa; Economic Resilience negative 9%; Household Resilience 24% and Employment Resilience negative 172%. Not wanting to diminish or lessen the devastating toll the September 11 attacks had on human life and acknowledging that the city is still recovering, the GFC appears to have had a comparatively larger economic and population impact. In 2009 the effects recorded were: GDP Velocity negative US\$41,495M pa; POP Velocity 67,713 people pa; Economic Resilience negative 61%; Household Resilience negative 43% and Employment Resilience negative 407%.

Consequently as a result of these Terrorist attacks, the significant magnitudes of these figures in London and Manchester, affected the respective historical averages for City Structure POP Velocity, GDP Velocity, Economic Resilience, Household Resilience and Employment Resilience. For comparative purposes the POP and GDP Velocities together with the Economic, Household and Employment Resiliencies for London and Manchester have been noted in the OE tables (which includes the impact of the Terrorist attack(s)) and beneath the OE tables in the table footnotes numbered “5” (London) and “6” (Manchester) which provides the historical averages which exclude the impacts for the year most severely impacted i.e. 1992 for London and 1998 for Manchester.

However in light of the unfortunate observation that these terrorist attacks are occurring with somewhat regular frequency they will in all likelihood continue into the future. Therefore in spite of the significant impact, it was concluded that these effects should form part of the calculation of these historical averages. These Terrorist attacks should not be regarded as “outliers” but part and parcel of the unfortunate type of events that do take place in cities and it is important to assess the city’s response or resilience to these events.

The timeframe for the analyses covers up to 33 years (based on available data) and includes recent events, structural changes as well as several business/economic cycles. Subsequently development performance determinants such as velocity, acceleration and economic resilience can more accurately gauge a city’s response to macro/global events, city/country specific events and assess longer development trajectories.

In assessing longer development trajectories, future performance can be benchmarked against historical performance and provide a better understanding of the impact of future macro/global events on a city structure’s future development performance.

It should be noted that the stage two of Analysis A looked at the overall development trends from a longitudinal perspective which took into account various macro events. The approach in this third stage is to condense the snapshot by looking at the historical average over the same timeframe to investigate equilibrium points for performance benchmarking purposes.

Where relevant, city structures with a city population of over 20M were classed as Megacity (United Nations Human Settlements Programme UN-HABITAT 2008) and due to their propensity to amplify numerical measures by virtue of their size, these were identified in the tables. When assessing indicative ranges, a separate sub-category was given where Megacities were present in a particular development stage category.

For the purposes of facilitating this analysis, the UN’s 20M city population threshold was used to clearly determine megacity status. It is also acknowledged that there are other complex factors which define a megacity. For example, it is advocated by Hall, Sassen and Soja that a megacity can be defined by its “*agglomeration of functions and networks*” and they underscore the critical supportive role of infrastructure “*the underpinning role of infrastructure which allows, encourages and makes possible these regional megacity arrangements. The story of the rise and the decline of a megacity is*

very much determined by the conditions of its supporting infrastructures" (Buijs, Tan & Tunas 2010: Chapter "Defining Megacities" co-authored by Peter Hall, Saskia Sassen & Edward Soja: 78-79). However for this analysis, the quantitative city population threshold of 20M was used as the primary criteria to provide a clear, quick identification and classification of megacities within the range of key and cross reference city structures.

7.3.3 Key Limitations

In undertaking the Development Stages and Points of Confluence Analysis, the same key limitations discussed in **6.3.3 Key Limitations** apply with regards to taking into account any significant differences between the United Nations and Oxford Economics city population datasets.

In addition to the above limitations, the following key limitations are also acknowledged:

The sample of six key and 23 cross reference cities was selected to provide reasonable representation across development stage categories and across geographic regions. The sample is by no means comprehensive/exhaustive, however for the purposes of the research, it was considered a valid and reasonable cross representation. As mentioned previously, due to unavailable city level data for Dubai and Tel-Aviv-Jaffa, these two cities were excluded in this analysis.

Historical annual averages were typically calculated across the 1980-2012 timeframe based on the data available from Oxford Economics for each city. It should be noted that not all datasets for each critical indicator or derived trajectory indicator for each key and cross reference city extend back to 1980. However to facilitate calculations, the statistical average was taken across the 1980-2012 timeframe.

Where a comparison was undertaken between United Nations and Oxford Economics POP velocities (**Table 7.1: City Structure Population Velocities – UN & OE (1980-2010)** and **Figure 7.1: City Structure Population Velocities – UN & OE (1980-2010)**), owing to the five-year snapshot frequency of the data available from the United Nations, the historical averages were undertaken on a five year basis to facilitate a consistent comparison between the Oxford Economics and United Nations data over the 1980-2010 timeframe. Again it should be noted that not all datasets for the derived trajectory

indicator, POP Velocity, for each key and cross reference city extend back to 1980 – Shanghai, Beijing, Singapore, Hong Kong, London, Tokyo, Manchester extend either back to 1980 or 1985. The other key and cross reference datasets extend back to varying degrees based on the city and the indicator. However, in order to facilitate calculations, the statistical average was taken across the 1980-2010 timeframe.

In determining the indicative ranges, a preliminary evaluation of the minimum and maximum within the range of historical averages was identified. It is acknowledged that a more in depth statistical analysis across a wider sample of cities would provide greater rigour and build a more comprehensive profile of threshold ranges for each development stage. However for the purposes of devising and initially testing the proof of concept and given the already extensive scope of the thesis, this approach was considered valid.

In determining the indicative ranges, where there were Megacities it was previously outlined in the Key Assumptions section that a separate megacity sub-category was provided. It is acknowledged that in these instances the sample of Megacities within a development category was limited and that further investigative work outside the scope of this thesis would be required to determine more comprehensively if these preliminary indicative ranges were representative.

It was determined that using the comparative tables and indicative threshold ranges alone were not sufficiently definitive to quantitatively define and describe common characteristics of cities within each development stage. Because the city structure development stages could not be easily quantified into stages given lack of city level data, the assessment of development stages had to be tackled on several fronts by examining various points of confluence i.e. looking at different combinations and sub sets of the derived trajectory indicators. Therefore the Points of Confluence analysis was able to further supplement the analysis and better identify common characteristics for cities in different development stages.

Given the multi-collinear nature (Everitt 2010; Levine et al. 2008) (refer to **Table 5.1: Summary Table of Correlation Analyses for Key City Cities** and **Appendix 4: Correlation Tables – Critical Indicators**) between GDP, HDI and EMP and hence similar relationships and trends between various rates of change for GDP, HDI and EMP, the analysis will focus on POP and GDP and their respective derivations. However a table

comparing Economic Resilience, Household Resilience and Employment Resilience was compiled and discussed.

The analysis of POP, GDP, HDI and EMP Acceleration was instructive in evaluating development trends from a longitudinal perspective. However it was determined that as an examination of inflection points was not required and for the purposes of focusing the analysis, a further analysis of Acceleration measures was excluded from this stage of the analysis.

For the three Points of Confluence graphs developed where POP Velocity was used as an x axis variable, UN City POP Velocities were substituted for OE State POP Velocities for only the Indian cities Bangalore and Mumbai. This was to provide a more accurate gauge and scale of City Population levels when plotted against the three different Resilience graphs. It was considered valid to do so given the correlations between the UN and OE datasets have previously been shown to be strongly correlated.

7.4 Results and Analysis: Outcomes for Key & Cross Reference Cities

7.4.1 Comparative Tables and Graphs

The development trajectory trends for the six key cities have already been discussed in detail in Chapter 6. This section therefore builds on these results by highlighting common characteristics across the six different development stages of city structures. This is achieved through a presentation of a series of summary tables and charts supplemented with brief comments.

7.4.1.1 City Structure Population Velocity

Table 7.1: City Structure Population Velocities – UN & OE (1980-2010) provides a comparison of the historical averages for City Structure POP Velocities based on a five-year snapshot basis calculated for both the Oxford Economics (OE) and United Nations (UN) datasets (United Nations Human Settlements Programme UN-HABITAT 2008). These results were also presented graphically in **Figure 7.1: City Structure Population Velocities – UN & OE (1980-2010)**.

Also tabled are the annual historical averages calculated for City Structure POP Velocities from the Oxford Economics datasets for the 29 key and cross reference cities - refer to **Table 7.2: City Structure Population Velocities – OE Annual Historical Averages (1980-2010)**. In both tables, the datasets have been sorted by development stage and then by increasing OE POP Velocity. Key cities are highlighted in bold text.

A summary table was constructed that provides indicative threshold ranges for OE POP Velocities for each city structure development stage. Refer to **Table 7.3: City Structure Population Velocities – Indicative Ranges (1980-2012)**.

City Structure Population Velocities: 1980-2010

Population Velocity Comparison: 1980-2010 Historical Average (Five Year Snapshots)

City Structure	Oxford Economics	United Nations	Indicative Preliminary Dvt Stage	Megacity Status *** as at 2012
Johannesburg	101,447	63,331	Early Emerging	
Jakarta	110,366	137,623	Early Emerging	
Bangalore *	688,437	176,127	Early Emerging	
Guangzhou	384,346	251,068	Emerging	
Sao Paulo	193,777	286,724	Emerging	Megacity
Mumbai *	1,675,229	352,572	Emerging	Megacity
Adelaide	6,261	8,563	Maturing (Early)	
Berlin	5,214	9,136	Maturing (Early)	
Auckland	26,037	19,374	Maturing (Early)	
Perth	34,751	24,213	Maturing (Early)	
Brisbane	35,330	30,425	Maturing (Early)	
Melbourne	53,482	38,154	Maturing (Early)	
Boston	14,636	43,980	Maturing (Early)	
Singapore	88,760	80,400	Maturing (Early)	
Sydney	39,122	43,383	Maturing (Established)	
Hong Kong	67,479	74,469	Maturing (Established)	
Toronto	97,771	77,564	Maturing (Established)	
Moscow	61,018	109,970	Maturing (Established)	
Los Angeles	42,183	122,786	Maturing (Established)	
London	52,537	39,333	Mature	
Paris	20,169	55,968	Mature	
New York	98,599	120,689	Mature	Megacity
Tokyo	49,010	294,801	Mature	Megacity
Budapest	2,092	7,834	Obsolescence - Decline	
Manchester	4,200	4,408	Obsolescence - Decline	
Detroit	16,769	13,695	Obsolescence - Decline	
Athens	24,123	18,396	Obsolescence - Decline	
Beijing	351,137	290,620	Obsolescence - Re-Growth	
Shanghai	383,554	397,926	Obsolescence - Re-Growth	Megacity

Note: * Oxford Economics uses State of Karnataka for Bangalore & Maharashtra for Mumbai

*** Note: Megacity - As defined by UN-HABITAT State of the World's Cities 2010/2011 report, defines a Megacity as a "city with a population that exceeds 20 million".

Source: United Nations & Oxford Economics

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Table 7.1: City Structure Population Velocities – UN & OE (1980-2010)

City Structure Population Velocities: 1980-2012

City Structure Population Velocity Comparison: Historical Annual Average ¹			
City Structure	Population Velocity		Megacity Status ³ as at 2012
	Economics), (No. of People pa)	Indicative Dvt Stage	
Johannesburg	98,741	Early Emerging	
Jakarta	119,484	Early Emerging	
Bangalore ⁴	686,935	Early Emerging	
Sao Paulo	184,314	Emerging	Megacity
Guangzhou	293,758	Emerging	
Mumbai ⁴	1,663,133	Emerging	Megacity
Berlin	1,391	Maturing (Early)	
Adelaide	6,431	Maturing (Early)	
Boston	19,164	Maturing (Early)	
Auckland	25,468	Maturing (Early)	
Perth	30,129	Maturing (Early)	
Brisbane	35,945	Maturing (Early)	
Melbourne	51,220	Maturing (Early)	
Singapore	100,132	Maturing (Early)	
Hong Kong	5,847	Maturing (Established)	
Sydney	39,179	Maturing (Established)	
Moscow	55,863	Maturing (Established)	
Toronto	95,677	Maturing (Established)	
Los Angeles	617,035	Maturing (Established)	
Paris	18,188	Mature	
Tokyo	54,841	Mature	Megacity
London ⁵	68,061	Mature	
New York	112,704	Mature	Megacity
Detroit	-11,914	Obsolescence - Decline	
Budapest	238	Obsolescence - Decline	
Manchester ⁶	6,904	Obsolescence - Decline	
Athens	23,027	Obsolescence - Decline	
Beijing	438,950	Obsolescence - Re-Growth	
Shanghai	475,847	Obsolescence - Re-Growth	Megacity

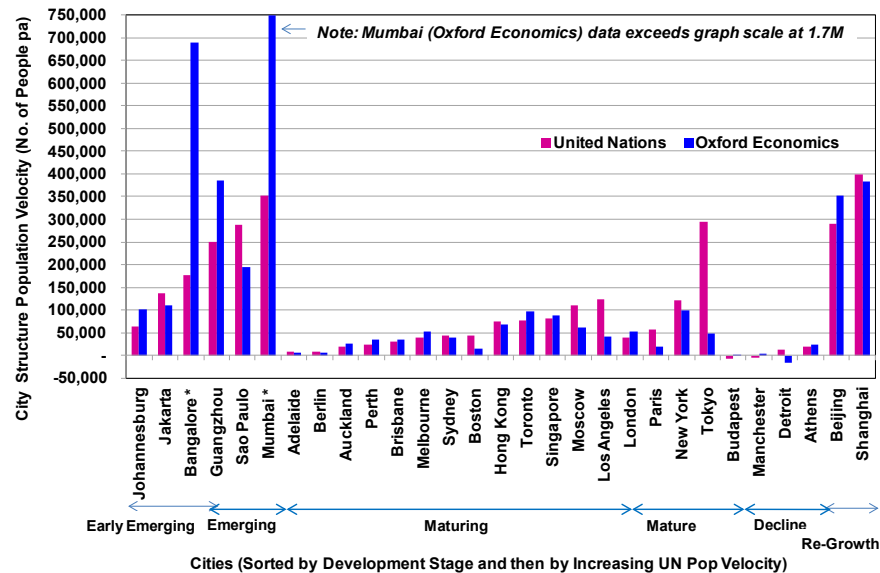
Source: Oxford Economics

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Table 7.2: City Structure Population Velocities – OE Annual Historical Averages (1980-2010)

¹ Note: Population Velocity: 1980-2012 Historical Annual Average	
³ Note: Megacity - As defined by UN-HABITAT State of the World's Cities 2010/2011 report, defines a Megacity as a "city with a population that exceeds 20 million".	
⁴ Note: Oxford Economics uses State of Karnataka for Bangalore & Maharashtra for Mumbai	
⁵ Note: LONDON - The historical average figure include the effects of the 1992 London Terrorist Attacks which adversely impacted London's POP level. Otherwise if the historical average figure in 1992 is excluded, the POP Vel = 50,397.	
⁶ Note: MANCHESTER - These historical average figures include the after effects experienced in 1998 of the 1996 IRA Manchester Bombing which adversely impacted Manchester's POP level. Otherwise if the historical average figure in 1998 is excluded, the POP Vel = 2,760	

City Structure Population Velocities: 1980-2010



Source: United Nations & Oxford Economics

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Figure 7.1: City Structure Population Velocities – UN & OE (1980-2010)

City Structure Population Velocities: Indicative Ranges 1980-2012

City Structure	Indicative POP Velocity Range (No. of People pa), (Oxford Economics)	MEGACITY*: Indicative POP Velocity Range (No. of People pa), (Oxford Economics)
Early Emerging	98,000 to 690,000	NA
Emerging & Obsolescence - Re-Growth	293,000 to 368,000	184,000 to 1,700,000
Maturing (Early)	1,300 to 89,000	NA
Maturing (Established)	39,000 to 618,000	NA
Mature	18,000 to 49,000	47,000 to 113,000
Obsolescence - Decline	-12,000 to 24,000	NA

* Note: Megacity - As defined by UN-HABITAT State of the World's Cities 2010/2011 report, defines a Megacity as a "city with a population that exceeds 20 million".

Note: Based on Average Historical Averages taken between 1980 - 2012

Source: Oxford Economics

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Table 7.3: City Structure Population Velocities – Indicative Ranges (1980-2012)

Based on the sample of 29 key and cross reference cities analysed and the results tabled and charted on the calculated historical averages, the common characteristics emerging are:

- **Early Emerging, Emerging and Obsolescence-Re-Growth City Structures:** In light of their early development or re-growth stages, city structures in Early Emerging, Emerging and Obsolescence-Re-Growth development stages tended to record higher POP velocities compared to their more mature city structure counterparts. Typically Early Emerging city structure POP Velocities historically average 98,000 - 690,000 people pa whilst Emerging and Re-Growth city structures have POP Velocities that collectively historically average 293,000 - 368,000 (non Megacities) and 184,000 - 1,700,000 (Megacities) people pa.
- **Maturing (Early and Established) and Mature City Structures:** These more developed groups tended to record relatively moderate POP Velocities in the vicinity of: 1,300 - 189,000 for Maturing (Early); 39,000 - 618,000 for Maturing (Established); 18,000 - 49,000 for Mature (non Megacities) and 47,000 - 113,000 for Mature (Megacities) people pa.
- **Obsolescence-Divide City Structures:** As a development stage category, the Obsolescence-Divide cities recorded the lowest POP Velocities which ranged from negative 12,000 to 24,000 people pa.
- The notable exceptions across all development stages are the Megacities which are noted in a separate sub-category. By virtue of their sheer population size, the quanta tend to be more pronounced and/or magnified. However when the Megacities are compared across development stages (where data was available), they also exhibited similar characteristics/trends to their non megacity counterparts.
- It should also be reinforced these ranges are based on the historical averages calculated across the 1980-2012 timeframe and are therefore cited for indicative purposes. During this period, there were POP Velocities in these cities that were far below and/or exceeded these averages. However the purpose of calculating the historical average was to obtain some quantitative gauge of the historical "State of Equilibrium" in order to evaluate a long term "Equilibrium Point" (albeit a dynamic one) that could be used to gauge and benchmark future performance.

7.4.1.2 City Structure GDP Velocity

Historical averages were calculated for OE GDP Velocities over the same timeframe and are presented in **Table 7.4: City Structure GDP Velocities (1980-2012)**. These results were also presented in a chart – refer to **Figure 7.2: City Structure GDP Velocities (1980-2012)**.

A summary table was also constructed to provide indicative threshold ranges for OE GDP Velocities for each city structure development stage (Oxford Economics 2013; **United Nations** Department of Economic and Social Affairs 2011a). Refer to **Table 7.5: City Structure GDP Velocities – Indicative Ranges (1980-2012)**.

City Structure GDP Velocities: 1980-2012

City Structure GDP Velocity Comparison: Historical Annual Average ¹			
City Structure	GDP Velocity ¹ (Oxford Economics), (US\$M pa)	Indicative Dvt Stage	Megacity Status ³ as at 2012
Johannesburg	1,445	Early Emerging	
Jakarta	3,034	Early Emerging	
Bangalore ⁴	3,627	Early Emerging	
Sao Paulo	5,689	Emerging	Megacity
Guangzhou	7,370	Emerging	
Mumbai ⁴	11,038	Emerging	Megacity
Berlin	817	Maturing (Early)	
Adelaide	840	Maturing (Early)	
Auckland	899	Maturing (Early)	
Brisbane	2,422	Maturing (Early)	
Perth	3,288	Maturing (Early)	
Melbourne	4,063	Maturing (Early)	
Boston	4,198	Maturing (Early)	
Singapore	5,986	Maturing (Early)	
Sydney	4,041	Maturing (Established)	
Toronto	5,034	Maturing (Established)	
Moscow	7,685	Maturing (Established)	
Los Angeles	11,747	Maturing (Established)	
Hong Kong	67,492	Maturing (Established)	
Paris	4,576	Mature	
Tokyo	7,454	Mature	Megacity
London ⁵	10,606	Mature	
New York	16,026	Mature	Megacity
Detroit	-902	Obsolescence - Decline	
Manchester ⁶	1,144	Obsolescence - Decline	
Budapest	1,165	Obsolescence - Decline	
Athens	1,325	Obsolescence - Decline	
Beijing	6,666	Obsolescence - Re-Growth	
Shanghai	8,753	Obsolescence - Re-Growth	Megacity

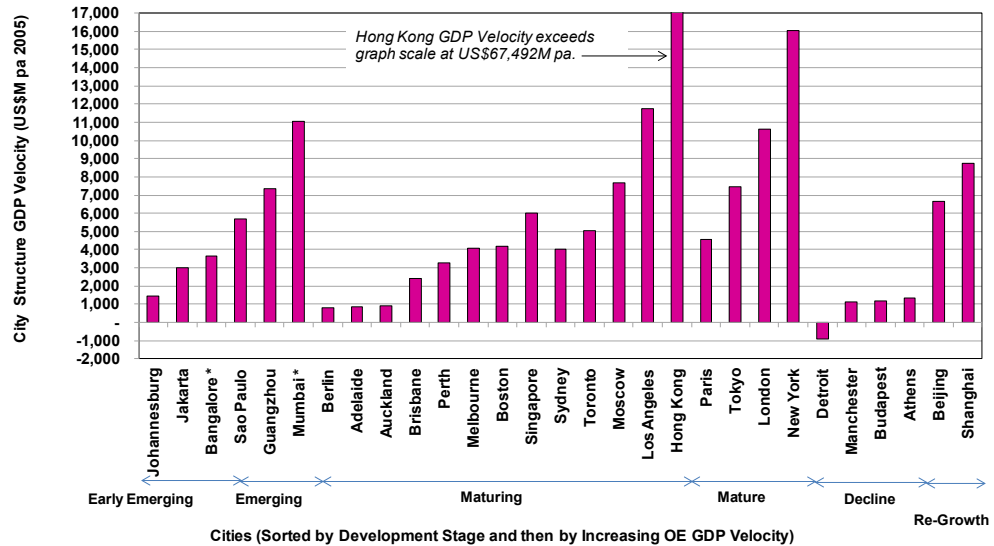
Source: Oxford Economics

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¹ Note: GDP Velocity Comparison: 1980-2012 Historical Annual Average.	
³ Note: Megacity - As defined by UN-HABITAT State of the World's Cities 2010/2011 report, defines a Megacity as a "city with a population that exceeds 20 million".	
⁴ Note: Oxford Economics uses State of Karnataka for Bangalore & Maharashtra for Mumbai	
⁵ Note: LONDON - The historical average figure include the effects of the 1992 London Terrorist Attacks which adversely impacted London's POP level. Otherwise if the historical average figure in 1992 is excluded, the GDP Vel = 11,043.	
⁶ Note: MANCHESTER - These historical average figures include the after effects experienced in 1998 of the 1996 IRA Manchester Bombing which adversely impacted Manchester's POP level. Otherwise if the historical average figure in 1998 is excluded, the GDP Vel = 1,245	

Table 7.4: City Structure GDP Velocities (1980-2012)

City Structure GDP Velocities: 1980-2012



Note: * Oxford Economics uses State of Karnataka for Bangalore & Maharashtra for Mumbai

Source: Oxford Economics

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Figure 7.2: City Structure GDP Velocities (1980-2012)

City Structure GDP Velocities: 1980-2012

City Structure	Indicative GDP Velocity Range (US\$M pa), (Oxford Economics)	MEGACITY*: Indicative GDP Velocity Range (US\$M pa), (Oxford Economics)
Early Emerging	1,400 to 3,700	NA
Emerging & Obsolescence - Re-Growth	6,000 to 7,400	5,600 to 11,100
Maturing (Early)	800 to 6,000	NA
Maturing (Established)	5,000 to 617,100	NA
Mature	4,000 to 10,700	7,400 to 16,100
Obsolescence - Decline	-900 to 1,400	NA

* Note: Megacity - As defined by UN-HABITAT State of the World's Cities 2010/2011 report, defines a Megacity as a "city with a population that exceeds 20 million".

Note: Based on Average Historical Averages taken between 1980 - 2012

Source: Oxford Economics

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Table 7.5: City Structure GDP Velocities – Indicative Ranges
(1980-2012)

Analysis of key and cross reference cities for GDP Velocity historical averages resulted in the following common characteristics for city structure development stages:

- **Early Emerging, Emerging and Obsolescence Re-Growth City Structures:** In light of their early development or re-growth stages, city structures in Early Emerging, Emerging and Obsolescence-Re-Growth development stages tended to record relatively modest GDP velocities. Typically Early Emerging city structure GDP Velocities historically average 1,400 - 3,700 US\$M pa whilst Emerging and Re-Growth city structures have GDP Velocities that collectively historically average 6,000 - 7,400 (non Megacities) and 5,600 - 11,100 (Megacities) US\$M pa.
- **Maturing (Early and Established) and Mature City Structures:** Whilst Maturing (Early) city structures recorded relatively small to modest GDP growth, the Maturing (Established) and Mature city structures collectively as development stage categories tended to record higher levels of GDP Velocity. Typically this was in the range of: 800 - 6,000 for Maturing (Early); 5,000 - 617,100 for Maturing (Established); 4,000 - 10,700 for Mature (non Megacities) and 7,400 - 16,100 for Mature (Megacities) US\$M pa.
- **Obsolescence-Delay City Structures:** As an overall development stage category, the Obsolescence-Delay cities recorded the lowest GDP Velocities which ranged from negative 900 to 1,400 US\$M pa.
- As noted in the POP Velocities for Megacities, a similar trend occurred for GDP Velocities where the historical averages and respective ranges were more pronounced and/or magnified. However when the Megacities were compared across development stages (where data was available), they also exhibited similar characteristics/trends to their non Megacity counterparts.
- It is emphasised that these indicative ranges are based on the historical averages calculated across the 1980-2012 timeframe. Whilst there were GDP Velocities in cities which dipped significantly below and above these averages, it was instructive to establish and analyse historical averages i.e. equilibrium points and indicative ranges.

7.4.1.3 City Structure Economic, Household and Employment Resilience

The final stage of Analysis A was to calculate historical averages for Economic Resilience, Household Resilience and Employment Resilience.

These results are collectively tabled in **Table 7.6: City Structure Resilience Comparisons (1980-2012)** (Oxford Economics 2013). In the table, the datasets have been sorted by development stage and then by increasing OE Economic Resilience. Key cities are highlighted in bold text. Graphs visually comparing Economic Resilience, Household Resilience and Employment Resilience are respectively presented in **Figure 7.3: City Structure Economic Resilience**; **Figure 7.4: City Structure Household Resilience** and **Figure 7.5: City Structure Employment Resilience**.

Separate summary tables were then constructed for each of the three types of Resiliencies to provide indicative threshold ranges for OE Economic, Household and Employment Resiliencies for each city structure development stage. Refer to **Table 7.7: City Structure Resilience Comparisons – Indicative Ranges (1980-2012)**.

On the basis of the historical averages calculated for the three Resiliencies within the 1980-2012 timeframe for the key and cross reference cities evaluated, the following common characteristics were exhibited across the six city structure development stages:

- **Early Emerging, Emerging and Obsolescence Re-Growth City Structures:** Due to their early development or re-growth stages, city structures in Early Emerging, Emerging and Obsolescence-Re-Growth development stages tended to record relatively low Economic, Household and Employment Resiliencies. Early Emerging, Emerging and Obsolescence-Re-Growth cities showed fewer fluctuations and limited amplitude swings as they slowly developed greater resilience. Whilst Early Emerging, Emerging and Obsolescence-Re-Growth cities tend to have relatively low volatilities, it was observed they tend to ride out impacts from macro events in a wave like motion. Consequently their collective ability to quickly bounce back is limited because their ‘coping ability’ has yet to be more fully developed.

City Structure Resilience Comparisons: 1980-2012

City Structure Resilience Comparison: Historical Annual Average ¹ : 1980-2012					
City Structure	Economic ¹ Resilience (Oxford Economics), (%)	Household ¹ Resilience (Oxford Economics), (%)	Employment ¹ Resilience (Oxford Economics), (%)	Indicative Dvt Stage	Megacity Status ³ as at 2012
Bangalore ⁴	0.55	0.41	49.71	Early Emerging	
Johannesburg	1.47	1.15	25.63	Early Emerging	
Jakarta	2.57	1.78	128.58	Early Emerging	
Mumbai ⁴	0.69	0.47	50.56	Emerging	Megacity
Sao Paulo	3.51	2.08	125.52	Emerging	Megacity
Guangzhou	4.39	1.28	132.04	Emerging	
Berlin	-4.39	8.30	-209.91	Maturing (Early)	
Boston	-0.72	20.29	72.14	Maturing (Early)	
Auckland	3.23	2.36	48.65	Maturing (Early)	
Singapore	5.11	1.21	-95.76	Maturing (Early)	
Brisbane	7.50	6.91	73.47	Maturing (Early)	
Melbourne	7.68	6.40	79.14	Maturing (Early)	
Adelaide	12.45	14.98	140.33	Maturing (Early)	
Perth	14.00	8.63	89.06	Maturing (Early)	
Los Angeles	-10.96	-1.00	-128.15	Maturing (Established)	
Toronto	5.37	3.83	57.23	Maturing (Established)	
Sydney	10.38	11.03	87.21	Maturing (Established)	
Hong Kong	10.84	6.54	64.86	Maturing (Established)	
Moscow	25.96	20.41	226.26	Maturing (Established)	
London ⁵	-58.89	206.14	-4,719.63	Mature	
Tokyo	-32.71	-12.56	-130.19	Mature	Megacity
Paris	23.58	13.75	147.82	Mature	
New York	86.47	40.42	109.54	Mature	Megacity
Manchester ⁶	-190.19	-152.73	1,610.55	Obsolescence - Decline	
Detroit	-14.30	-7.29	128.49	Obsolescence - Decline	
Athens	-12.29	-14.63	-314.72	Obsolescence - Decline	
Budapest	-6.55	-8.81	-108.47	Obsolescence - Decline	
Beijing	1.17	0.69	59.97	Obsolescence - Re-Growth	
Shanghai	1.51	0.78	18.94	Obsolescence - Re-Growth	Megacity

¹ Note: Economic, Household & Employment Resiliences Comparison: 1980-2012 Historical Annual Average

³ Note: Megacity - As defined by UN-HABITAT State of the World's Cities 2010/2011 report, defines a Megacity as a "city with a population that exceeds 20 million".

⁴ Note: Oxford Economics uses State of Karnataka for Bangalore & Maharashtra for Mumbai

⁵ Note: LONDON - These historical average figures include the effects of the 1992 London Terrorist Attacks which adversely impacted London's POP level. If these historical average figures in 1992 are excluded, the following historical averages would result:
POP Vel = 50,397; GDP Vel = 11,043; Economic Resil = 17.43; Household Resil = 11.31; Employment Resil = -11.10.

⁶ Note: MANCHESTER - These historical average figures include the after effects experienced in 1998 of the 1996 IRA Manchester Bombing which adversely impacted Manchester's POP level. If these historical average figures in 1998 are excluded, the following historical averages would result:
POP Vel = 2,760; GDP Vel = 1,245; Economic Resil = -77.69; Household Resil = -102.98; EMP Resil = -145.62.

Source: Oxford Economics

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Table 7.6: City Structure Resilience Comparisons (1980-2012)

City Structure Resiliencies: Indicative Ranges 1980-2012

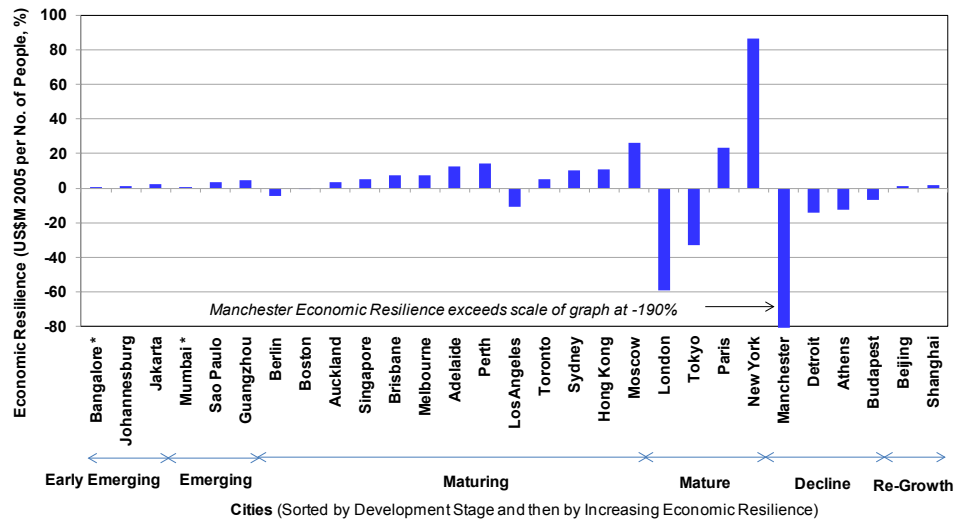
City Structure	Indicative Economic Resilience Range (%)	MEGACITY*: Indicative Economic Resilience Range (%)
Early Emerging	0% to 3%	NA
Emerging & Obsolescence - Re-Growth	1% to 5%	0% to 4%
Maturing (Early)	-5% to 15%	NA
Maturing (Established)	-11% to 26%	NA
Mature	-59% to 24%	-33% to 87%
Obsolescence - Decline	-191% to -6%	NA
* Note: Megacity - As defined by UN-HABITAT State of the World's Cities 2010/2011 report, defines a Megacity as a "city with a population that exceeds 20 million".		
City Structure	Indicative Household Resilience Range (%)	MEGACITY*: Indicative Household Resilience Range (%)
Early Emerging	0% to 2%	NA
Emerging & Obsolescence - Re-Growth	0% to 2%	0% to 2%
Maturing (Early)	1% to 21%	NA
Maturing (Established)	-1% to 21%	NA
Mature	13% to 207%	-13% to 41%
Obsolescence - Decline	-153% to -7%	NA
* Note: Megacity - As defined by UN-HABITAT State of the World's Cities 2010/2011 report, defines a Megacity as a "city with a population that exceeds 20 million".		
City Structure	Indicative Employment Resilience Range (%)	MEGACITY*: Indicative Employment Resilience Range (%)
Early Emerging	25% to 129%	NA
Emerging & Obsolescence - Re-Growth	59% to 133%	18% to 126%
Maturing (Early)	-210% to 141%	NA
Maturing (Established)	-129% to 227%	NA
Mature	-4,720% to 148%	-131% to 110%
Obsolescence - Decline	-315% to 1611%	NA
* Note: Megacity - As defined by UN-HABITAT State of the World's Cities 2010/2011 report, defines a Megacity as a "city with a population that exceeds 20 million".		

Source: Oxford Economics

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Table 7.7: City Structure Resiliencies Comparisons – Indicative Ranges (1980-2012)

City Structure Economic Resilience: 1980-2012 Historical Annual Average

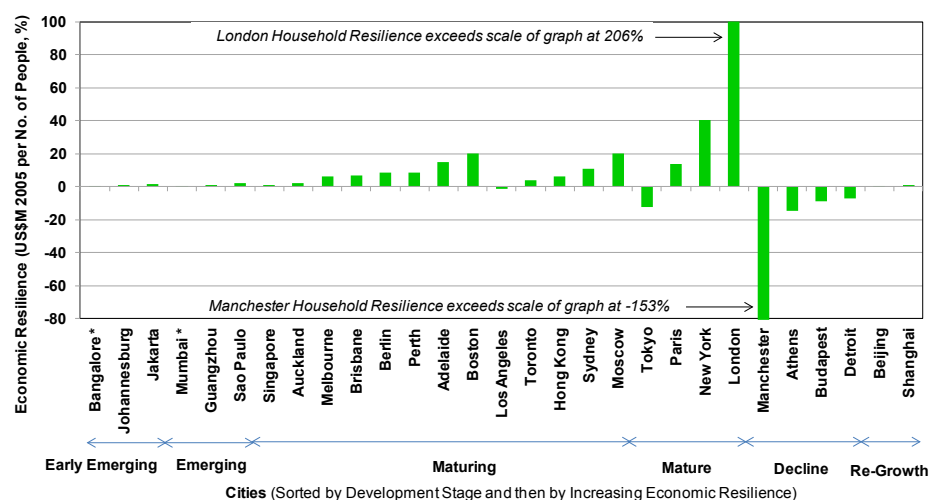


Source: Oxford Economics

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Figure 7.3: City Structure Economic Resilience

City Structure Household Resilience: 1980-2012 Historical Annual Average

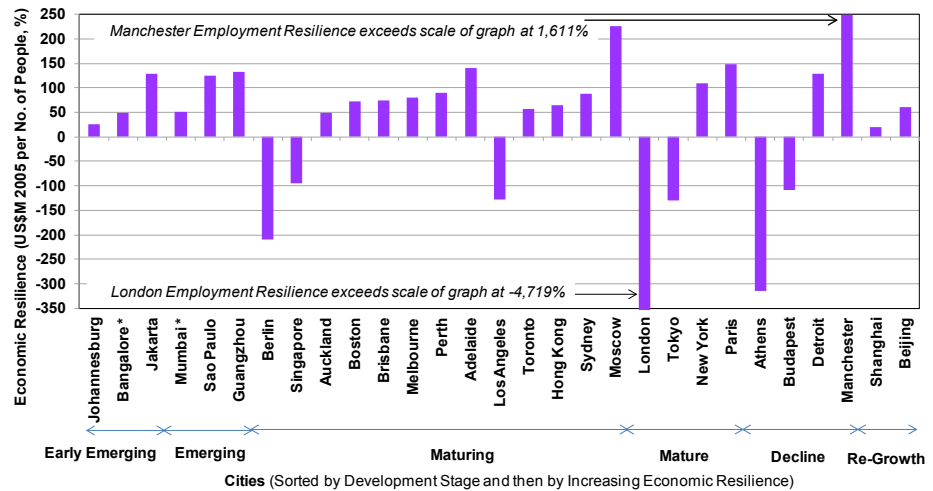


Source: Oxford Economics

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Figure 7.4: City Structure Household Resilience

City Structure Employment Resilience: 1980-2012 Historical Annual Average



Source: Oxford Economics

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Figure 7.5: City Structure Employment Resilience

- Maturing (Early and Established) and Mature City Structures:** In contrast, the Maturing (Early and Established) and Mature city structures recorded have developed the greatest levels of Economic, Household and Employment Resilience. Both maturing and mature cities tend to absorb the impact of major events reasonably well, quickly adjusting their amplitudes and settling back to an equilibrium point quickly. Resilience for Maturing and Mature cities demonstrated a greater fortitude in bouncing back from the GFC – particularly the Mature city structures. Whilst amplitude swings tended to be large, the periods of negative resilience were generally shorter. It should also be noted that a negative resilience is in itself not bad (provided it does not continue for a prolonged period). It is the ability of a city structure to accommodate large amplitude swings (from large negative levels to high positive levels) accompanied with the ability to quickly respond and adjust to adverse factors from macro and location specific events that provides the “bounce back” that that is key to recovery. Resilience is a strong reflection of how well a developed city copes with extreme circumstances and events and how rapidly it can settle back to carrying out its network of functional activities. Therefore in the Resilience tables presented, whilst it

can be observed that there is a wider variation in the range for Mature cities, this is actually seen as an admirable quality.

- **Obsolescence-Decline City Structures:** As an overall development stage category, the Obsolescence-Decline cities typically recorded the lowest levels of Economic, Household and Employment Resilience. Obsolescence – Decline cities tended to exhibit the most extreme signs. Key characteristics generally included a greater number of fluctuations, larger amplitude movements, slower response/lag times and exposure to longer periods of negative resilience when impacted by a macro event (e.g. the GFC).
- Again the Megacities evaluated also tended to indicate historical averages and respective ranges that were more pronounced and/or magnified. However when the Megacities were compared across development stages (where data was available), they also exhibited similar characteristics/trends to their non Megacity counterparts.
- Again it reinforced that these ranges are based on the historical averages calculated across the 1980-2012 timeframe and are only indicative. Whilst there were Economic, Household and Employment Resiliencies in cities that dipped significantly below and above these averages, it was useful to gauge equilibrium points and indicative ranges.

7.4.2 Points of Confluence Graphs

It can be observed from the previous section, that whilst the historical averages and indicative ranges tabled are instructive, they cannot definitively assign cities into specified development stages. For example for the three types of Resiliencies, a larger (and not necessarily a lower or higher) range is seen as a strong comparative advantage. These tools should be used as a guide based on the signature characteristics discussed.

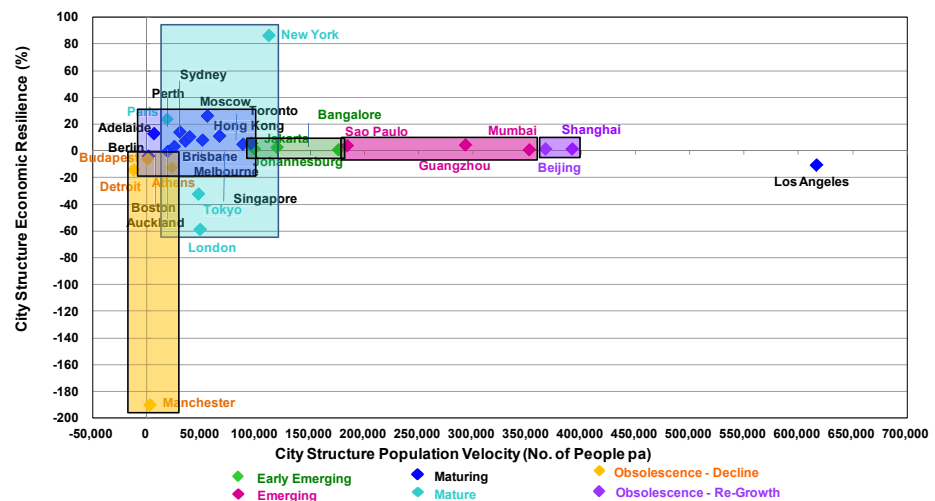
To further develop the “evaluative toolkit”, a further analysis was undertaken on where there may be common ground or areas of overlap/intersection (i.e. points of confluence) across more than one critical indicator or derived trajectory indicator. For the purposes of this analysis, Economic, Household and Employment Resilience were separately evaluated against POP Velocity, GDP Velocity and City POP Density (**Figures 7.6 - 7.14**). It should be noted that City Population Density is discussed in further detail in **Chapter 8 Proof of Concept: Compositional Aspects of City Population** as one of the Critical Indicators - please refer to sub section **8.4.1.3 Population Density**.

7.4.2.1 *Economic, Household and Employment Resilience versus Population Velocity*

As noted in the limitations section of this chapter, in order to more accurately gauge and scale City Population levels for the Indian Cities Bangalore and Mumbai, the UN City POP Velocities were substituted for the OE State POP Velocities for the following three Points of Confluence graphs. These three graphs feature POP Velocity as an x axis variable.

It was identified in all three graphs (**Figures 7.6 – 7.8**) that feature POP Velocity that Los Angeles could be a possible outlier as it appears to deviate significantly from its “Maturing” cluster group and any other development stage category clusters. The remaining six points of Confluence graphs indicated Los Angeles fell within the vicinity of its own Maturing cluster group and other development stage category clusters. Further investigations outside the scope of this research would need to be carried out to test if this was an outlier or still within a statistically accepted norm. In using these three graphs, note the parameter boxes drawn around the “Mature” development stage cities excluded Los Angeles.

Points of Confluence: POP Velocity vs Economic Resilience: 1980-2012



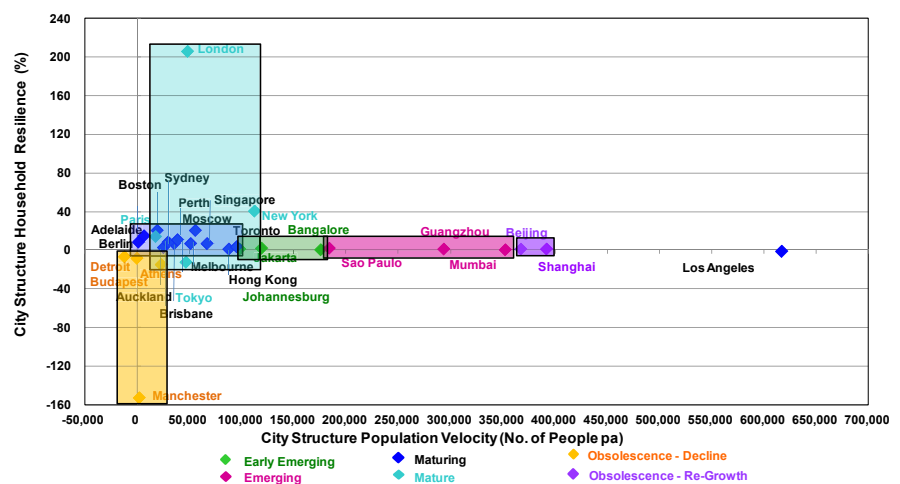
Source: Oxford Economics & United Nations

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Figure 7.6: Points of Confluence: POP Velocity vs Economic Resilience

The Points of Confluence graph **POP Velocity versus Economic Resilience** (Figure 7.6) was used to better evaluate and quantify city structure development stages and common characteristics (Oxford Economics 2013). Data for 29 cities was plotted to more accurately define the city structure development stage parameters. **Obsolescence – Decline** city structures (Detroit) by virtue of their lower Population Velocities and negative Economic Resilience levels were contained within the lower left of the chart, formatted as an orange box. **Maturing** (Sydney) and **Mature** (New York) city structures were positioned further along to the right because of their higher Population Velocities and wider amplitude (i.e. greater responsiveness) on the Economic Resilience axis – formatted as blue and turquoise boxes respectively. Whilst **Early Emerging** (Bangalore), **Emerging** (Guangzhou) and **Obsolescence – Re-Growth** (Shanghai) city structures had higher Population Velocities, they were less able to respond/adapt and were confined to a relatively narrow Economic Resilience band – respectively formatted as green, pink and purple boxes.

Points of Confluence: POP Velocity vs Household Resilience : 1980-2012



Note: For Bangalore & Mumbai, the UN City POP Velocities were substituted for OE State Pop Velocities on the x-axis

Source: Oxford Economics & United Nations

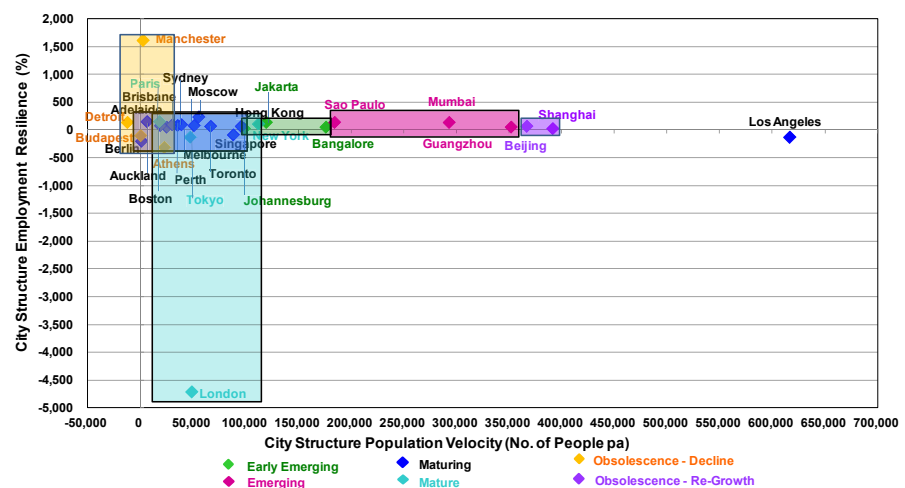
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Figure 7.7: Points of Confluence: POP Velocity vs Household Resilience

A similar trend was evident with the Points of Confluence graph **POP Velocity versus Household Resilience** (Figure 7.7) where the **Early Emerging**, **Emerging** and **Obsolescence-Re-Growth** city structures tended to operate within a narrow Household Resilience band but across comparatively higher levels of POP Velocities. Whilst

Maturing cities recorded historical average Household Resiliencies over a slightly wider amplitude/band and POP Velocities which spanned across a slightly negative and a positive range which were modest when compared with their early development and re-growth counterparts. Due to its highly developed resilience capacity, **Mature** city structures had the largest amplitude range for Household Resilience and typically recorded POP Velocities in a wider but generally positive range. In contrast, **Obsolescence – Decline** city structures were again relegated to the bottom left hand side of the chart due to POP Velocities that spanned both negative and positive territory and Household Resiliencies that typically settled in the negative range.

Points of Confluence: POP Velocity vs Employment Resilience : 1980-2012



Note: For Bangalore & Mumbai, the UN City POP Velocities were substituted for OE State Pop Velocities on the x-axis

Source: Oxford Economics & United Nations

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Figure 7.8: Points of Confluence: POP Velocity vs Employment Resilience

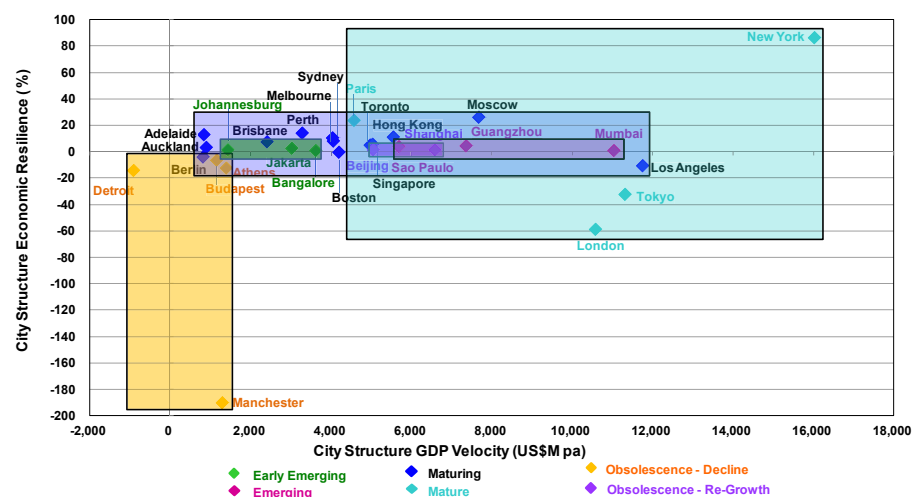
What was interesting in the Points of Confluence graph **POP Velocity versus Employment Resilience** (Figure 7.8) was that whilst the relative positioning of the **Maturing**, **Early Emerging**, **Emerging** and **Obsolescence- Re-Growth** categories essentially remained unchanged, the **Mature** and **Obsolescence- Decline** categories swapped ends along the y-axis. This could be attributed to **Obsolescence - Decline** cities having to more frequently (and therefore become better equipped to) cope with adverse employment conditions during tough economic times. Whilst **Mature** cities such as Paris, Tokyo and New York broadly kept within a +/- 500% Employment Resilience bandwidth, London recorded an

extraordinarily low Employment Resilience of negative 4,720%. A significant part of this was attributed to the fallout from the spate of 1992 Terrorist attacks previously discussed.

7.4.2.1 *Economic, Household and Employment Resilience versus GDP Velocity*

In this set of Points of Confluence charts, the three types of Resilience are compared against GDP Velocity (Oxford Economics 2013; United Nations Department of Economic and Social Affairs 2011a). Refer to **Figures 7.9 – 7.11**.

Points of Confluence: GDP Velocity vs Economic Resilience : 1980-2012



Source: Oxford Economics

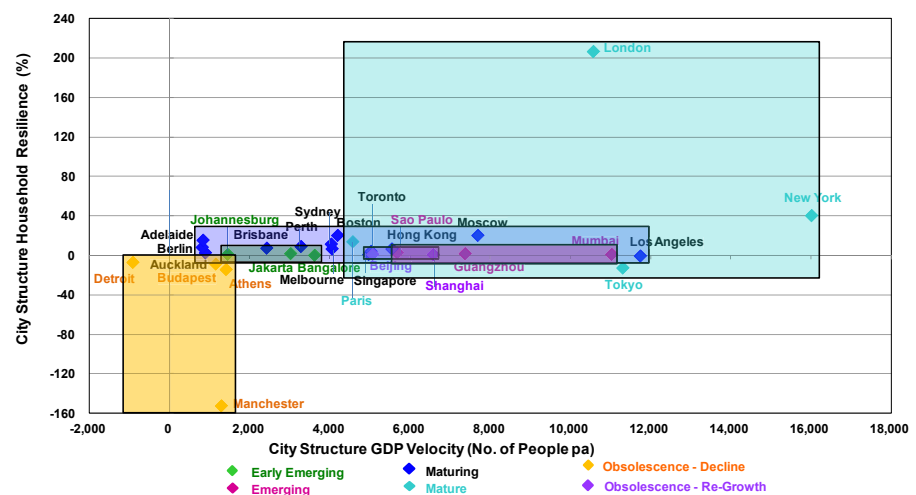
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Figure 7.9: Points of Confluence: GDP Velocity vs Economic Resilience

These three charts also demonstrate a similar trend when compared to the Points of Confluence charts using POP velocity. On the extreme left, the **Obsolescence-Decline** city structure category tends to reside with negative Economic and Household Resilience ranges and a negative to positive range for Employment Resilience but all three charts indicate this category overall has the lowest GDP velocities due to their poor economic state. **Early Emerging**, **Emerging** and **Obsolescence-Re-Growth** city structure categories recorded Economic, Household and Employment Resiliencies within

the narrowest bands and their respective GDP Velocities were spread out over a wide area. The **Maturing** city structure category tended to operate across a comparatively wider Resilience amplitude and spanned a GDP Velocity range wider than the combined ranges of the Early Emerging, Emerging and Obsolescence-Re-Growth city structure categories. Whilst the **Mature** city structure category showed the greatest resilience capacity – this was indicated by the widest resilience amplitude range of all development stage categories. Due to more mature markets, established infrastructure and greater investment confidence and regulatory transparency, the Mature development stage category tended to demonstrate a higher and wider range of productive capacity with typically the highest GDP velocities.

Points of Confluence: GDP Velocity vs Household Resilience : 1980-2012

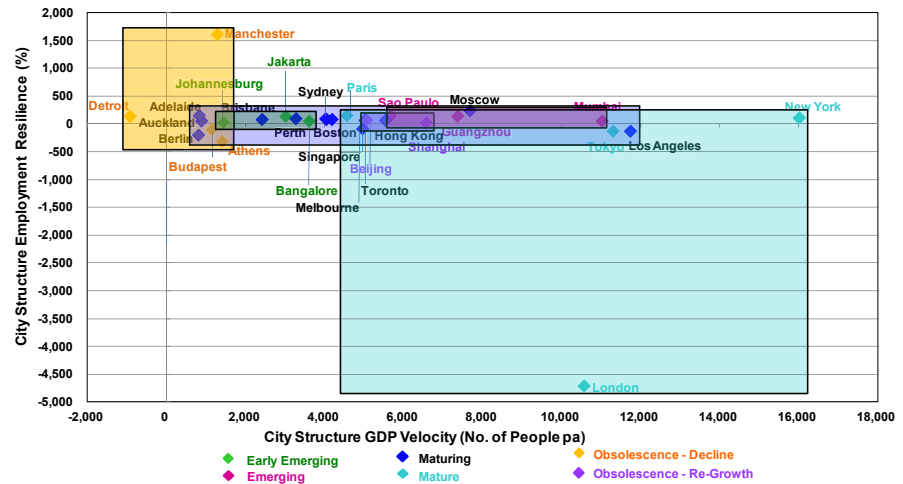


Source: Oxford Economics

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Figure 7.10: Points of Confluence: GDP Velocity vs Household Resilience

Points of Confluence: GDP Velocity vs Employment Resilience : 1980-2012



Source: Oxford Economics

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Figure 7.11: Points of Confluence: GDP Velocity vs Employment Resilience

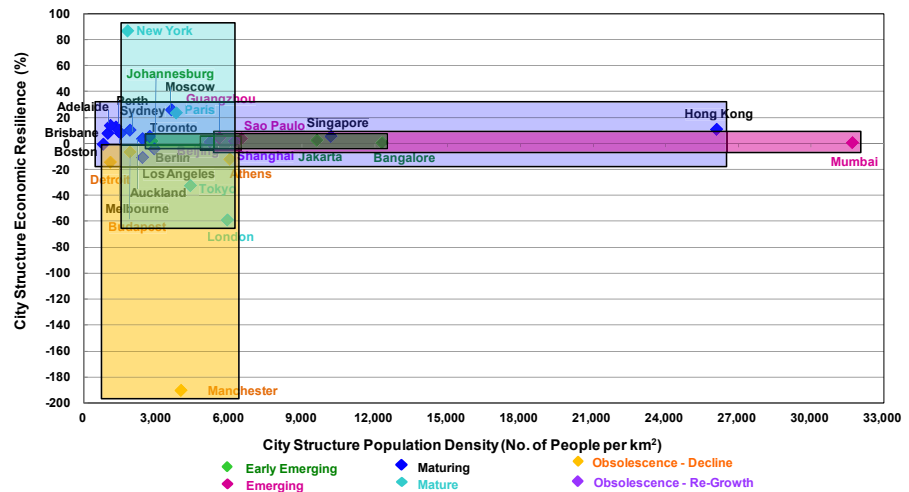
7.4.2.2 Economic, Household and Employment Resilience versus City Population Density

In the final set of Points of Confluence charts, the three types of Resilience are examined with respect to City Population Density (Oxford Economics 2013) – refer to **Figures 7.12 – 7.14**. Whilst City population Density has been selected as a Critical Indicator, it will be discussed in **Chapter 8 Proof of Concept: Compositional Aspects of City Population**.

Again these three charts exhibit the same resilience trend characteristics as the previous six charts, however what is interesting is in the Mature and Obsolescence-Decline categories, the cities that are more densely populated (London, Manchester and Athens) had a greater tendency for their respective historical average Economic, Household and Employment Resilience to steer into the negative resilience territory.

The two exceptions were where London exhibited positive Household Resilience (refer to **Figure 7.13: Points of Confluence: POP Density vs Household Resilience**) and Manchester exhibited positive Employment Resilience (refer to **Figure 7.14: Points of Confluence: POP Density vs Employment Resilience**).

Points of Confluence: POP Density vs Economic Resilience : 1980-2012

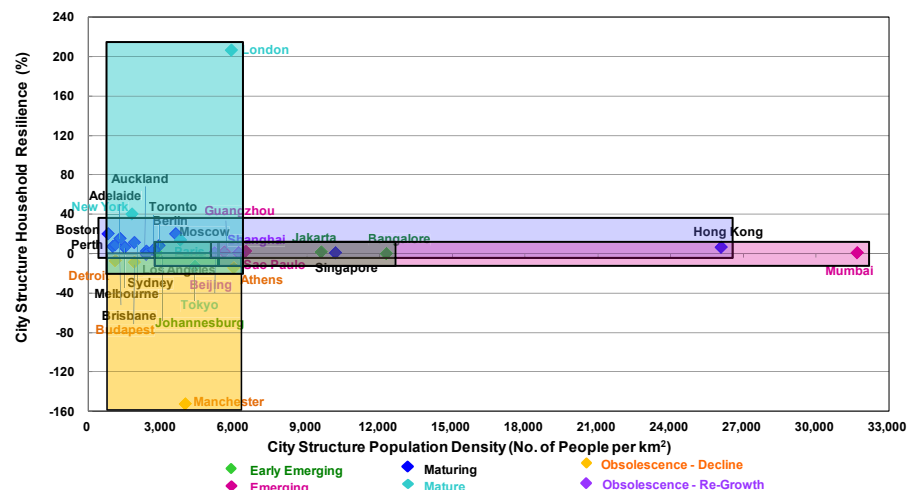


Note: Demographia POP Densities as at 2013
Source: Oxford Economics & Demographia

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Figure 7.12: Points of Confluence: POP Density vs Economic Resilience

Points of Confluence: POP Density vs Household Resilience : 1980-2012

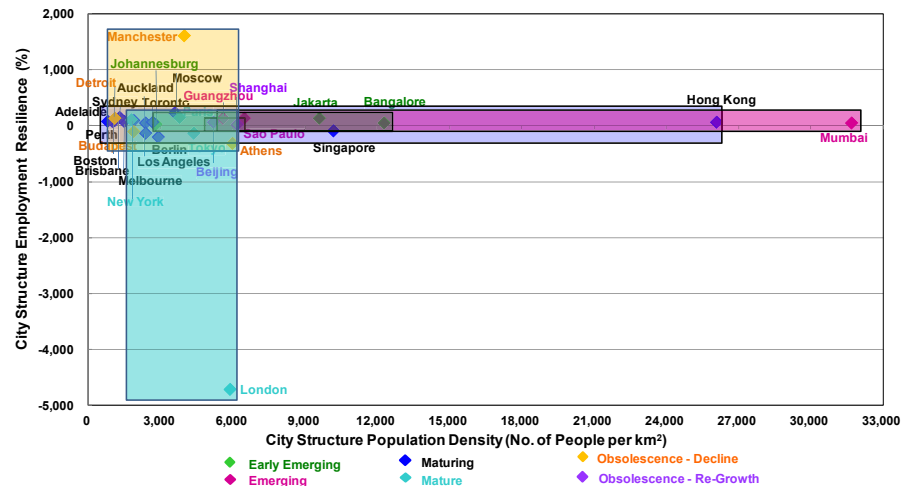


Note: Demographia POP Densities as at 2013
Source: Oxford Economics & Demographia

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Figure 7.13: Points of Confluence: POP Density vs Household Resilience

Points of Confluence: POP Density vs Employment Resilience : 1980-2012



Note: Demographia POP Densities as at 2013
Source: Oxford Economics & Demographia

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Figure 7.14: Points of Confluence: POP Density vs Employment Resilience

It has been previously noted that the Terrorist attacks that took place in London and Manchester adversely affected the historical averages for POP and GDP Velocities with knock on effects for Economic, Household and Employment Resiliencies. However there may be further underlying structural factors that may have orchestrated the extreme positions/ranking they have taken within their respective development stage category.

One plausible explanation could be the way in which these cities share their economic, household and employment wealth – not just in financial terms but also the way their functional networks develop and distribute all forms of capital e.g. financial/investment capital; labour/workforce skills and training; knowledge and technology generation and exchange; intellectual capital and innovation development; infrastructure provisioning across all parts of the city and its wider reach into inner city areas and other key metropolitan/regional markets.

Global cities, by their industrial and occupational structure and with their disproportionate share of finance and business services and transnational corporate headquarters, tend to produce a bifurcated earnings structure which in turn creates greater extremes of inequality (Sassen 2001). In her book chapter “*Inequality in Global City-Regions*”, Susan Fainstein undertook a review of five city regions

and the reasons underpinning their income inequality (Scott 2001: Susan Fainstein's Chapter 15 "*Inequality in Global City-Regions*": 285-298). Fainstein advocated the primary cause of growing inequality could be attributed to extremely large increases in individual earnings and household incomes within the small top percent. Whilst New York, London, Tokyo and Ranstad all exhibited significant income inequality, the reasons for the result varied and it was noted that London underwent a significant increase in income inequality in 1979-1993 as a result of increases in earnings at the top as opposed to a loss of income at the lower income end of the spectrum. Furthermore whilst on the surface London and New York may strongly resemble each other, the social composition is markedly different – New York has a population with a wide range of racial and ethnic minorities whilst London was noted as having a greater component of white collar professionals or knowledge workers in its labour force (Scott 2001: Susan Fainstein's Chapter 15 "*Inequality in Global City-Regions*": 285-298).

As a further extension of this investigation into income inequality, certain measures were identified that track this and are termed "*Gini Coefficients of Income Distributions*". According to Wikipedia, Gini Coefficient or Index on Disposable Income is calculated on a net income and measures income inequality within a country (Wikipedia 2013j).

Gini Index – Income Disparity since World War II

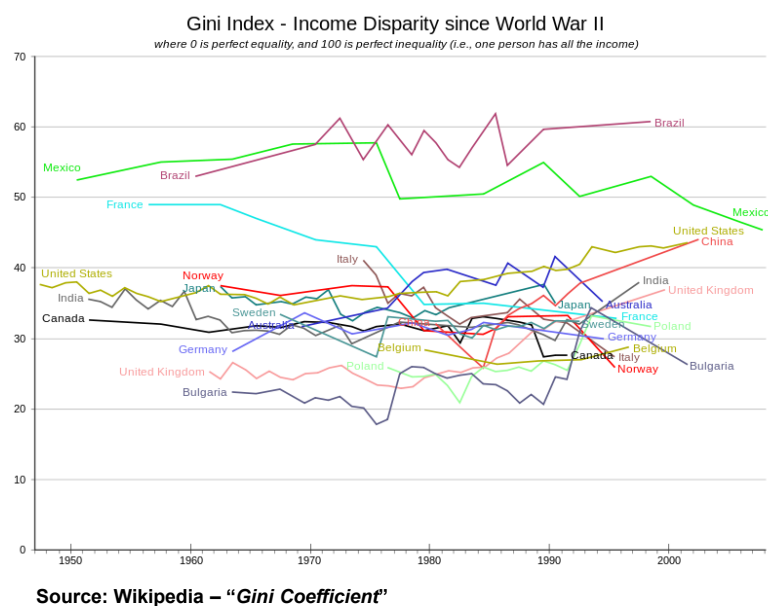


Figure 7.15: Gini Index – Income Disparity since World War II

The chart above (**Figure 7.15: Gini Index – Income Disparity since World War II**) compares the income disparity of a range of countries where a Gini Index of zero equates to perfect income equality and a Gini Index of 100 equates to total inequality i.e. one person holds all the income or wealth. From the chart, countries that have closed the gap on income disparity/inequality include Mexico, France, Japan and Canada. Whilst the USA and UK continue to have increasing levels of income disparity, emerging high economic growth countries such as China and India have recorded comparatively higher rates of growth in income disparity.

Whilst a detailed analysis of how the key and cross reference cities share develop/accumulate and share their capital; how income inequality and their analytics play out at a city level are beyond the scope of this research, it would certainly be worthwhile investigating this issue as a follow up for future research.

7.5 Chapter Conclusion

Chapter 7 City Structure Development Stages and Points of Confluence is the third proof of concept chapter (chapters 5-8). The chapter constructs a methodology that expands the “evaluative toolkit” for examining the results from the previous chapters in terms of development performance trends, common characteristics and the impacts of city structure development across the wider sample of 29 key and cross reference cities.

The knowledge gained from this chapter provides the following useful insights:

- Historical average data tables and charts for the 29 cities with respect to POP and GDP Velocities as well as Economic, Household and Employment Resiliencies;
- Indicative ranges for POP and GDP Velocities and Economic, Household and Employment Resiliencies by development stage classification (Early Emerging, Emerging, Maturing (Early and Established), Mature, Obsolescence-Delay and Obsolescence-Re-Growth);
- Signature characteristics typically held true for each of the six key development stage categories evaluated against the key and cross reference cities;

- Whilst the historical average data and indicative ranges are instructive, these indicators could not individually and categorically locate the cities in their development stages – this was particularly the case for the three types of resiliencies given their wide amplitude ranges. Subsequently this required the “evaluative toolkit” to be further developed – points of confluence graphs were constructed which simultaneously compared two variables for the 29 cities to identify where there was common ground for each development stage category.
- Collectively these insights build on the understanding of how city structures evolve and the development stages they transition through.

Chapter 8

Proof of Concept: Compositional Aspects of City Structure Population



Sydney CBD Western Corridor Precinct and Darling Harbour

Source: Kyle Willimott

“A great city is not to be confounded with a populous one.”

(Aristotle, Greek philosopher, 384BC - 322BC)

8 Proof of Concept: Compositional Aspects of City Structure Population

8.1 Chapter Outline

In **Chapter 3 Methodology and Data Collection**, the research design, methodological approach and key considerations regarding data treatment were discussed. **Chapters 5-7** comprised the three stages of Analysis A: City Structure Development Performance Trajectory Analysis. **Chapter 8 Proof of Concept: Compositional Aspects of City Structure Population** constitutes Analysis B (**Appendix 1 Key Reference Charts – Research Design: Conceptual Framework**). The chapter commences with a discussion on the process undertaken for the analysis and the key considerations with respect to the assumptions and limitations of the analysis. Significant trends, findings and the impacts on city structure development performance are evaluated in the results and analysis section.

8.2 Process

Analysis B: Compositional Aspects of City Structure Population supplements the work previously undertaken in Analysis A by examining the fundamental make-up of a City Structure Population to further understand changes from within a city structure's population that impact its productivity, capacity and resilience. Analysis B also builds on the development performance trajectory outcomes from Analysis A in order to benchmark future development performance.

Analysis B comprises three stages:

- Compositional Indicators;
- Network Structure;
- Development Performance Trajectory Benchmarking.

The process for each of these stages is discussed in the following sub-sections.

8.2.1 Compositional Indicators

As discussed in section **5.2 Process**, the 25 critical indicators were assessed and categorised according to the outcomes required for further evaluation in either Analysis A: City Structure Development Performance Trajectory Analysis or Analysis B: Compositional Aspects of City Structure Population. Refer to **Appendix 1 Key Reference Charts – Research Design: Conceptual Framework** and City Structure Indicator Pathways and Application charts.

Out of the 25 critical indicators, the final 11 indicators were selected for use in Analysis B (refer to **Figure 5.1: City Structure Indicator Pathways & Application**). On the basis of the length of the historical series, these indicators were classified as either longitudinal indicators (i.e. 15 years or more of historical data) or cross sectional indicators (less than 15 years of historical data).

Compositional indicators that were identified as longitudinal indicators are:

- Prison Population Rate (No. per 100,000 Inhabitants);
- Net Migration (No. of People per annum);
- Total Dependency Ratio (per 100 People aged 19-64 years);
- Completed Tertiary Educational Attainment (% of Total);
- Hospital Beds (per 1,000 People);
- Energy Use (Kg of oil equivalent per capita); and
- Carbon Dioxide Emissions (Metric Tons of CO₂ per capita).

Compositional indicators that were identified as cross sectional indicators are:

- City Office Occupancy Costs (US\$ / Sq ft per annum); and
- Revenue Multiplier(Sq ft / Person);
- Population Density (No. of People / km²);
- Motor Vehicles (per 1,000 People).

For the purposes of examining changes more broadly from within a city structure's population, this analysis was not broken into longitudinal and cross sectional analyses as in Chapter 5.

In Chapter 3, the methodology for selecting the indicators, data treatment, key assumptions and limitations were discussed and still apply to the compositional indicators analysis. Once the indicator data was reviewed, graphs were constructed from the datasets to examine trends and ascertain key implications for the development performance of the six key city structures.

The underlying trends, their associated reasons and the relevance of these indicators to city structure development performance and in particular the composition of city population are discussed in section **8.4 Results and Analysis: Outcomes for Key Cities**.

8.2.2 Network Structure

The purpose of the Network Structure analysis was to briefly identify the primary industries and key industry clusters within each of the key cities – a key compositional aspect of city structure population. This overview was presented in a series of tables for each city – refer to **Appendix 5: Key Cities Overview**.

Where data availability permitted, the overview analysis identified the key factors contributing to city structure development trends; major macro events and specific events; impact of recent government planning and investment/economic policies and decisions; primary industry clusters and associated major companies; network interactions & other considerations. Information used to compile the Overview Tables was acknowledged at the bottom of each table in **Appendix 5**.

Network structures were examined with respect to the importance of hierarchies, markets and networks; developing the network structure and before examining the network structures of the key cities. An indicative comparison of metrics for intelligent cities (based on the research undertaken by Nicos Komninos (2008)) was also made with equivalent indicators in the City Structure Universal Indicator Matrix.

8.2.3 Development Performance Trajectory Benchmarking

The purpose of Development Performance Trajectory Benchmarking is to gauge the future performance of key city structures using the evaluative framework and tools developed in Analyses A and B.

This was achieved by evaluating the projected performance i.e. 13 year forecasted averages (2013-2025, the forecast range for the datasets provided by Oxford Economics) and comparing this to the benchmark 33 year historical average (1980-2012, the historical range for the datasets provided by Oxford Economics) equilibrium points. This comparative approach was applied to the Derived Trajectory Indicators – in particular the POP, GDP, HDI and EMP Velocities as well as Economic, Household and Employment Resiliencies.

The key comparative results (POP and GDP Velocities and Economic Resilience) along with other relevant reference data (city structure population magnitude and density) were then tabled to facilitate ease of comparison between the six key cities.

8.3 Key Assumptions and Limitations

The definitions and reasons for the Critical Indicator selection were discussed previously and are tabled in **Appendix 3: City Structure Critical Indicator Matrix**.

8.3.1 Key Cities Overview

A brief overview of the historical evaluation of the key cities was examined and tabled in **Appendix 5: Key Cities Overview**. This material should be read in conjunction with this chapter's analyses.

8.3.2 Key Assumptions

In undertaking the Compositional Aspects of City Structure Population analysis, the same key assumptions discussed in **5.3.2 Key Assumptions** apply with regards to taking into account Major Events and Structural Changes when evaluating development trends.

In addition to the above assumptions, the following key assumptions are also acknowledged:

- Based on data availability, two Critical Indicators (**City Occupancy Costs** and **Revenue Multiplier**) only extend 6 years (2008-2013) and partly straddle the GFC (2007-2009). The remaining nine of the eleven Critical Indicators extend between 9-63 years and are assumed to cover recent events, some structural changes as well as several business/economic cycles to varying extents according to the respective timeframes.
- In utilising the projections/forecasts provided by United Nations and Oxford Economics, the analysis also assumes their assumptions associated with growth assumptions (typically were based on medium growth case scenarios) and model forecasting methodologies.
- In assessing longer development trajectories, future performance can be benchmarked against historical performance and provide a better understanding of the impact of future macro/global events on a city structure's future development performance. Whilst the actual events and structural changes will differ, what can be usefully determined is the city structure's response to these past events and structural changes of varying scopes/magnitude to better gauge how city structures may respond to similar events/structural changes in the future.

8.3.3 Key Limitations

In undertaking the Compositional Aspects of City Structure Population analysis, the same key limitations discussed in **5.3.3 Key Limitations** apply with regards to taking into account the analysis of cross sectional and longitudinal Critical Indicators as snapshots of the state of the economy or city population at particular points or between points in time. Both types of indicator analyses are valid in providing useful insights into how city structures evolve.

In addition to the above assumptions, the following key limitations are also acknowledged:

- Based on the data available and in light of the cross sectional and longitudinal Critical Indicators used for this analysis, the timeframe varies from examining data trends from 6 years (2008-2013: **City Occupancy Costs** and **Revenue Multiplier**) to 63 years (1950-2013: **Total Dependency Ratio**) historically and in two instances provides forecasts for a further seven years (2014-2020: **Total Dependency Ratio** and **Completed Tertiary Educational Attainment**). In the case of the **Revenue Multiplier** and **City Population Density**, both overall development trends were studied in addition to a wider city comparison based on 2013 data.
- In utilising the projections/forecasts provided by United Nations and Oxford Economics, the analysis also assumes their limitations associated with growth assumptions (typically were based on medium growth case scenarios) and model forecasting methodologies.
- For the critical indicators “**City Office Occupancy Costs**” and the “**Revenue Multiplier**” (which uses “City Office Occupancy Costs” in its calculation), the following assumptions and limitations should be noted. The Candidate was directly advised by Dr Ray Torto, (Global Chief Economist, Global Research and Consulting, CBRE (Leong Glastris 2011)) that the research report methodology was revised in 2011 and that no 2011 data was available. Given data is being primarily compared against other cities at certain points in time, the changes to methodology were not considered substantially critical, subsequently a mathematical average of 2010 & 2012 data was taken to provide an approximate 2011 data point for each key and cross reference city. In addition CBRE stopped covering Detroit in the Global Market View Office Occupancy Costs research publication in 2011-2013, therefore the Candidate has used Detroit CBD asking

rent (US\$18.14 per sq ft pa) in "*CBRE Detroit Office MarketView Q2 2013*" for the 2013 data point and interpolated back for approximate 2011 & 2012 data points to known 2010 data (US\$20.64 per sq ft pa) from "*CBRE Prime Office Occupancy Costs 2010*" report (CB Richard Ellis (CBRE) Global Research and Consulting 2008, 2009, 2010, 2012, 2013a, 2013b).

- Using equilibrium points or historical averages over a short timeframe can change dramatically, however over a longer timeframe of 30-60 plus years, the historical averages do not move substantially. That said, the implications for using historical averages to benchmark future performance through forecasted averages is that the type, magnitude and range of future events and structural changes that will occur in the future have been typically identified and evaluated based on the type, magnitude and range of historical events and structural changes.

There will always be unexpected and unplanned occurrences or risks that will take place in a city structure's evolution. However part of any Key Protagonist's good risk management strategy is to identify and evaluate those risks (i.e. event and structural changes) and market dynamics. One of the key outcomes of this thesis research is to develop an evaluative framework and tools for assessing the key drivers of city structure development performance and how a range of factors/parameters impact its development performance. In doing so, an evaluation platform or premise can be established for further investigations and analysis.

Once the premise has been established, Key Protagonists can then decide whether to 1) Accept the consequences of the risk; 2) Develop a mitigation strategy to either reduce the likelihood of the risk occurring and its consequences; and/or 3) Eliminate the threat by eradicating the risk (Australian College of Project Management 2013).

8.4 Results and Analysis: Outcomes for Key Cities

This section is divided into three parts:

- Compositional Indicators;
- Network Structure; and
- Development Performance Trajectory Benchmarking.

Both **Appendix 1: Key Reference Charts – City Structure Indicator Pathways and Application** and **Appendix 3: City Structure Critical Indicator Matrix** should be used as references to

track the indicators and as a source for definitions and reasons for indicator selection.

8.4.1 Compositional Indicators

The underlying trends, their associated reasons and the relevance of these indicators to city structure development performance and in particular city population composition are discussed in the following sub sections.

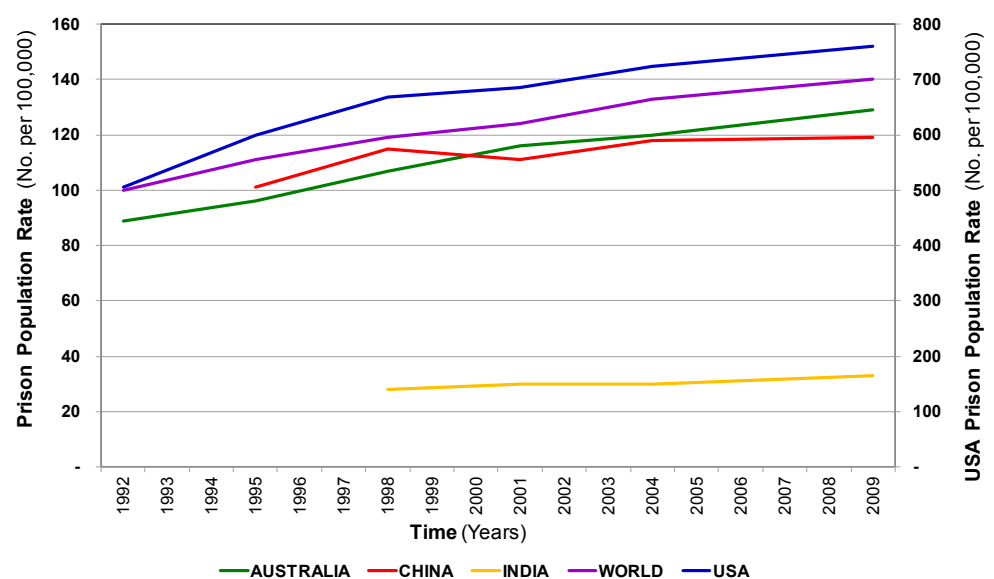
8.4.1.1 Prison Population Rate

a) Data Explanation

The Prison Population Rate (No. per 100,000 Inhabitants) measures a country's number of prisoners as a proportion of the total population. It is one indicator of a country's level of crime and state of lawlessness based on incarceration rates.

Figure 8.1 charts the Prison Population Rates for the countries the key cities are located in (OECD 2010, 2011, 2012). The right hand side of the graph plots the scale for the USA Prison Population Rate whilst the left hand side scale plots the Prison Population Rates for India, China and Australia. The average Prison Population for the World is also plotted using the left hand side scale.

Governance: Prison Population Rate



Source: Organisation for Economic Co-operation and Development (OECD)

Figure 8.1: Prison Population Rate

However it should be noted with this indicator that a low prison population rate does not necessarily equate to lower levels of crime, corruption and lawlessness. This is because the country may be under resourced to monitor, apprehend and incarcerate criminals – this is particularly the case for developing countries where the cities are heavily over populated and the government departments (e.g. police, judicial and prison systems) are under resourced to cope and bring criminals to justice. Furthermore, the restricted level of political and religious democratic freedom exercised within a country also impacts the incarceration, civil unrest and/or lawlessness levels e.g. in some countries, people can be unfairly/unreasonably imprisoned as a political activist simply for publicly expressing their personal views and/or criticisms of the current political/government regimes.

According to the OECD, India's prison population rate is one of the lowest recorded – in 2009 there were 33 people imprisoned for every 100,000 in the total population. This incarceration rate was lower than other low range prison population rate countries such as Indonesia (58 prisoners) and Japan (63 prisoners). However in a 2012 report "*Crime in India: 2011 Statistics*" published by India's National Crime Records Bureau (Government of India - National Crime Records Bureau 2012), the incidence of Total Cognizable Crimes (TCCs) in 2006 - 2011 across all Indian cities rose by 45.7% where Bangalore (Bengaluru) TCCs rose by 15.2% to 30,283 crimes and Mumbai TCCs rose by 5.1% to 32,647 crimes and were accorded criminality ranks in 2011 of respectively 17 and 44. The highest rank of criminality (i.e. highest crime rate) city of 1 was in the city of Kochi compared to the Calcutta (Kolkata) the city with the lowest rank of criminality (i.e. lowest crime rate) of 53 (Government of India - National Crime Records Bureau 2012).

As at 2009, both China and Australia recorded prison population rates in the mid range at respectively 119 and 129 prisoners per 100,000 of total population. In comparison to other mid range prison population rate countries, these China and Australia's rates were higher than France (96 prisoners), Greece (109 prisoners) and Canada (116 prisoners) but were lower than the World average (140 prisoners), UK (153 prisoners) and New Zealand (195 prisoners).

In 2009, the USA recorded one of the highest prison population rates at 760 prisoners per 100,000 of total population. This exceeded other high range prison population rate countries such as Israel (325 prisoners) and Russia (624 prisoners). According to the US Department of Justice in 2011, the prison population rate had declined to 492 sentenced prisoners for every 100,000 inhabitants in

the US where 48% were incarcerated for drug offences compared to 35% who were incarcerated for public order crimes (Carson & Sabol 2012). According to the Federal Bureau of Investigation's latest "*Crime in the United States 2012*" statistics in 1993-2012, the volume of violent crimes has declined by 36.9% from 1.9M to 1.2M violent crimes or from a violent crime rate of 747.1 to 386.9 violent crimes perpetrated for every 100,000 inhabitants (Federal Bureau of Investigation (FBI) 2012c). According to the FBI's 2012 statistics of US cities with a population over 200,000 inhabitants, Detroit City has one of the highest violent crime rates at a rate of 2,122.9 incarcerated for every 100,000 inhabitants (Federal Bureau of Investigation (FBI) 2012a). In contrast, since 1990 the city of New York has recorded a significant decline in its overall crime rate and as at 2012 New York City's violent crime rate was 639.3 incarcerated per 100,000 inhabitants (Federal Bureau of Investigation (FBI) 2012b).

b) Implications

Whilst it is acknowledged that a low prison population rate does not necessarily imply a lower level of crime and lawlessness, this Critical Indicator does provide a good general indication of rates of crime and incarceration. The Governance indicator also reflects the leadership vision accorded to crime and its prevention as well as the level of incarceration services required. It also reflects a country's collective values on dealing with crime in relation to other key priorities and governance and social trade-offs (i.e. money spent on crime and crime prevention that could be otherwise directed at health or education, etc).

In monitoring, apprehending, incarcerating criminals and also implementing crime prevention programs, the indicator also reflects the operational effectiveness and resourcing available to its law enforcement agencies, policy and other stakeholders within the criminal justice system.

Low/lower prison population rates do send a signal to the investment, business and residential communities. Areas of low crime rate incidence are seen as safer and more attractive places to live, work and conduct business. This impacts on safety and amenity but also enhances its social and cultural vitality as a 24 hour city. Consequently low crime rate incidence promotes development of stronger, safer networks of functional activities and more attractive places within a city structure. This in turn increases a city structure's investment attractiveness, economic productivity, cultural and social vitality.

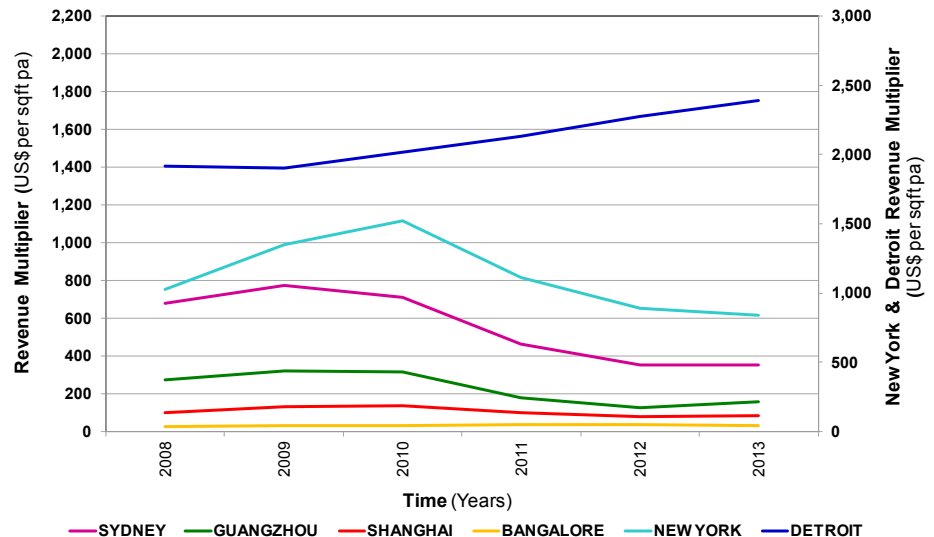
8.4.1.2 *Revenue Multiplier*

a) Data Explanation

The Economic Revenue Multiplier (Sq ft / Person) was devised as a calculation to measure the value in a city structure's economic productivity relative to the office occupancy costs i.e. is it worthwhile locating an office executive in a particular city given the expected GDP output. Assumptions and limitations associated with interpolating/calculating the Total Office Occupancy Cost and Revenue Multiplier were discussed in this chapter's Key Limitations section. The Revenue Multiplier can be regarded as an indicator of the cost of doing business globally. In its calculation, it uses another Critical Indicator that will be discussed later in this section, Total Office Occupancy Costs. As stipulated in **Appendix 3: City Structure Critical Indicator Matrix**, the Revenue Multiplier is calculated by dividing City GDP per Capita (Oxford Economics 2013) by City Total Office Occupancy Costs (CB Richard Ellis (CBRE) Global Research and Consulting 2008, 2009, 2010, 2012, 2013a, 2013b).

Two graphs were constructed using the Revenue Multiplier as an indicator. The first graph (**Figure 8.2: Revenue Multiplier**) provides a cross sectional analysis over a short six-year time frame based on available Total Office Occupancy Costs data from CBRE. What it indicates is that ideally if all factors across the key cities are equal except for City GDP and Office Occupancy, locating an executive in a Detroit office would give a prospective employer/company the "biggest return for their dollar". This is because whilst economic productivity in GDP per Capita is comparatively high/higher in Detroit, New York and Sydney, Detroit's total office occupancy rents are the lowest of the key cities and have not increased substantially in recent years.

Economic: Revenue Multiplier



Source: Oxford Economics &
CB Richard Ellis (CBRE)

Research, Methodology & Analysis Developed By: Leong Glastris

Figure 8.2: Revenue Multiplier

With the exception of Detroit and Bangalore, all other key cities recorded an overall decline in their respective revenue multiplier in 2008-2013. Revenue multipliers (Sq ft / Person) for the key cities currently stand at: Detroit (2,392); New York (841); Sydney (353); Guangzhou (159); Shanghai (82) and Bangalore (34).

The second graph (**Figure 8.3: Revenue Multiplier – GDP per Capita versus Total Office Occupancy Costs**) provides a comparative analysis of key and cross reference cities at a single point in time (2013) with respect to the calculation components for Revenue Multiplier – GDP per Capita and Total Office Occupancy Costs. Each development stage category cluster of cities is enclosed by a box to identify common characteristics.

Economic: Revenue Multiplier – 2013 GDP per Capita vs Total Office Occupancy Costs

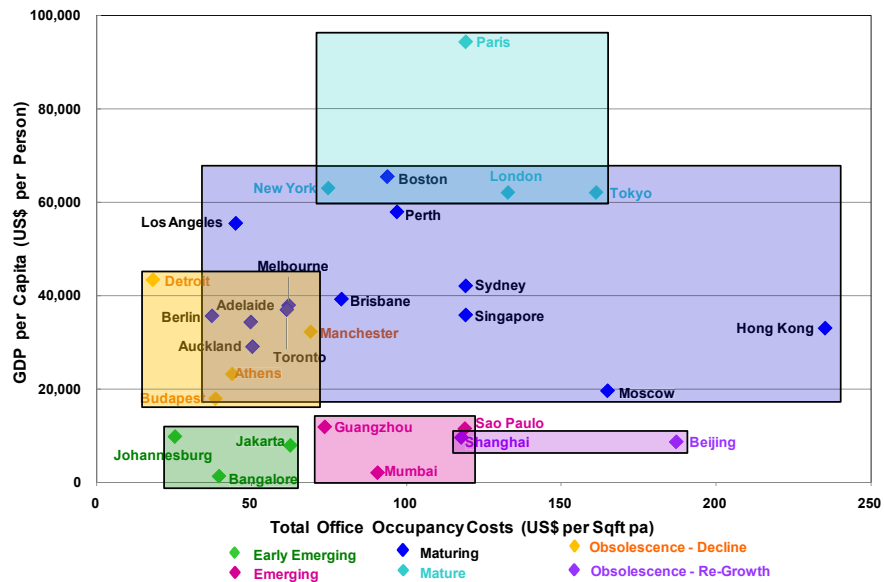


Figure 8.3: Revenue Multiplier – GDP per Capita versus Total Office Occupancy Costs

The chart can be broadly desegregated into four horizontal striations. The first striation comprises Early Emerging, Emerging and Obsolescence-Re-Growth cities with the lowest level of GDP per capita and the second widest range of Total Office Occupancy Costs (25 to 187 US\$ / Sq ft pa). The second striation comprises Obsolescence-Decline cities with a higher level of GDP per capita but Total Office Occupancy Costs contained at the lower end of the spectrum (18 to 69 US\$ / Sq ft pa). The third striation comprises Maturing cities which has some cross over with the Obsolescence-Decline cities and Mature cities. Generally for the Maturing cities striation, the GDP per Capita ranges from 19,503 to 65,40 US\$/person and has the widest range of Total Office Occupancy Costs (37 to 235 US\$ / Sq ft pa) The fourth striation comprises the Mature cities which as a group have the highest level of GDP per capita and a narrower range of Total Office Occupancy Costs.

What is interesting to note is Mature cities with comparatively higher levels of GDP per capita do not necessarily command the highest total office occupancy rents. This can be attributed to a wider selection of prime and secondary quality office stock where rising land values place upward pressure on obsolete stock to be

refurbished to increase rental returns and capital values. This in turn keeps the city's market office rents competitive where demand to stay in a global city location is high and rental incentives are frequently offered to attract major tenants for a short-medium lease term.

Mature cities have learnt to keep a reasonable rein on office supply and demand dynamics to ensure the development mistakes of the 1980s/1990s are not repeated and that supply projects i.e. timing and the quantum of delivery of new and refurbished stock are more in tandem with demand i.e. tenant pre-commitment levels, net absorption and total vacancy rates. Banks financing these development projects have been helpful in this respect by imposing stricter loan covenants such as loan to value ratios and minimum tenant pre-commitment levels before a proposed development receives funding approval and can commence construction.

b) Implications

The Revenue Multiplier provides a useful way to compare the cost of a transnational company conducting business globally. It provides a measure of economic productivity (GDP per capita) relative to the total office cost of locating in a particular city. It should be regarded as a rough rule of thumb guide as to whether it is worthwhile locating an executive in a particular city.

This impacts the development performance of cities because as mentioned, mature cities have developed a greater ability to keep market supply and demand dynamics in relative check. The Revenue Multiplier and its constituent components reflect an economic and urban development premium, worker productivity as well as the investment/business attractiveness of the city, level of infrastructure support provided as well as the supply-demand dynamics of the market. This also impacts the development of associated retail, residential, hotels and leisure, industrial and other supporting markets that rely on a city's catchment of workers, residents and visitors to sustain a strong level of economic, cultural and social activity. Consequently the Revenue Multiplier also embodies economic opportunities (e.g. diverse range of higher paying employment opportunities) and social collective values and urban concepts. The last two factors include the desire for workers, residents and visitors to locate to/visit a city with an attractive urban lifestyle e.g. good access to entertainment, leisure and cultural facilities and activities, affordable housing, proximity to good social and transport infrastructure and amenities e.g. shopping centres, schools, universities, hospitals and public transport, etc.

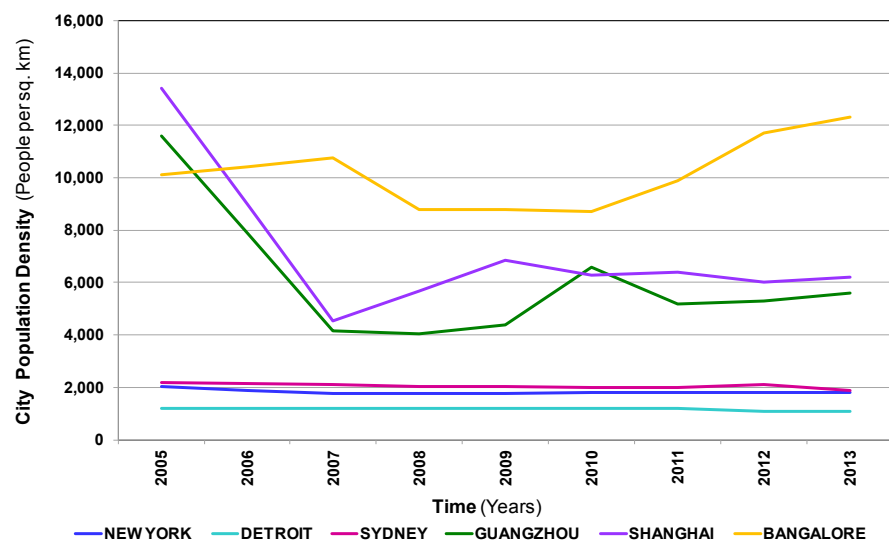
8.4.1.3 Population Density

a) Data Explanation

Population Density (No. of People / km²) measures how intensely inhabitants within a city are living together and is expressed as the number of city inhabitants divided by the city's land area.

Two graphs were constructed using City Population Density as an indicator. The first graph (**Figure 8.4: City Population Density Trends**) provides a cross sectional analysis over a nine-year time frame based on available data from Demographia (Demographia 2005, 2007, 2009, 2010, 2011, 2012, 2013a, 2013b).

Social: City Population Density Trends



Source: Demographia

Figure 8.4: City Population Density Trends

Bangalore (Early Emerging), Guangzhou (Early Emerging) and Shanghai (Obsolescence-Re-Growth) exhibited the greatest level of volatility in population density and the highest population densities in 2005-2013. Bangalore's city population density took a temporary slump (when the GFC adversely affected its base of national and global companies in 2007-2010 and as some of the population leached out to other centres across India with improved intra-city transport) before rising to 12,300 people per km² in 2013. By way of comparison, Mumbai's city population density is the highest of all the key and cross reference cities examined and currently stands at a staggering 31,700 people per km²; it eclipses Hong Kong's population density of 26,100 people per km².

Owing to Guangzhou's status as the main manufacturing hub of the Pearl River Delta and Shanghai's status as mainland China's key financial and commercial centre and a major international shipping port, both cities are regarded as instrumental in helping China achieve its Five Year Plan targets. One of the objectives set out in the Tenth Plan (2001-2005) was to raise urban employment levels by relocating surplus rural workers to the cities (Wikipedia 2013i) – this boosted city population densities in both Guangzhou (11,600 people per km²) and Shanghai (13,400 people per km²) in 2005. However as the Eleventh Guideline (2006-2010) and the Twelfth Plan (2011-2015) came into implementation, there was an emphasis on also developing small cities. The decline in Guangzhou and Shanghai's population densities could be attributed to some of the residents and workers in these cities opting to relocate to find better employment opportunities or they offered enticements to relocate to these new/developing cities. Whilst the Twelfth Plan has identified five central cities (where Guangzhou and Shanghai are included), it also identified a further six "regional central cities" and twenty urban centres for future growth (Miller 2012). It is anticipated that whilst city population growth and population densities will continue to rise in Guangzhou and Shanghai, it will not be at a highly accelerated rate (circa 2005) as there will also be a focus on building the smaller city clusters around the central cities. So far this has been borne out with a more moderate pace of population density growth in both Guangzhou and Shanghai post 2011. As at 2013, population densities stood at 5,600 people per km² in Guangzhou and 6,200 people per km² in Shanghai.

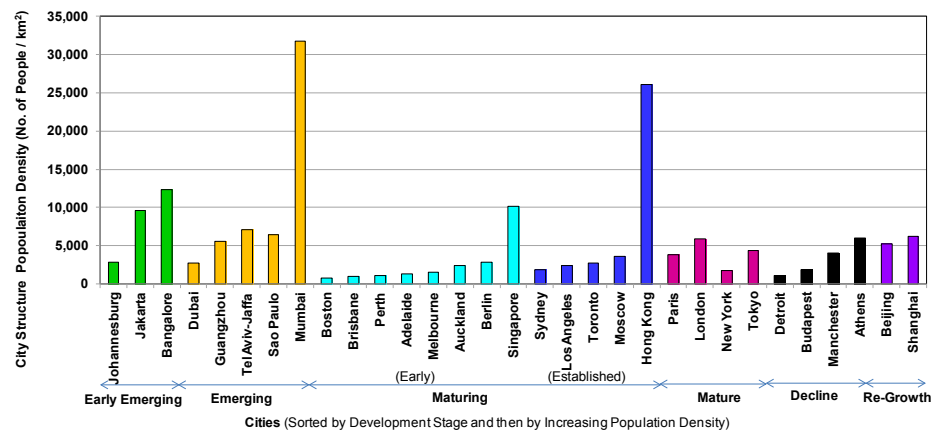
In contrast, population density trends over the 2005-2013 timeframe for Detroit, New York and Sydney were comparatively stable given their greater level of development maturity. These city population densities currently range at: Detroit 1,100 people per km², New York 1,800 people per km² and Sydney 1,900 people per km².

The second graph (**Figure 8.5: City Population Density Comparison 2013**) provides a cross sectional analysis at a current point in time and compares key and cross reference cities.

When grouped according to development stages, no particularly strong pattern emerged other than all of the cities with a high population density of 9,500 people per km² were either from Asia Pacific (Jakarta, Singapore and Hong Kong) or South Asian (Bangalore, Mumbai) countries. Only Mumbai is regarded as a Megacity by UN standards. It should also be noted there is a significant difference in the city population quoted for Jakarta by the

UN (9.97M) and Demographia (24.75M) which is attributed to the different geographic definition of the city that Demographia has used – this was also confirmed by Monsieur François Pelletier (Chief, Population Estimates and Projections Section United Nations Population Division (Leong Glastris 2013c)).

Social: City Population Density Comparison 2013



Note: City Population Densities as at 2013

Source: Demographia

Research Developed By: Leong Glastris

Figure 8.5: City Population Density Comparison 2013

What is also evident of the sample of Mature cities analysed, none of them had population density levels above 6,000 people per km² – London came the closest with 5,900 people per km². It is acknowledged that whilst outside the scope of this research, it would be interesting to investigate if there is a natural equilibrium point or equilibrium range in population densities for cities that transition into the Mature stage, particularly when they have attained Megacity status (e.g. New York and Tokyo).

b) Implications

City Population Density is a useful indicator because as was discussed with China's Five Year Plans, it can be used to examine a government's ability to provide a supportive regulatory framework for sustainable population growth and densities. Population densities also impact on the overall city population capacity, workforce composition, cultural and religious diversity, community and cultural identity as well as the health, education and other infrastructure support required to sustain higher population densities.

This directly impacts City Structure development performance because higher city population densities have a critical mass to attract further investment and economic opportunities and enable certain economies of scale to be achieved. Higher city population densities increase the concentration of resources, opportunities, functional activities and networks within the city and it increases the flow of information and knowledge transfer. Whilst a higher population density does not necessarily equate to a more efficient or highly developed city structure, it does increase the frequency with which people can access resources and opportunities; meet and develop relationships; and exchange/transfer both explicit and tacit knowledge. Higher density working and living also inculcates a social responsibility for greater racial, cultural and religious tolerance particularly where there is a strong influx/component of migrants within the community.

There are also governance, economic, social and environment tradeoffs associated with high city population densities. For example these include a greater need for higher density housing; increased demand placed on schools, hospitals, public transport and other infrastructure; increasing land values and rents; a reduction in the availability of limited land and commercial and housing stock; and higher consumption of water and energy. There is also the potential to generate greater social and wealth inequity; increased racial, cultural and religious tensions; and increased levels of pollution and traffic congestion.

8.4.1.4 Net Migration

a) Data Explanation

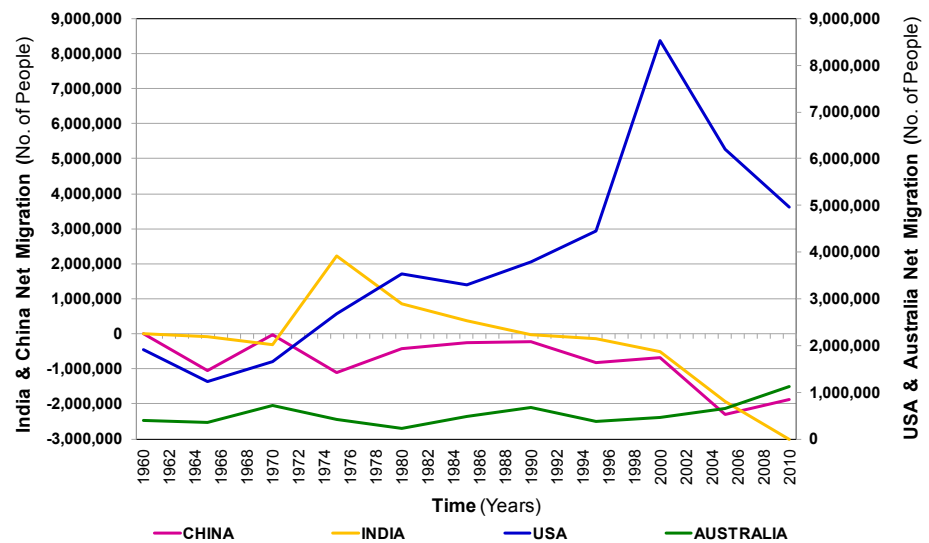
Net Migration (No. of People per annum) is a Social Critical Indicator that measures the net amount of migrants that inhabit a country and is equal to total migrants less total emigrants (citizens and non citizens).

In the chart, **Figure 8.6: Net Migration**, net migration trends over a 50 year period are depicted for the countries which house the key cities (World Bank 2013c). Net Migration levels are depicted on the left hand side of the graph for India and China and on the right hand side of the graph for the USA and Australia.

Both the USA and Australia with its comparatively politically stable and greater democratic freedoms, are recipients of positive net migration. Whilst India and China have been typically recipients of

negative net migration. The exodus of emigrants from these countries can be attributed to a range of reasons e.g. to pursue better economic and educational opportunities elsewhere, to flee political or religious persecution, to escape from the Indo Pakistani War conflict, etc.

Social: Net Migration



Source: World Bank

Figure 8.6: Net Migration

In the most recent 2010 data from the World Bank (**World Bank 2012c**), net migration levels stand at: India negative 3.0M, China negative 1.9M, USA 5.0M and Australia 1.1M.

b) Implications

Net Migration is an important critical indicator because it provides a measure of the desirability of prospective inhabitants to locate to a particular country. When read in conjunction with other socio-demographic indicators such as median age, total life expectancy, fertility rate and total dependency ratios, it begins to build a picture of the current and future prospects of a country and its cities.

A declining natural population growth rate coupled with a comparatively high median age and low/declining fertility rate becomes a significant problem particularly as the population catchment ages and an increasing financial and social burden is placed on the younger generations to support the ageing population demographic. Therefore there is an increasing reliance on

supplementing the working and residential population with migrants to grow and sustain economic and social activity. This is particularly the case with countries like China, Japan and the UK where the median age is increasing, fertility rates are below replacement levels, the expected life span is reasonably high and the total dependency ratios are falling. In recognition of these concerns, China recently announced some relaxing of reforms to its “*One Child Policy*” permitting couples where either parent comes from a one child family, to have two children; this is estimated to affect around 10 million couples and is expected to also help boost future economic growth (Australian Broadcasting Corporation 2013a, 2013b).

Table 8.1 provides some key socio demographics statistics on Median Age, Total Dependency Ratio, Fertility Rate and Total Life Expectancy at Birth for six countries and the World average (United Nations 2013; **World Bank** 2013b). The Median Age, Fertility Rate and Total Life Expectancy at Birth are included as social indicators in the City Structure Universal Indicator Matrix (refer to **Appendix 2**).

Key Socio-Demographic Trends: 1990, 2015 & 2040

Key Socio-Demographic Trends : 1990, 2015 & 2040												
Country	Median Age (Years)			Total Dependency Ratio			Fertility Rate (Births per Woman)			Total Life Expectancy at Birth (Years)		
	1990	F: 2015	F: 2040	1990	F: 2015	F: 2040	1990	F: 2015	F: 2040	1990	F: 2015	F: 2040
Australia	32.1	37.4	40.3	70.4	67.9	82.0	1.9	1.9	1.9	77.0	82.4	85.9
USA	32.9	37.7	40.4	70.3	68.6	84.6	2.1	2.0	2.0	75.2	78.9	82.4
China	24.8	36.0	45.9	83.6	50.4	72.0	2.3	1.7	1.8	69.5	75.3	78.7
India	21.3	26.9	34.1	106.0	75.8	63.9	3.9	2.5	2.0	58.1	66.3	71.3
WORLD	24.0	29.6	34.6	95.4	73.3	76.1	3.2	2.5	2.3	65.4	70.0	74.5
UK	35.8	40.3	42.4	53.2	54.6	67.4	1.8	1.8	2.0	75.9	80.4	83.3
Japan	37.4	46.4	52.6	43.4	64.6	57.2	1.5	1.4	1.8	78.8	83.7	86.4

Source: United Nations & World Bank

Table 8.1: Key Socio-Demographic Trends: 1990, 2015 & 2040

In 2015 for the UK and Japan, the median age is expected to rise to over 40 years, the fertility rates are well below replacement levels and the total life expectancy levels are rising placing an increasing total dependency burden on the younger working demographic.

In light of the above socio-demographic statistics, net migration plays an increasingly important role in supplementing the residential and workforce population within a country and its cities.

Net migration plays a vital role in boosting productivity levels; economic activity; enhancing the workforce composition with skilled migrant labour; creating a greater number of jobs (and in some instances, increasing competition for other jobs) and enhancing racial, cultural and religious diversity. Net migration levels also impact the built environment by placing potentially increased demands on more and higher density housing, hospitals, schools, universities, public transport and other infrastructure as well as water, energy consumption and pollution and traffic congestion levels.

8.4.1.5 Total Dependency Ratio

a) Data Explanation

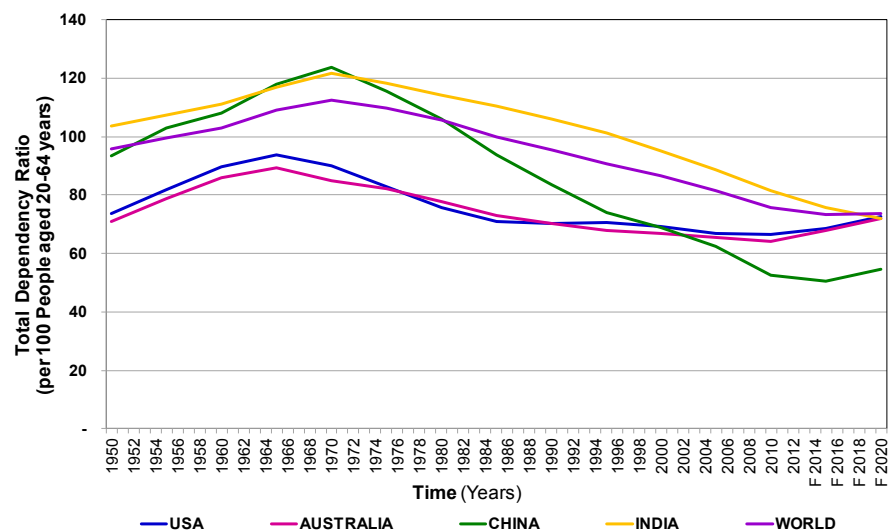
The Total Dependency Ratio (no units) is a Social Critical Indicator that measures the proportion of young children (0-19 years) and elderly dependents (greater than 65 years) of the total population who are able to work (20-64 years). It enables an assessment of a segment of the population most likely to be economically dependent (net consumers) in relation to the segment of the population who are most likely to be economically active (net producers) – this provides an indication of future level of social and economic support (United Nations 2007). A high total dependency ratio means those who are of working age and are economically active face a greater burden in supporting the ageing segments of the population.

It should be noted that this indicator comes with caveats: It assumes that children under the age of 19 and people over the age of 65 are economically dependent. In reality this is not necessarily the case as some children become economically independent earlier and there are a growing number of people aged 65 or over who continue to be economically active. Also it acknowledged that there are some people aged between 20-64 who are not economically active or independent. As young adults finish school and opt to undertake further training or tertiary education, this can also extend their length of economic dependency beyond 19 years. Nevertheless, the total dependency ratio does provide a useful rough rule of thumb to the future economic capacity of the population.

Figure 8.7: Total Dependency Ratio charts the total dependency ratios for the four countries as well as the world average (United Nations 2013). All four countries and the world average recorded an overall decline in total dependency ratio levels between 1950-2013. There was a notable peak in the 1965 for the USA at 93.7 and Australia at 89.2 and in 1970 for China at 123.8, India at 121.6 and the World average 112.4 economic dependent people (net consumers) per 100 economic independent people (net producers).

Whilst India has reduced its total dependency ratio more in keeping with the rate of the world average, China has greatly accelerated its reduction in the total dependency ratio to comparatively more sustainable levels.

Social: Total Dependency Ratio



Source: United Nations

Figure 8.7: Total Dependency Ratio

As at 2010, the total dependency ratios stand at: USA 66.6, Australia 64.3, China 52.6, India 81.6 and World average 75.7 economic dependent people (net consumers) per 100 economic independent people (net producers). As indicated in **Table 8.1: Key Socio-Demographic Trends: 1990, 2015 & 2040**, by 2040 USA, Australia, China and the World Average are expected to record an increase in their respective total dependency ratios. The exception is India where the total dependency ratio is expected to significantly decline to 63.9 net consumers per 100 net producers by 2040.

As outlined previously, one of the other indicators used in the City Structure Universal Indicator Matrix is the country's median age. As at 2010, the median ages for the countries are USA 37.1 years, Australia 36.9 years, China 34.6 years, India 25.5 compared to the World median age of 28.5 years. The median age and total dependency ratio are directly affected by factors such as the fertility rate, net migration levels and the total life expectancy at birth. These factors are in turn strongly affected by public policy on fertility, migration, health, social security benefits and supporting social infrastructure (e.g. child care centres and benefits, aged care and health facilities, etc). For example Australia provides generous parental leave, child care support benefits and maternity leave provisions to encourage higher fertility levels and female workforce participation rates post maternity leave. In contrast, since 1979 China has undergone a stringent "*One Child Program*" with an associated reward system and use of controversial "unofficial" coercive measures to reduce population growth. India has also embarked on a "*Family Planning Program*" since the 1960s where at one stage Indira Gandhi unsuccessfully attempted to instigate a forced sterilisation program for married males with two or more children. Collectively whilst these programs have reduced fertility rates, it has raised other issues such as ethical concerns about sex-selective abortion, infanticide, adverse affects on the natural human sex ratio as well as cultural concerns about valuing a male heir, having sufficient children to care for elderly parents and increased difficulties in males finding prospective brides.

b) Implications

This indicator is generally regarded as a useful gauge of population composition with regards to the propensity of those who are unable to be economically independent and would therefore require financial and social support by those in the population segment who are actively engaged in economic activity or who are economic independent.

A high dependency ratio signals concerns for a country and its cities if an increasingly large amount of public expenditure is directed at child care, education, health and social security for the 0-19 years and over 65 years population segments. This places an increasing social and financial burden on those working in the 20-65 years working demographic. If there is a shrinking amount in this working demographic, it means there are fewer "net producers" to support the "net consumers" and therefore less revenue to fund the provision and maintenance child care centres, schools, hospitals, aged care

facilities and services, retirement and disability pensions, etc to support these more economically vulnerable segments and to further reduce social and financial inequities.

Therefore as the Post World War II Baby Boomers (circa 1946-1964) transition into retirement, for most countries where fertility and net migration rates are low/declining, this means an increasing financial and social burden as borne out in the rising levels of health expenditure and total dependency ratios. Consequently in order to reduce higher dependency ratios and reduce the financial and social burden in cities, there are three key measures that are advocated – increase the retirement age as life expectancy levels increase; supplement a shrinking workforce with the net migration and attraction of young skilled migrants; and reduce government sponsored pensions and encourage greater take up of private pensions and retirement investment self-managed funds.

For the development of city structures, the direct implications are with an ageing demographic, falling fertility rates and longer life expectancy levels, it is incumbent on governments to encourage responsible family planning and proactively encourage and attract young skilled professional migrants to supplement the workforce. This in turn requires appropriate planning and policies for providing the requisite employment and training opportunities, affordable housing, transport and social infrastructure, etc to attract new workers and residents to cities.

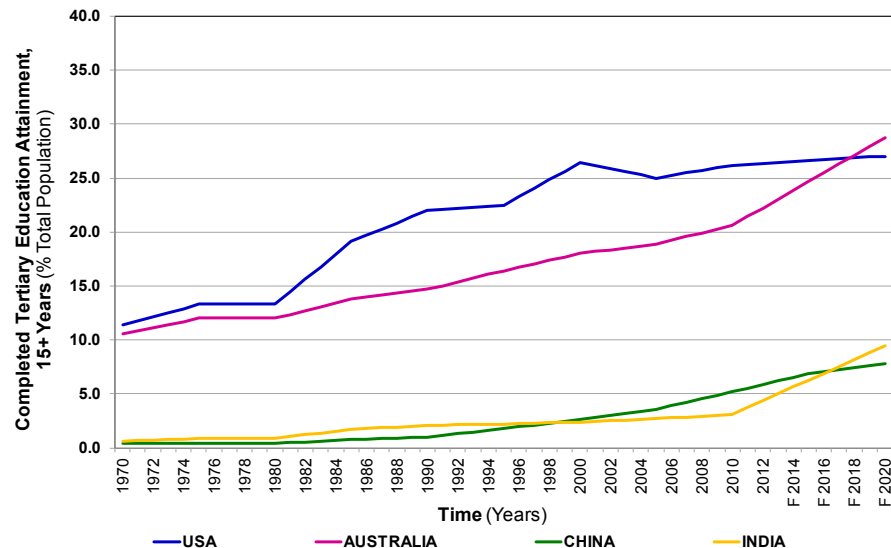
8.4.1.6 Completed Tertiary Educational Attainment

a) Data Explanation

The Completed Tertiary Education Attainment (% of Total) is a social Critical Indicator used to measure the number of people over 15 years that have completed a tertiary education degree. It is expressed as a percentage of the total population.

Completed tertiary education attainment levels are depicted in the chart in **Figure 8.8: Completed Tertiary Education Attainment** (World Bank 2012a).

Social: Completed Tertiary Education Attainment



Source: World Bank

Figure 8.8: Completed Tertiary Education Attainment

More mature countries such as USA and Australia lead the way in completed tertiary education attainment - these levels have risen from 11.4% (1970) to 26.2% (2010) in the USA and from 10.6% (1970) to 20.6% (2010) in Australia. By 2020 the World Bank projects Australia will overtake the USA in completed tertiary education attainment with 28.7% (versus the USA's 27.0%) and is expected to stay ahead over the next 30 years (2050).

Since 1980, both China and India have been steadily increasing tertiary education levels from 0.4% (1980) to 5.2% (2010) in China and from 0.9% (1980) to 3.1% (2010) in India. Both countries are also expected to accelerate their respective rates of growth in completed tertiary education attainment. The World Bank projects these completed tertiary education attainment levels will rise and India (9.5%) is expected to overtake China (7.8%) by 2020.

When read in conjunction with other indicators such as Public Spending on Education; Completed Secondary Educational Attainment as well as Total Employees Employed in the Industry & Services sectors as well as GDP per Capita, it provides a good profile of how well government investment into the population's young generation has paid off.

For example, Australia's public expenditure on education is higher than India's (as previously discussed in Sub section **5.4.1.3** at 5.1% of Australian GDP versus 3.2% of Indian GDP in 2009 (**World Bank** 2013b). However Australia's completed secondary and tertiary education attainment levels are significantly higher at respectively 37.0% and 20.6% compared to India's 1.3% and 3.1% in 2010 (**World Bank** 2013b). This has flow on consequences for the country and therefore city knowledge based building capacity where the number of people employed in higher skill and knowledge intensive jobs in the industry and services sectors in 2009/2010 for Australia was 96.6% of the total population compared to India's 49.0% (**World Bank** 2013b). The ability to be employed in more knowledge and skill intensive jobs also raises a city worker's ability to obtain higher paying jobs which increases their overall income generation capacity. As at 2013, the GDP per capita for Australia was US\$68,939 compared with India's US\$1,592 (**World Bank** 2013b).

The above example demonstrates a widely held acknowledgement there is a strong correlation between levels of higher education and training (or tertiary educational attainment) and higher GDP/GDP per capita levels (Kelly & Mares 2013; OECD 2013; World Economic Forum 2013). According to the OECD in OECD countries, the potential earnings difference in obtaining a tertiary education is significant, *"Educational attainment not only affects employability, it also has an impact on income from employment. On average, the relative earnings of tertiary-educated adults is over 1.5 times that of adults with upper secondary education, while individuals without an upper secondary education earn 25% less, on average than their peers who have attained that level of education"* (OECD 2013: 8). With the occurrence of the GFC, this has further widened the earnings differential: *"the average difference between earnings from employment between low-educated and highly educated individuals was 75%, on average across OECD countries in 2008, and increased to 90% in 2011"* (OECD 2013: 8).

b) Implications

Completed tertiary education attainment is an instructive measure because it provides a gauge as to likely rates of tertiarisation, the future provision of knowledge and service workers, levels of knowledge and capacity to innovate and future earning propensity of its graduates.

Major transnational corporations and large state/national firms have the ability to attract highly qualified professionals who are more likely to be based in cities with deep labour markets. In addition to

competitive economics of scale, the Grattan Institute advocate that these larger companies have a distinct advantage over smaller firms because they are able to readily form multi-disciplinary teams with different capabilities to develop more innovative products and services (Kelly & Mares 2013).

Whilst it is acknowledged that a highly tertiary educated workforce does not necessarily equate to how well that workforce applies its knowledge, it will be better armed with acquired skills and knowledge to solve problems, generate ideas, innovate and more swiftly develop new and more complex products and services. When operating in these agglomerations or clusters of knowledge-intensive activities, this enables workers to interact and learn in closer proximity; develop, exchange and transfer explicit and tacit knowledge which in turn yields higher productivity for workers, firms and ultimately its cities.

This type of knowledge and innovation system and networks more rapidly facilitates the transition of a city from what the World Economic Forum terms “Factor-Driven” and “Efficiency-Driven” economies to “Innovation-Driven” economies (World Economic Forum 2013). Innovation-Driven economies constitute more mature, developed economies where basic macroeconomic, infrastructure and investment conditions have already been successfully addressed and market efficiencies already achieved. These more developed economies have predominantly knowledge intensive industries that are able to hone business and investment market development and focus on innovation practices to ensure these firms and the cities they are located in stay ahead on the technological and innovation curve.

The implications of having a greater proportion of the workforce that have completed a tertiary education are enormous. Not only do more highly educated workers have a greater probability of obtaining potentially better paying knowledge intensive jobs which provides a greater level of household wealth, it also enables cities to develop deeper labour markets of workers with specialised skills. In terms of city structure development, these deeper labour pools enable better and more efficient networks to develop and transactions to take place where both workers and firms can better match requisite job skills sets with workers. In addition, having agglomerations of knowledge intensive networks, activities and relationships in close proximity and constantly interacting facilitates the exchange of ideas, information and develops relationships which further enhances the exchange of explicit and tacit knowledge.

In using completed tertiary education attainment as a critical indicator, it is also possible to better gauge a city structure's

workforce composition and the working population's collective potential to generate higher GDP levels based on the greater productive and innovative outcomes previously discussed.

8.4.1.7 City Office Occupancy Costs

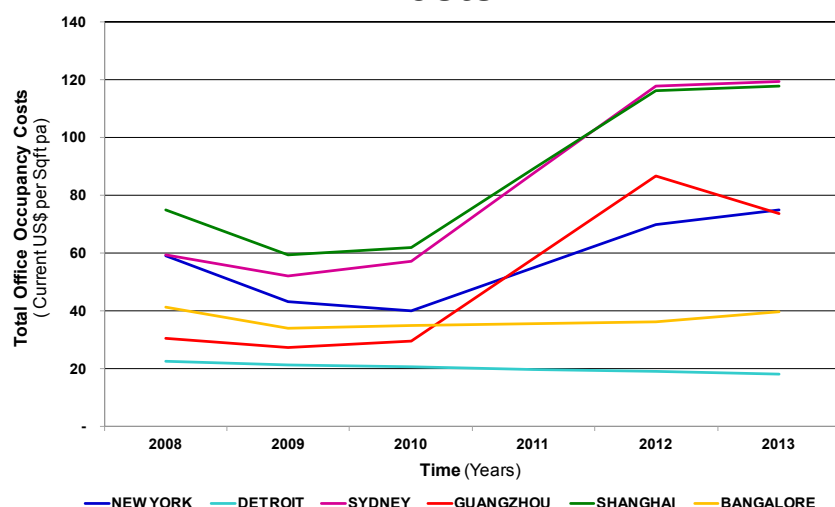
a) Data Explanation

City Office Occupancy Costs (US\$ / Sq ft pa) was selected as an Environment (Built) Critical Indicator to measure the cost of a firm conducting business in a prime quality grade office building located in a particular city. Assumptions and limitations associated with interpolating/calculating the Total Office Occupancy Cost and Revenue Multiplier were discussed in this chapter's Key Limitations section.

The city office occupancy costs tracks a gross face rent which includes typical outgoings and incentives e.g. fit out costs and a rent-free period(s). For global comparative purposes all of the cities analysed are couched in current US\$ per square foot per annum. The office rent is based on leasing an office space in a prime (typically a blend of Premium and Grade A quality office space) quality office building in the downtown/CBD core/key precinct of a city. All city office occupancy costs and rental data were sourced from CBRE (CB Richard Ellis (CBRE) Global Research and Consulting 2008, 2009, 2010, 2012, 2013a, 2013b).

City office occupancy costs for the six key cities are graphically represented in **Figure 8.9: City Office Occupancy Costs**.

Environment: City Office Occupancy Costs



Source: CB Richard Ellis (CBRE)

Figure 8.9: City Office Occupancy Costs

During the six-year timeframe (2008-2013), total office occupancy costs trends have overall risen for four of the key cities (Sydney, Shanghai, Guangzhou and New York) and have marginally declined in Bangalore and Detroit. As at 2013, total office occupancy costs currently stand at (US\$ per Sq ft pa): At the higher end of the spectrum Sydney \$119 and Shanghai \$118, in the middle range New York \$75 and Guangzhou \$74 and at the lower end of the spectrum Bangalore \$40 and Detroit \$18.

b) Implications

City office occupancy costs are a useful indicator for measuring the cost of utilising office accommodation in a city. It reflects an economic and urban development premium as well as the investment/business attractiveness of the city.

City office occupancy costs also directly reflect the supply-demand dynamics of the city's office market. For example rental growth in office occupancy costs for Detroit CBD/downtown has been nominally negative and has been adversely affected by the city's overall economic decline and the City of Detroit's filing for financial bankruptcy (Davey 2013; Szczesny 2013) . This has reduced business and investor confidence and deterred a number of potential new tenants from locating to the city. Subsequently there has been a modest net take-up in Detroit CBD office space of 123,015 square feet in the second quarter of 2013 – most of this was attributed to existing tenants already in the market negotiating/re-negotiating favourable rents and concessions/incentives (CB Richard Ellis (CBRE) Global Research and Consulting 2013a). Total vacancies are still running at historical highs at 22.2% of total office stock (CB Richard Ellis (CBRE) Global Research and Consulting 2013a) and point towards a significant slump in tenant demand for office space and hence a lack of desire to locate to Detroit CBD.

In comparison, Sydney CBD has also shown some signs of weakening demand post GFC, but to a far lesser extent than Detroit. Whilst prime office occupancy costs rose a nominal 1.1% to US\$119 per Sq ft pa in June 2013 (CB Richard Ellis (CBRE) Global Research and Consulting 2008, 2009, 2010, 2012, 2013b), there was an increase in the total vacancy rate from 7.8% to 8.9% in the year to July 2013 (attributed to negative tenant demand for office space and supply additions to office stock); this resulted in a net reduction in the take up of occupied space i.e. net absorption of negative 19,100 sqm pa (Property Council of Australia (PCA) 2013). Based on the

Candidate's Sydney CBD office market calculations using PCA data (Property Council of Australia (PCA) 2012) , whilst the total vacancy rate of 8.9% is high, it is trending below the equilibrium point or 22 year historical average (1991-2012) of 10.4% and the current annual net absorption level of negative 19,100 sqm pa is trending significantly below the equilibrium point or 22 year historical average of 370,100 sqm pa. Further calculations revealed that the stock replacement ratio in July 2012 was around 1.3 sqm supplied to every 1 sqm withdrawn and trends below the 22 year historical average of 2.04 sqm supplied to every 1 sqm withdrawn. This slowdown in tenant demand, rental growth and stock replacement ratio together with an increase in the total vacancy rate suggests a softening office market. This softening is likely to reflect investor and business sentiment where firms are wary about taking new or additional office space given the level of global economic uncertainty; concerns about lack lustre aggregate demand and domestic consumption; whether Australia may tip into an economic recession (or be further hindered by her reliance on major trading partners e.g. USA, Japan, China, UK, etc) and a continued weakening in the AU\$ against the US\$ currency.

City office occupancy costs can be regarded as a "litmus test" for the demand and supply market dynamics of a city and directly impact city structure development. The supply of office space is fuelled by the demand for new and refurbished office stock and the availability of land or obsolete stock that can be profitably developed/redeveloped. Demand for office space is fuelled by a wide range of market and external factors – primarily the market and firm's premiums placed on the prestige and attractiveness of wanting to locate in that city (as well as the particular precinct location, office building and tenancy); proximity to customers/clients, suppliers/service providers and industry clusters/peers; access to public transport and parking and key amenities, etc. Other demand considerations have been discussed in the Detroit and Sydney office market examples cited.

Competitive office occupancy costs are amongst some of the key considerations when a transnational firm is assessing where to locate a head office or regional headquarters. Occupancy rental costs versus purchase of office building, access to deep labour markets with highly skilled workers, strong business and investment climate, high productivity and market efficient processes, mature and innovative markets, regulatory transparency, political stability, good infrastructure (telecommunication, transport and social), etc all have considerable weight in the decision making process.

Office buildings together with retail (shopping centres, major department stores, prime strip retail, cafes and restaurants); medium-high rise residential; peripheral industrial (logistics and warehousing facilities, high tech or industrial parks, ancillary industrial to support construction industry); hotels and leisure (pubs; entertainment, tourist and cultural venues); social infrastructure (child care centres, schools, hospitals, community centres); higher education buildings and major transport hubs (airports, port, passenger and freight rail) house and sustain a wide range of functional networks, activities and relationships within a city structure. Consequently it is vital that key protagonists accommodate the current and future needs of existing and prospective firms, workers, residents and other key stakeholders that work/reside in a city. This includes greater involvement with industry, the wider business community and other stakeholders in the planning, implementation and monitoring of new investment, planning and development endeavours regarding city structure development.

It is also essential that when developing or refurbishing these buildings that the supply and demand dynamics are kept in relative tandem to keep supply and pricing (rents, investment yields, land and capital values) volatilities in check.

8.4.1.8 Hospital Beds

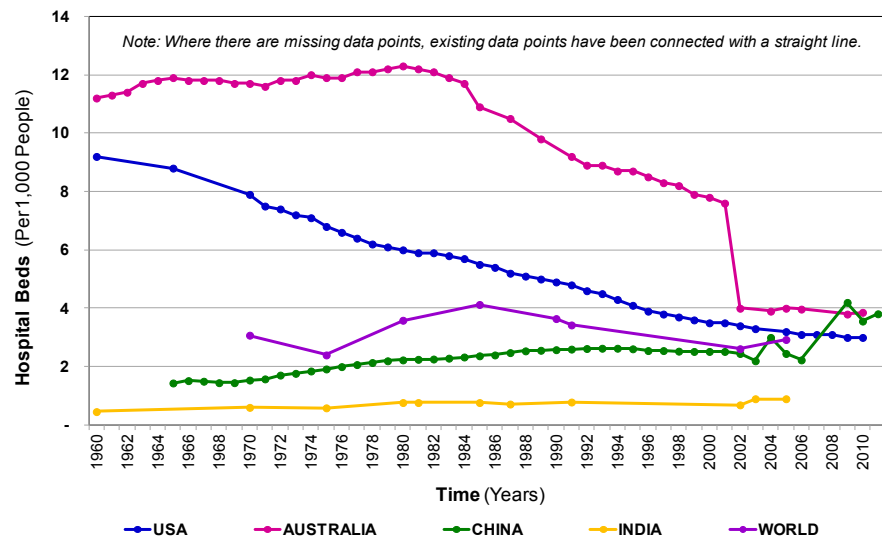
a) Data Explanation

Hospitals Beds (per 1,000 People) measures the number of hospital beds (in private, public and general hospitals and rehabilitation centres) per 1,000 people within a country (urban and rural). The Environment (built) Critical Indicator provides an approximate indication of the pro-rata extent the population has access to a hospital. Given the specialised nature and requirements, the majority of these hospitals tend to be located in cities and major urban and rural centres (e.g. critical mass of specialised medical professionals and medical/health service providers; extensive infrastructure required and the need to be closely located to the wider medical, health care, medical research and teaching networks). The indicator however does not take into account the processing time a patient may have to wait for a hospital bed to become available, the quality of the medical care or the location concentration of these hospital beds (cities versus urban/rural centres).

Figure 8.10 charts the rate of hospital beds per 1,000 people for each of the four countries and the world average (World Bank 2013c). It should be noted where there is missing annual data, existing data

points have been connected with a straight line – this is evident where there are missing data points i.e. less frequent data points on the line graphs e.g. India and World average.

Environment: Hospital Beds



Source: World Bank

Figure 8.10: Hospital Beds

Both the USA and Australia recorded an overall decline in the number of hospital beds from 1960 to 2010: the USA from 9.2 to 3.0 beds and in Australia from 11.2 to 3.9 beds per 1,000 people. This decline can be attributed to the government and private sector not building a sufficient number of new hospitals or adding additional beds to existing hospitals to keep pace with the increased population growth. To further exacerbate the situation, hospital owners have been cutting costs and resourcing, increasing efficiencies and using hospital beds and facilities more intensively where the rate of patient churn has been increasing over the last 20 years.

Both India and the World average recorded nominal growth and the lowest levels which respectively stand at 0.9 and 2.9 beds per 1,000 people in 2005.

In contrast the number of hospital beds in China has significantly risen nearly three-fold from 1.4 in 1965 to 3.8 beds per 1,000 people in 2011. This was attributed to approximately 685M residents signing up in September 2007 for the “*New Rural Co-Operative Medical Care System*” which aimed to overhaul the health care system (Wikipedia 2013m). In addition, according to an article authored by Meesen and

Bloom, around 80% of China's medical and health care services are provided in cities and ready access to medical services is unavailable to over 100 M people in rural areas – in order to redress this, the Government declared in 2005 it would invest 20B renminbi (~US\$2.4B) over five years in rebuilding the rural medical service systems which includes village clinics as well as township and county-level hospitals (Wikipedia 2013m). Collectively both these initiatives would have boosted the provision of additional hospitals beds and medical services.

b) Implications

With a significant ageing demographic and increased life expectancies in China, USA, Australia and India, there will be an increasing need for hospital beds, medical and health care services. The number of hospital beds is one indicator that can be used to gauge how a country's Government is demonstrating leadership and vision in providing for current and future medical needs in terms of health care policy and expenditure; growing population pressures; changing demographic needs; capacity of existing hospitals and other health care infrastructure support; and ensuring the community's expectations of accessing a hospital in a timely and efficient manner are met.

Access to key infrastructure such as convenient access to hospitals with specialised medical services, medical centres/clinics, schools, shopping centres and public transport are regarded as key considerations for young families and older/elderly couples when locating to cities.

The consequences of providing an adequate level of hospitals, medical and health care services as well as other social infrastructure has a notable impact on the development of city structures. If the level of service is inadequate, many potential workers and residents will simply elect to locate elsewhere. Fortunately cities tend to attract a critical mass of medical doctors and other health care professionals by virtue of where many of the large, prestigious hospitals are located which offer state of the art and leading edge medical care. There are also strong ties between many of the medical universities and the numerous teaching hospitals and medical clinics that tend to concentrate in cities where there are greater employment opportunities and higher levels of funding/resourcing and infrastructure support.

As part of a city structure's development of network functionalities, relationships and interactions, many of these hospitals tend to have

associated medical and healthcare, pharmaceutical, biomedical and research and development clusters that develop and support knowledge intensive activity and increase innovative capacity.

8.4.1.9 Energy Use

a) Data Explanation

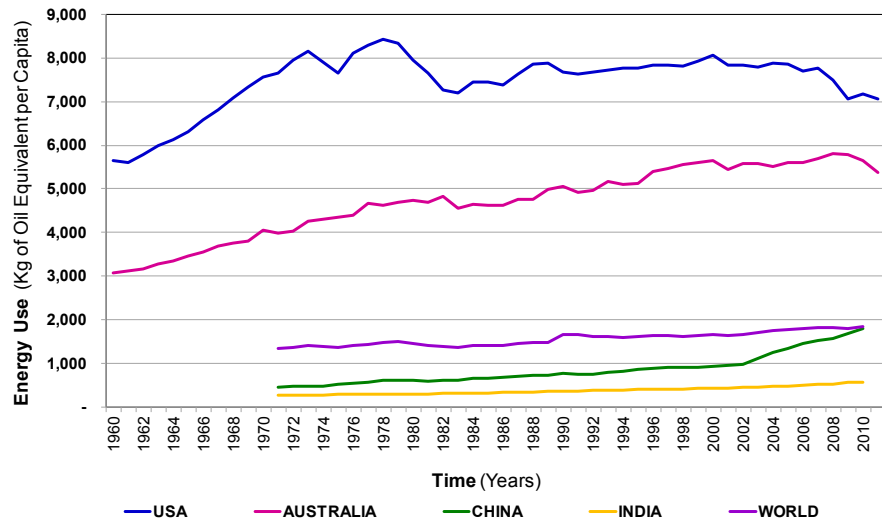
Energy Use (Kg of oil equivalent per capita) is an Environment Critical Indicator that measures the total amount of primary energy consumed and is measured in kilograms of oil equivalent per capita. The indicator specifically measures energy consumption but also provides a broad level indication of energy consumption intensive countries, accessibility to energy, energy efficiency and sustainability measures that may be employed as well as quality of living and globalisation trends.

Charted in **Figure 8.11: Energy Use** are the energy consumption trends for the four countries and the World average (World Bank 2013c) . Since 1960 (USA and Australia) and 1971 (China, India and the World average), energy use as an overall trend has risen. The most notable increase has been China's energy consumption since 2004. Energy declines that coincide with the macro event Oil Crises (1973-74, 1979 and 2003-08) should also be noted – this was most noticeable for the USA.

In the year to 2010, only Australia recorded a decline in energy use: a reduction of 2.3% to 5,653 kg of oil equivalent per capita. Over the same timeframe, energy use levels (kg of oil equivalent per capita) rose by: 1.5% to 7,165 in USA, 6.9% to 1,807 in China, 1.3% to 575 in India and 3.6% to 1,852 as a World average.

India, China, USA and Australia are part of the Group of 20 major economies (G20). It was reported that energy consumption in G20 countries generally recorded a strong increase in 2010 but declined in 2011 where the GFC and record international oil prices were attributed to the decreased demand (Enerdata 2012). As described above, according to the World Bank statistics, energy use for Australia actually declined in 2010. However available 2011 data from the World Bank for USA and Australia confirms Enerdata's reported decline in 2010-2011 with negative 1.3% to 7,069 kg of oil equivalent per capita in the USA and negative 5.1% to 5,366 kg of oil equivalent per capita in Australia (World Bank 2013c).

Environment: Energy Use



Source: World Bank

Figure 8.11: Energy Use

Whilst developing countries such as India and China are identified as strong energy consumer markets, this has been more markedly demonstrated with China in recent years. With China's strong growth in manufacturing activity and as city household disposable incomes rise generating a greater demand for and use of electrical goods, this has increased energy consumption significantly post 2004. In 2011, China was the largest electricity consumer globally and was responsible for 80% of the world's growth in electricity consumption where 40% stemmed from strong industrial activity (Enerdata 2012).

b) Implications

Whilst energy use tracks energy consumption, it also identifies which countries consume energy more intensively. The indicator also provides a useful gauge of a country's general state of development – developed countries generally tend to consume greater levels of energy as GDP and HDI per capita rise in line with increased levels of manufacturing, commercial and domestic consumption. Developing countries that have strongly developing manufacturing industries as their primary economic base (e.g. China) have gained strong traction in the energy consumption stakes.

The indicator can also broadly reflect where a particular macro event (e.g. GFC and Oil Crises), international (e.g. implementing Kyoto Protocol targets for participating countries) and national measures

(e.g. Australia's Carbon Tax and Solar Panel Rebate Scheme) have impacted energy and how city structures respond to energy efficiency and sustainability measures.

A long term commitment is required to effectively and unilaterally reduce energy consumption and Greenhouse gas emissions; develop and support environmentally friendly energy alternatives; and to implement energy sustainability practices. This is best achieved through global and national organisations and Governments demonstrating leadership and vision in responsibly planning for future energy needs in urban development, planning, energy and environmental policies and expenditures and ensuring their successful policy implementation.

Energy use also reflects community and business values and their expectations of energy consumption, capturing energy efficiencies and realised cost savings; living sustainably for the long term as well as environment trade-offs e.g. increased pollution, greenhouse gas emissions, adverse climatic conditions, etc. This impacts city structure development in two ways.

The first is the manner in which key protagonists (e.g. Energy providers, end users, Government, other statutory and regulatory bodies, investors, architects, engineers and energy experts, etc.) and other stakeholders (e.g. research and development community in the areas of energy development and sustainable energy) develop city structure networks, relationships and clusters of industry expertise in the form of centres of innovation excellence. This includes exploring, developing and promoting alternative sustainable energy sources; reducing energy consumption; increasing energy efficiencies in buildings, manufacturing equipment, consumer appliances and products; and proactively reducing the impact of energy consumption and greenhouse gas emissions.

The second is in the way cities are designed and used to provide renewable and sustainable sources of energy; building owners, workers/tenants and residents are encouraged to reduce energy consumption and increase energy efficiencies to realise cost savings. This includes using energy efficient building design principles, recycled building and construction products that have large embodied energies (e.g. re-using concrete, aluminium, steel and glazing products in new and refurbished developments), building intelligence systems, Green Star/NABER or equivalent energy efficiency rated products, increased planting through more public parks, community food gardens and rooftop gardens, greater rubbish and unwanted goods (appliances, furniture, clothing) recycling, etc.

8.4.1.10 Motor Vehicles

a) Data Explanation

Motor Vehicles (per 1,000 People) use measures the number of motor vehicles (cars, buses and freight vehicles but excludes motor cycles) used on a pro rata basis of per 1,000 people within a country.

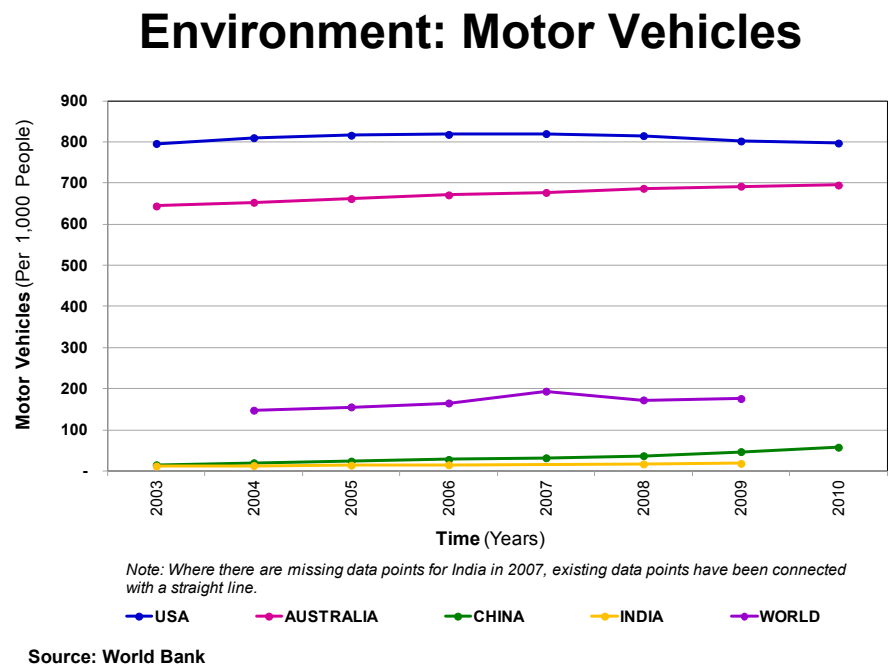


Figure 8.12: Motor Vehicles

Figure 8.12: Motor Vehicles charts the rate of motor vehicles per 1,000 people for each of the four countries and the world average (World Bank 2013c). It should be noted where there is missing annual data, existing data points have been connected with a straight line – this applies to India in 2006-2008 there is a missing data point in 2007.

Between the 2003-2010 timeframe, the four countries and the World average recorded an overall trend increase in motor vehicle use – albeit a nominal increase for the USA. As at 2010, motor vehicles per 1,000 people stood at: 797 in USA, 695 in Australia and 58 in China. Based on the most recent available 2009 data for India and the World average motor vehicles per 1,000 people was 18.4 and 176 respectively.

It should be noted that developed countries tend to have a comparatively higher level of motor vehicle usage rate particularly as

their GDP and HDI levels rise and households are better able to afford the increased mobility and convenient use of one or more motor vehicles. However with rising oil and petrol prices, this has seen the rise of more fuel efficient cars, a reduction in the number of motor vehicles used and in some instances where it is practicable and/or an increased reliance on public transport or other non-motor vehicle modes (e.g. walking and cycling) as a primary means of transport.

b) Implications

Motor vehicle use is an instructive indicator as it not only tracks a country's reliance on motor vehicles, but it also provides a general indication of motor vehicle consumption and it impacts journey to work/speed to markets and urban sprawl.

From the perspective of city structure development, significant implications result from increased motor vehicle use. First, Governments need to balance the investment and economic interests of supporting a viable automotive manufacturing industry within their country and its cities, tax revenues compared with its transport, urban development and environmental policies, expenditures on transport hubs, road construction and related maintenance costs.

Secondly, the automotive industry/sector covers a wide range of organisations and stakeholders involved in the business of research development; design; manufacturing; testing/inspecting, regulatory oversight, financing and insurance, marketing, selling, hiring/rental, transport/shipping logistics, professional car racing as well as the repair, maintenance and metal scrapping of motor vehicles. Each of these aspects has one or more networks that stakeholders interact in which in turn generates economic activity with flow on multiplier effects and has the capacity to raise productivity and enhance innovation across the sector.

However with globalisation trends making manufacturing highly competitive in developing countries, car manufacturers in developed countries in the UK, USA, Europe and Australia are finding it increasingly difficult to compete with the lower manufacturing cost base in developing countries. In the lead up to the GFC, the US motor vehicle manufacturing industry was already suffering declining motor vehicle sales and a tight credit environment. When the GFC hit, this sent major global motor vehicle manufacturers such as Chrysler, General Motors and Ford teetering over the financial edge and they requested emergency loans to cover cash shortfalls and by June 2009 both Chrysler and GM filed for financial protection. In order to

safeguard the automotive industry, both the USA and Canadian Governments provided an unprecedented financial bailout of US\$85B (Wikipedia 2013g). After restructuring and recovering from bankruptcy, it was reported in October 2012 that Chrysler is proposing to add 1,250 jobs in Detroit – primarily in their Jefferson North Assembly Plant (IndustryWeek 2012). It remains to be seen whether all of these Chrysler jobs will be created and sustainably maintained.

Another case in point was the recently announcement that Holden would close most of its plant operations in South Australia and Victoria in 2017 at a cost of 1,600 and 1,300 jobs respectively (Griffiths 2013b). According to the Workplace Innovation and Social Research Centre at the University of Adelaide, Holden's plant closure and its flow on effects on parts manufacturers to car manufacturers to Holden in South Australia is estimated to cost \$1.24B and 13,200 jobs (Mann 2013).

The third major implication is that increased motor vehicle use impacts the efficiency of the road and public transport systems; community and business values and expectations of transport efficiencies, living sustainably and associated environment trade-offs e.g. potential for increased traffic congestion, urban sprawl, pollution, etc.

8.4.1.11 Carbon Dioxide Emissions

a) Data Explanation

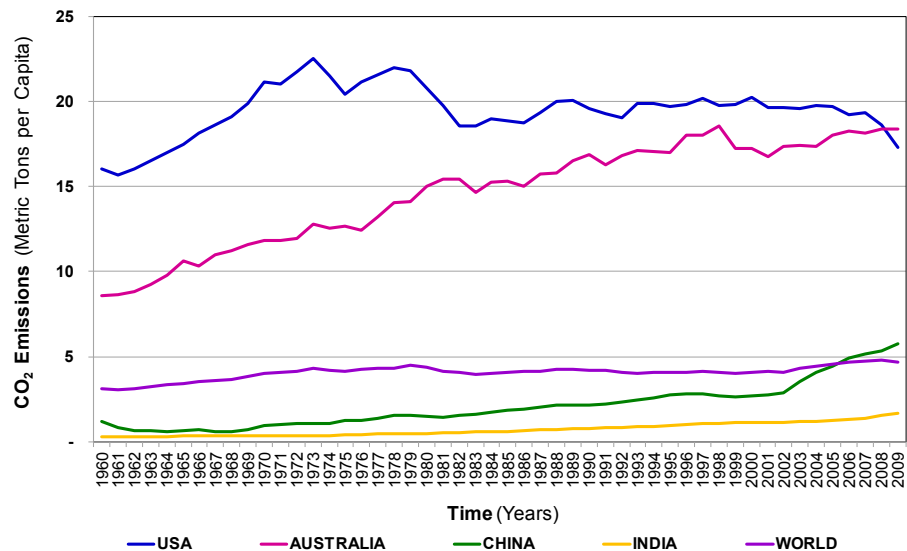
Carbon Dioxide Emissions (Metric tons of CO₂ per capita) is an Environment Critical Indicator that measures the level of one of the six main Greenhouse gases, carbon dioxide.

Charted are carbon dioxide emission trends for the four countries and the World average in **Figure 8.13: Carbon Dioxide Emissions** (World Bank 2013c).

Whilst the USA and the World average indicated a recent decline in CO₂ emissions, in overall terms, all countries and the World average recorded an overall trend increase. It is significant because it reflects trends in overall Greenhouse Gas emissions and associated global warming consequences, pollution levels, adverse health side effects and general quality of living trends.

The most recent 2009 data available from World Bank recorded carbon dioxide levels (metric tons per capita) stand at: 17.3 for USA, 18.4 for Australia, 5.8 for China, 1.7 for India and 4.7 for the World average.

Environment: Carbon Dioxide Emissions



Source: World Bank

Figure 8.13: Carbon Dioxide Emissions

This was in line with the energy use trends and attributed reasons previously discussed.

The UN's Kyoto Protocol is an international treaty that sets binding obligations on industrialised countries to reduce their Greenhouse gas emissions.

It has been acknowledged by the UN's Kyoto Protocol for the United Nations Framework Convention on Climate Change that developed countries are the largest contributors to Green House Gas Emissions (United Nations 2011c).

Enerdata reported carbon dioxide energy emissions growth for G20 countries outpaced energy demand growth (3%) due to the higher growth increase in coal demand and noted that China's emissions per capital were swiftly approaching levels obtained for OECD countries (Enerdata 2012). In fact less than 20% of Chinese cities meet World Health Organisation standards for sulphur dioxide and nitrogen

dioxide levels whilst almost none of these cities meet WHO standards for particulate matter (Miller 2012). This situation will only be further compounded if stricter environmental targets and regulations are not enforced and Chinese cities continue to grow car ownership, increase urban sprawl, do not invest in mass rapid transit systems in a more timely manner and continue to rely on coal for 70% of its primary energy needs (Miller 2012).

b) Implications

Carbon dioxide emissions provide an important barometer of the consequences of failing to prudently manage and consume energy, utilise alternative renewable and sustainable forms of energy and to reduce Greenhouse gas emissions.

Whilst developing countries such as China and India currently do not have legally binding targets under the UN Kyoto Protocol, they are still committed under the treaty to reduce their emissions. In the first of two commitment periods (2008-2012), Australia's target was +8%. Whilst the US signed the treaty, it did not ratify the protocol as a result of the Byrd-Hagel Resolution which stipulated unanimous disapproval of any international agreement did not require developing countries to reduce their emissions thereby seriously impacting the US economy.

The implications discussed for energy consumption also hold true for the implications for carbon dioxide emissions. Increased carbon dioxide emission levels also have the additional impetus of long term and irreversible environmental damage - it is argued that the failure to reduce Greenhouse gas emissions in a prudent and timely manner has dire consequences (United Nations Energy Programme (UNEP) 2012) . This includes global warming, adverse climate effects, rising sea levels and coastal erosion, increased particulate matter, air pollution and adverse health effects. This clearly has widespread consequences for the long term survival of city structures and how its key protagonists, workers and residents respond to the energy management and green house gas emission challenges in a proactive, timely and responsible manner.

8.4.2 Network Structure

A key compositional aspect of city structure population is the network structure. The **Network Structure** is delineated by the physical geography and development of transport routes, industry clusters and activity networks and interactions within a city structure. As the physical configuration evolves over time, it grows to service the networks of activities and flows of information, capital, etc. By examining these networks, greater understanding and insights can be gained from what informs the development of city structures and why they are shaped in a certain way and what drives them to stagnate/renew and evolve.

8.4.2.1 Importance of Hierarchies, Markets and Networks

In order to improve operational efficiencies and reduce costs; exchange information and knowledge more effectively; and develop a greater capacity to service a wide web of activities and relationships, there has been an increasing reliance on structuring operations in different ways to gain competitive advantage. Three alternative forms of institutions which permit transactions costs to be reduced are advocated by Douglas Henton who cites the work of Oliver Williamson (Scott 2001: Douglas Henton's Chapter 20 "*Lessons From Silicon Valley: Governance in a Global City-Region*": 392-393):

- i) **Hierarchies:** These are vertical forms of organisation within a company which can reduce transactions costs through vertical integration within a stable environment;
- ii) **Markets:** These are horizontal market forms of organisation where transactions costs can be reduced through external contracts in an uncertain environment. For example, outsourcing to a company that specialises in a non-core area or entering joint venture partnerships with another firm to gain expertise in a particular field and/or to gain market coverage in a particular geographic area.
- iii) **Networks:** These are an intermediary form of organisation between hierarchies and markets and are most effectively used in environments where speed is a critical factor. Networks have the advantage of reducing transaction costs by "*combining flexibility of markets with the trust relationships of hierarchy*" (Scott 2001: 393). A network is also viewed as a less informal group of individual agents who share common interests or objectives and are able to exchange interactions, information and knowledge on a regular basis.

Henton (Scott 2001: Douglas Henton's Chapter 20 "Lessons From Silicon Valley: Governance in a Global City-Region": 391-400); Saxenian (Saxenian 1996, 2006) and Willoughby (Brotchie et al. 1995: Kelvin Willoughby's Chapter 13 "*The Local Milieux of Knowledge-Based Industries*": 252-285) discuss the vital role these networks have in riding waves of technological innovation i.e. creating a mutually beneficial collaborative and innovative climate which increased the creativeness and complexity of the products and services being produced; greatly increased the speed of the R & D gestation period and hence increased the speed to market; and improved operational efficiencies of the products and services created.

8.4.2.2 Developing the Network Structure - Creating Knowledge and Innovation Systems and the Value of Intelligent Environments within City Structures

Whilst there is a wide discourse on cities and economic innovation, it is acknowledged that cities are great catalysts for enabling innovation to occur and to provide the requisite knowledge, capital and infrastructure support (Shearmur 2012).

In order to develop the network structure of a city structure, it is vital to create knowledge and innovation systems and intelligent environments in which to create and sustain innovation.

Within every city structure, each key protagonist and stakeholder is a source of knowledge, an instigator of interactions and a creator of pathways. Thus the extent to which these key protagonists and stakeholders successfully collaborate, transfer information, exchange knowledge and create innovation synergies/dynamics dictates how dense, complex and rich these networks structures become. This is explained further by Nicos Komninos (Komninos 2008):

"Every resident of a city and every organisation located there (be it a business, foundation, research centre or university) is a nucleus of explicit and tacit knowledge. Their relationships of cooperation determine how information and knowledge channels are created, and technologies transferred and exchanged. Due to synergies and systemic relations, knowledge resources of the whole agglomeration are much greater than the sum of the individual sets of knowledge and skills". (Komninos 2008: 15)

These knowledge and innovation systems are fragmented and not homogenous because by their nature, they comprise "*separate clusters of dense cooperation networks, which correspond to different*

fields of knowledge, science and technology" (Komninos 2008: 15). This is evident when clusters of different agglomeration size, different sector knowledge, varying degrees of knowledge depth and different stages of network maturity are observed. Komninos elaborates further on their complexity:

"Within each cluster, cooperation is enhanced by proximity, support institutions, and information and knowledge spillovers. Next to the clusters, universities and research centres create additional networks of knowledge and cooperation. The city assumes the form of a polycentric system of innovative clusters within wider networks of knowledge and technology linking the clusters within the wider networks of knowledge and technology linking the clusters with R & D institutions and technology intermediation organisations". (Komninos 2008: 15)

It is not sufficient just to create these knowledge and innovation systems, in order for networks structures to thrive, they need a conducive "intelligent" environment. The increasing growth in knowledge intensive activities, the imperative to develop a wide and deep knowledge base, the endless quest for developing innovative products and services and improving the commercialisation and speed to market efficiencies makes a conducive and intelligent environment critical. It is advocated that the research stage of technological development requires "soft infrastructure" which comprise "information systems, education and research, business and environmental supports" (Blakely & Bradshaw 2002) . This is succinctly explained:

"Technology is driven by information, the essential link between each stage. It would be impossible to proceed to the next stage without information, because it provides the clues about the direction in which to move. Without research, no matter how simple, a product is unlikely to be developed; without marketing information, new products run a high risk of failure; without social interaction, the flow of information about research and new ideas between scientists slows, and so does the rate of change in technology". (Blakely & Bradshaw 2002: 363)

What this highlights is that the process of innovation is complex and non linear and Komninos concurs with Blakely and Bradshaw that technological development/innovation requires a requisite set of catalysts:

"Converting scientific knowledge into new products and services, which is the core process of innovation, is only feasible under an

environment rich in resources for research, experimentation, financing and entrepreneurialism. Innovation is not produced by a linear process using and applying scientific research. This is a false oversimplification. Research is a crucial component of innovation; but it becomes fertile by mobilising various capabilities within a wider system of knowledge, risk taking and entrepreneurialism". (Komninos 2008: 16)

Australian-born Silicon Valley entrepreneur, Adrian Taylor echoes these sentiments and cites the following ten principles for innovation success: *"The 10 principles for innovation success are strong research universities with endowments, globally experienced repeat entrepreneurs, sophisticated risk capital, social capital (links between innovative executives), knowledge sharing, risk tolerance, creative destruction of obsolete or unsuccessful ventures to build new ones, learning from constructive failures, positive returns for entrepreneurs and supportive government policy"* (Jay 2012: Australian Financial Review article 23/3/2012).

Rather than relying on innovation as a process per se which can be unpredictable in yielding the desired results, it is more fruitful and sustainable to focus on creating the environment conducive to generating the innovation process (Komninos 2008). Whilst there may be a reasonable failure rate in generating some of these innovative products/services, the expectation is that an environment is created that facilitates experimentation and therefore produces a *"portfolio of innovation designs"*; this results in an *"intensifying of efforts with higher probability"* (Komninos 2008: 16). A further advantage of the "intelligent environments" approach is that it aligns well with *"global innovation networks and supply chains"* whereby they *"enable information retrieval from sources scattered around the world, getting technologies wherever these are available, and enabling global real time communication and exchange"* (Komninos 2008: 16). This not only creates a sustainable way to foster innovation, it also enables innovators and firms to be cognisant of information, knowledge and distribution channels and improving speed to market efficiencies.

In creating an intelligent city, there are several dimensions which need to be addressed to ensure their success and this relates to how they manage different forms of knowledge flows. This entails *"the creation of new knowledge (research), monitoring knowledge flows (intelligence), disseminating current knowledge (technology transfer), cooperating in applying knowledge (innovation), developing new*

activities based on knowledge (incubation), and managing knowledge remotely (e-government)” (Komninos 2008: 20).

As a further extension to his research on intelligent cities Komninos devised a range of metrics to benchmark and quantitatively model the activities and functions that occur in intelligent cities (Komninos 2008). These are tabled in **Appendix 7A: Metrics for Intelligent Cities**. The 35 indicators are categorised into four dimensions: 1) Education and skills of the population; 2) Knowledge and innovation institutions; 3) Digital structure and e-services; and 4) Innovation performance.

As an exercise, a comparison was made of Komninos’ metric indicators and the City Structure Universal Indicator Matrix to see how many of these indicators or their equivalents matched. Out of Komninos’ 35 indicators, there were seven that matched or were equivalent which represented 20% of the total sample of metric indicators – two of which were selected as critical Indicators (**Completed Tertiary Educational Attainment** and **Research and Development Expenditure**). The comparison of these indicators is tabled in **Appendix 7B: Indicator Comparison**.

Whilst it is acknowledged that both sets of indicators were devised for different purposes, it was interesting to note that there are some cross-overs and that some of the indicators selected in the City Structure Universal Indicator Matrix could be used and further expanded as a further investigation examining innovation and intelligence aspects of city structure development.

8.4.2.3 Key City Network Structures

Based on the above discussion and looking at the level of information required for the Metric of Intelligent Cities, it was not feasible to undertake an in depth examination for the purposes of this research. Given the level of complexity and the limited information available at a city level, it would require a separate research study to develop a significant amount of detail about how clusters of different agglomeration size, different sector knowledge, varying degrees of knowledge depth and at different stages of network maturity observable at the network scale level.

However in **Appendix 5: Key Cities Overview**, an overview has been provided of the following:

- Key Factors Contributing to City Structure Development Trends

- Macro Events and City Specific Events post 1950 (which is the earliest commencement year of some of the datasets used)
- Impact of Recent Government Planning and Investment/Economic Policies and Decisions;
- Primary Industry Clusters – in terms of the industry cluster type and the types of companies involved. Also, other research and development catalysts such as tertiary education and hospitals are listed and where available research/innovation centres where information was available.
- Network interactions which give a preliminary discussion on where there may be significant relationships or synergies e.g. between hospitals and pharmaceutical and biotech firms or between aeronautical and aerospace clusters and universities with specialist facilities and faculty staff and students or where there may be similar or complementary firms to collaborate with.
- Other Considerations provides cross references with the city classification GaWC provides for that city (e.g. alpha or beta grade city) and the World Economic Forum Competitiveness Classification provided to the country's economy (e.g. factor, efficiency or innovation driven economy). Also listed are any key considerations and what might be needed for the city to transition to the next level/stage of development or where it might be able to improve its performance.

A City Structure Overview extract regarding Sydney's network structure's Primary Industry Clusters and Network Interactions has been provided in **Table 8.2: Sydney City Structure Overview Network Structure Extract – Primary Industry Clusters and Network Interactions** – for the complete Overview, please refer to **Appendix 5**.

What is evident from the preliminary analysis of primary industry clusters and network interactions (**Appendix 5** and extract **Table 8.2**) is the critical role networks of relationships, knowledge flows and capital play in shaping city structures. The scope, depth and maturity of these networks enable a city structure to adapt and evolve through synergies between various industry clusters which enable city structures to achieve greater economic diversity, productivity, innovative capacity and resilience.

In the pages following **Table 8.2, Figures 8.14-8.55: Network Structures of Key Cities** provide aerial photos of the cities, maps indicating major road networks and urban development patterns as well as photos with some accompanying notes. These figures should be read in conjunction with **Appendix 5: Key Cities Overview**.

Table 8.2: Sydney City Structure Overview Network Structure Extract – Primary Industry Clusters and Network Interactions

Key Highlights:	Comments:
Primary Industry Clusters:	• According to the 2011 Census data within the Sydney LGA the six largest industry sectors for employment are Professional, Scientific and Technical Services (16.8% of the total employment population within Sydney LGA); Financial and Insurance Services (10.1%); Accommodation and Food Services (10.0%); Health Care and Social Assistance (7.9%); Retail Trade (7.6%); Education and Training (7.3%) – collectively they represent 57,677 workers or 59.7% of the Sydney LGA's working population (City of Sydney 2013). • Sydney tends to specialise in business and professional services; banking, finance and insurance; ICT and software development, creative industries and media; medical and science research; education, information and communications technology; defence and aerospace and advanced manufacturing. • Business and Professional Services – Includes Deloitte Touche Tohmatsu, Ernest and Young, KPMG, PricewaterhouseCoopers, Accenture, Siemens, Sinclair Knight Mertz, Ove Arup, Cardno, Computershare, Bluelink, Datacom, Thomson Reuters, Sony, Brother, Toshiba and Fuji Xerox. • Banking, Finance & Insurance– Includes American Express, AMP Group, AXA, BT Financial, Blackrock Investments, Schroder Investment Management, Macquarie Bank, General Electric, Deutsche Bank, BNP Paribas, Citigroup, UBS, Credit Suisse, ING, Morgan Stanley, Mizuho Corporate Bank, Mitsui, Sumitomo Bank, Societe Generale, American International Group, Bank of America, HSBC Holdings, Royal Bank of Scotland, Standard and Poors and Moody's. • Retail – Includes Coca Cola Amatil, PepsiCo/Smith's Snackfood, Nestle, Woolworths, Metcash and Aldi. • Petrochemicals – Includes Chevron Australia / Caltex Australia. • Creative Industries and Media- Includes Fairfax Media, ABC, SBS Network, Seven Network, Nine Network, Network Ten, Animal Logic, Omnilab, KMM, FremantleMedia (Australia) and Jets Digital Group. • ICT, Computer and Software Development –Includes Apple, IBM, Microsoft and Google. • Defence and Aerospace – Includes Thales, GHD, Aerospace & Defence Products, BAE Systems, Raytheon, Schenker Australia and ThyssenKrupp Aerospace. • Bio-Tech and Advanced Manufacturing – Includes Cochlear, Bluescope Steel, Silixsolar and Silanna. • Pharmaceuticals, Chemicals, Bio-Tech & Diagnostic/Pathology Laboratories– Includes Novartis, Bayer, Eli Lilly, Merck Serono Australia, Astra Zeneca, Roche, Novartis, Boehringer Ingelheim, Du Pont, Lavery Health, Douglass Hanley Moir and Johnson and Johnson. • Science, Innovation and Research and Development Centres – Include CSIRO, University of Sydney; University of Technology Sydney (UTS); The ARC Centre for Autonomous Systems; University of NSW (UNSW); National ICT Australia (NICTA); Defence Science & Technology Organisation, Warren Centre for Advanced Engineering, Australian National Fabrication Facility, Advanced Manufacturing Cooperative Research Centre, Australian Nuclear Science and Technology Organisation, Defence Materials Technology Centre & Australian Technology Park. • Tertiary Education – Sydney six major universities are Sydney University, University of NSW, University of Technology, Macquarie University, Australian Catholic University and the University of Western Sydney. There are also secondary campuses for the University of Notre Dame Australia, University of Wollongong and Curtin University of Technology. • Hospitals – There are around 43 public hospitals and 78 private hospitals in Sydney which also include 14 teaching hospitals (e.g. Royal North Shore Hospital, Royal Prince Alfred Hospital, Prince of Wales Hospital, St. Vincent's Hospital, Childrens Hospital at Westmead, Macquarie University Hospital), etc.

Table 8.2: Sydney City Structure Overview Network Structure Extract – Primary Industry Clusters and Network Interactions continued...

Key Highlights:	Comments:
Primary Industry Clusters continued...	• Medical Research Institutions- There are over 16 medical research institutions and include the Garvan Institute of Medical Research, Victor Chang Cardiac Research, St. Vincent's Centre for Applied Medical Research, Children's Medical Research Institute, Children's Cancer Institute of Australia for Medical Research, Melanoma and Skin Cancer Research, Kolling Institute of Medical Research, Bosch Institute – University of Sydney, Ophthalmic Research Institute of Australia, Neuroscience Research Australia, Schizophrenia Research Institute, ANZAC Research Institute, Ingham Institute of Applied Medical Research, Glaxo Smith Kline Medicines Research Unit, Woolcock Institute of Medical Research and Westmead Millennium Institute.
Network Interactions:	• Given the incredibly diverse range of industry clusters and the housing of a large number of multinational/Fortune 500 companies, significant relationships, innovation and production synergies have developed both within and between different cluster groups. Given some of these clusters have a sizeable critical mass, the scales of production/economies of scale provides significant momentum in the business and professional services; banking, insurance and finance; ICT and software, defence and aerospace; pharmaceuticals, chemicals and bio-tech; mining; creative industries and media arenas. • There are also considerable synergies between the private sector and the universities and colleges which provide a stream of highly educated graduates as the new recruits in the labour market. • There are also a number of business incubators, innovation centres and start up networks to provide entrepreneurial advice, introductions to venture capitalists and angel investors as well as government funding and assistance.
Other Considerations:	• GaWC classify Sydney as an <i>Alpha+ city</i> with a <i>Global Network Proportionate Connectivity Score</i> of 0.71 (1.00=London) and the World Economic Forum classify Australia as a <i>Stage 3 Innovation Driven Economy</i>. • The Sydney City to Airport Corridor is a microcosm of Sydney. It is located within a 10km radius of the Sydney CBD and extends from the Sydney CBD through to the Sydney's Domestic and International Airports and Port Botany. It hosts a diverse range of functional activities of global and domestic significance and houses key commercial and infrastructure hubs critical to Australia's economic and commercial development. A report (Leong Willmott 2004c) on the Corridor found: 1) Key to the Corridor's attractiveness are its major linkages (proximity to other CBD and major suburban centres, extensive transport networks, major transport and logistics hubs; 2) The Gap Analysis highlighted large spatial imbalances particularly for the office and industrial markets where there were lengthy supply turnover and construction lag times and the need to preserve industrial zoned lands for high end industrial uses that support servicing the airports and Port Botany; 3) The need to raise Sydney's global competitiveness by improving efficient access to international channels of distribution, key commercial and transport hubs and the specialised knowledge intensive employment base; 4) Further examine office, retail and industrial land consolidation; large site consolidation and re-zoning and development capacities; land use and sensitivity modelling.

Network Structure : Bangalore

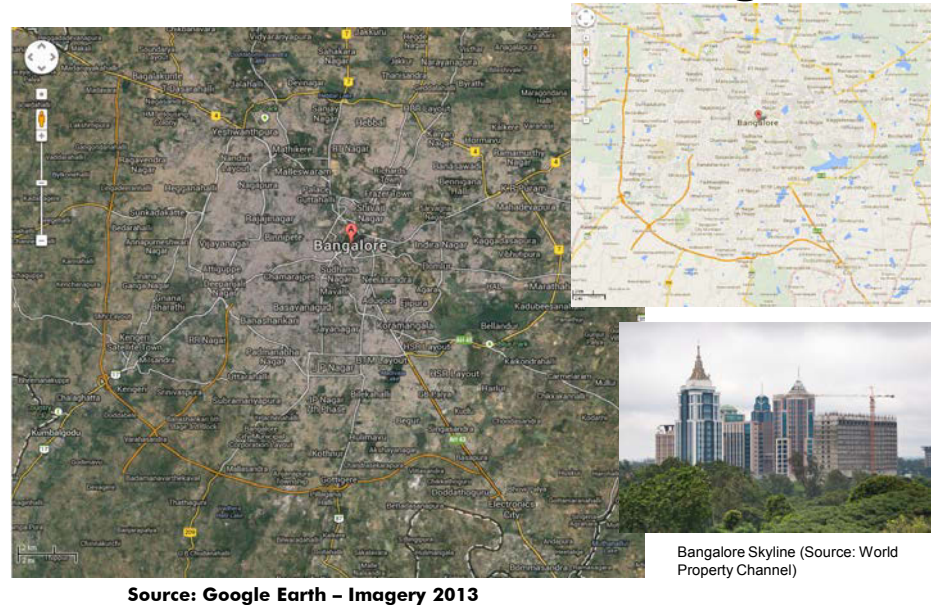


Figure 8.14: Bangalore Network Structure

Observations based extracts from the Key Cities Overview Table for Bangalore (Appendix 5):

- Karnataka state pioneered a comprehensive IT policy, worked cooperatively with city planners and the private sector to develop several industrial parks serviced by high tech infrastructure & actively promoted Bangalore to attract foreign investment (Saxenian 2006).
- Significant relationships and synergies have developed between industry and the educational institutions with regard to providing the requisite education and skills training and research initiatives often funded by local offices of transnational firms e.g. Texas Instruments.
- Significant wealth inequality/disparity between Bangalore's circa 8M computer engineers versus the rest of the city's inhabitants living without basic services (e.g. electricity, roads and water) – it is estimated more than 40% of Bangalore's population live in slums (Kim & Short 2008).
- Key issue with lagging transportation system and other public infrastructure which is not keeping up with private investment and Bangalore's population growth – whilst Bangalore is building the Namma Metro, a rapid transit system to improve transportability, there have been extensive project delays and additional budget costs (Wikipedia 2013r). There is still expected to be a shortfall in providing sufficient transport accessibility and this potentially compromises Bangalore's competitive ability to attract new or maintain existing international firms compared to more attractive, better serviced emerging IT centres across India.

Bangalore Slum: 2013



Source: foreignpolicyblogs.com – Reza Akhlaghi 6/5/2013

Figure 8.15: Bangalore Slum

Bangalore Traffic: 2013



Source: <http://stuarthart.com/blog/2013/09/will-bangalore-become-the-next-detroit.html> – Stuart L. Hart 16/9/2013

Figure 8.16: Bangalore Traffic

Bangalore: International Tech Park



Source: itpbangalore.com

Figure 8.17: Bangalore International Tech Park

Bangalore: Cyber Park



Source: indiacatalog.com

Figure 8.18: Bangalore Cyber Park

Bangalore: Garuda Mall



Source: en.wikipedia.org

Figure 8.19: Bangalore Garuda Mall

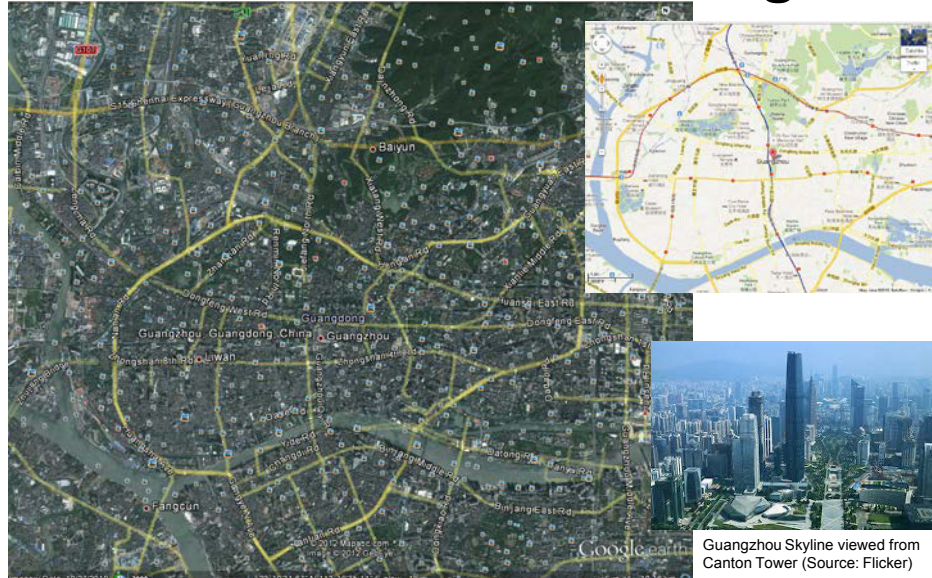
Bangalore: Luxury Villas in Bangalore



Source: www.pruksa.co.in

Figure 8.20: Bangalore Luxury Villas

Network Structure : Guangzhou



Source: Google Earth – Imagery Date 27/10/2010

Figure 8.21: Guangzhou Network Structure

Observations based extracts from the Key Cities Overview Table for Guangzhou (Appendix 5):

- With a significant increase in foreign investment, Guangzhou is the key manufacturing hub on Pearl River Delta where 34 out of China's total 40 industrial manufacturing sectors are located in Guangzhou.
- Guangzhou is divided into four separate state level industrial development zones based on industrial and economic activity under a single administrative committee.
- There are also environmental trade-offs associated with Guangzhou's high level of manufacturing activity. Key concern over Guangzhou's air pollution levels where it was reported by the World Health Organisation that whilst Beijing had four times the concentration of sulphur dioxide as London, Guangzhou in fact had seventeen times the amount of sulphur dioxide as London (Beall & Fox 2009a). This extraordinarily high level of air pollution manifests itself in the city being frequently so thickly immersed in smog that air flights have been cancelled/re-scheduled and also in a wide range of major health problems (e.g. respiratory ailments, cancers) and increased mortality rates. It is anticipated that in line with the Twelfth Five Year Plan, that the 3.5% reduction in carbon dioxide emissions and the 3.5% reduction in energy use will be swiftly realised in Guangzhou and other industrial manufacturing intensive cities/regions (KPMG 2011).

Guangzhou: Yangxi Village



Bird's eye view of Yangxi Village before redevelopment commences

Source: www.lifeofguangzhou.com - Guangzhou Daily

Figure 8.22: Guangzhou Yangxi Village

Guangzhou: Bus Rapid Transit System



Source: www.designother90.org - Design Other 90% Network

Figure 8.23: Guangzhou Bus System

Guangzhou: Guangzhou Economic and Technological Development Zone



Guangzhou Haige Communications Group Incorporated Company – "A hi-tech enterprise group integrating with R&D, manufacturing, marketing and service, providing communication, navigation equipments for all services and arms".

Source: Guangzhou Haige Communications Group Incorporated Company (<http://www.haige.com/en/About81.htm?tid=81>)

Figure 8.24: Guangzhou ETDZ - Haige

Guangzhou: Guangzhou Economic and Technological Development Zone



Guangzhou Tech-Long Packaging Machinery Company – Provides beverage-factory turnkey solutions and includes a 120,000 sqm manufacture workshop for liquid packaging machines.

Source: Guangzhou Tech-Long Packaging Machinery Company (<http://tech-long.en.made-in-china.com/>)

Figure 8.25: Guangzhou ETDZ – Tech Long

Guangzhou Retail: Canton Fair



Shopping in Guangzhou – Canton Fair

Source: www.greatwallvacation.com

Figure 8.26: Guangzhou Canton Fair

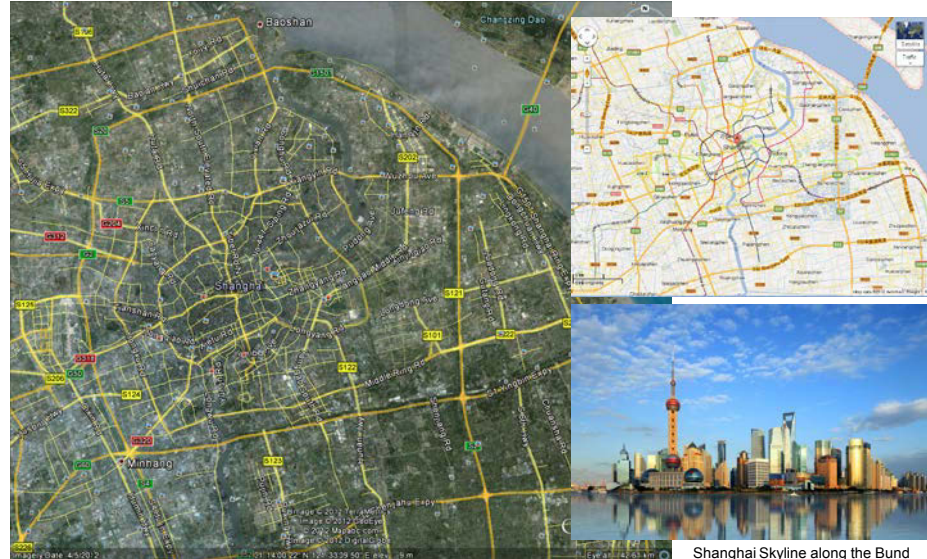
Guangzhou: Tulou Collective Housing



Source: dipeteryi.com

Figure 8.27: Guangzhou Tulou Housing

Network Structure : Shanghai



Source: Google Earth – Imagery Date 5/4/2012

Shanghai Skyline along the Bund
(Source: Luxury Travel)

Figure 8.28: Shanghai Network Structure

Observations based extracts from the Key Cities Overview Table for Shanghai (**Appendix 5**):

- Shanghai's rapid re-development in the 1990s, the transformative market economic reforms and land management practices has propelled Shanghai as a world city and has become mainland China's leading financial centre and a major manufacturing and logistics hub.
- Shanghai has 41 development zones. Fifteen of these are state-level development zones which include 4 state state-level economic and technological development zones, 8 customs surveillance development zones, 1 high tech industrial zone, 1 financial and trade zone and 1 national tourist resort.
- However in transitioning to the next stage of development, it will need to address a number of concerns which include: "inadequate port facilities, unwise location of the new international airport, excess supply of real estate in Pudong, serious traffic congestion, air and water pollutions and the lack of bottom-up development based on rural enterprises in the counties...Perhaps most important of all, Shanghai still lacks the "software" required to make good use of its hardware, that is a well-enforced legal system and protection of intellectual property rights" (**Brunn, Williams and Zeigler 2003: 435-6**).

Shanghai: Record Smog Levels Delays Hundreds of Flights



Source: www.businessinsider.com

Figure 8.29: Shanghai Smog Levels

Shanghai: Shanghai Caohejing High Tech Development Zone



Source: China Ministry of Commerce (<http://www.caohejing.com/enchy/index.asp>)

Figure 8.31: Shanghai Caohejing HTDZ

Shanghai Retail: East Nanjing Street



Source: commons.wikimedia.org

Figure 8.33: Shanghai East Nanjing Street

Shanghai: Road & Port Traffic



Source: dreamstime.com & Wikipedia

Figure 8.30: Shanghai Road & Port Traffic

Shanghai: Shanghai Pudong Zhangjiang Hi-tech Park



Source: english.pudong.gov.au

Figure 8.32: Shanghai Pudong Hi-Tech Park

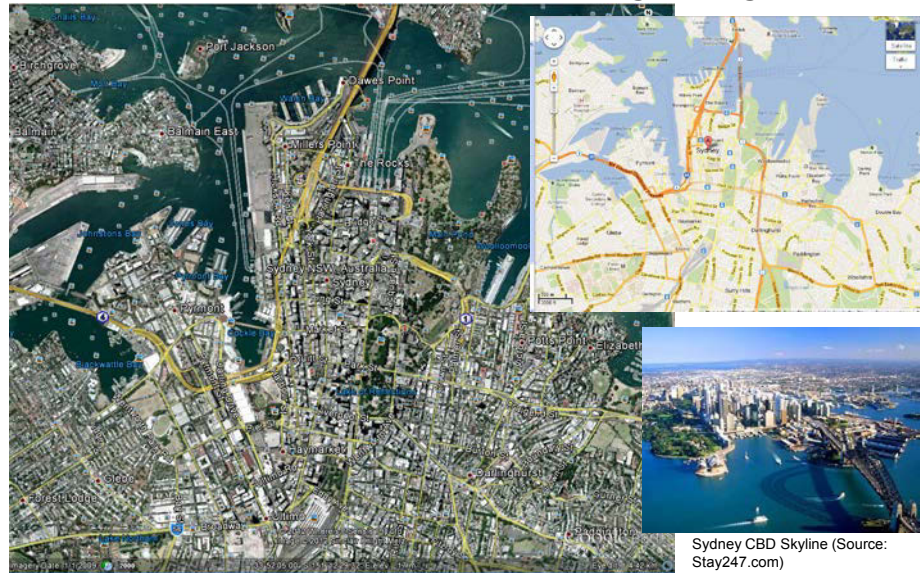
Shanghai: Medium-High Density Housing



Source: madaboutshanghai.com

Figure 8.34: Shanghai Housing

Network Structure: Sydney



Source: Google Earth – Imagery Date 1/1/2009

Figure 8.35: Sydney Network Structure

Observations based extracts from the Key Cities Overview Table for Sydney (Appendix 5):

- In line with Australia’s general trend of rising migration levels, net migration has contributed to Sydney’s population growth and created a greater demand for employment, housing, retail, transport and social infrastructure (schools, universities, hospitals, cultural, leisure and community facilities, public open spaces, etc).
- Sydney tends to specialise in business and professional services; banking, finance and insurance; ICT and software development, creative industries and media; defence and aerospace; medical and science research; education, information and communications technology and advanced manufacturing.
- In spite of its achievements, Sydney does need to make some significant improvements if it is to build on its productivity, innovative capacity, resilience and enhance its global presence and international networks. It has been advocated that whilst Sydney and Melbourne “*demonstrate strength in...Liveability and Attractiveness, Environmental Sustainability and Creativity and Diversity*”, both cities need to improve on the areas of “*Governance, Connectivity and Enterprise Hub*” (Hu, Blakely & Zhou 2013).

DOCTORAL THESIS:

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

MICHELLE LEONG GLASTRIS

Network Structure: Transport



Figure 8.36: Sydney Transport Network

Sydney: Pyrmont, Ultimo, Glebe, Darlington, Redfern & Camperdown - IT, TV, Media, Universities, Hospital, Medical Research & Technology Park



Figure 8.38: Inner Sydney R & D

Sydney CBD: Pitt Street Mall, Sydney



Figure 8.40: Sydney Pitt Street Mall

Sydney CBD: Banking & Finance



Figure 8.37: Sydney CBD – Banking & Finance

Sydney: Macquarie Park, North Ryde



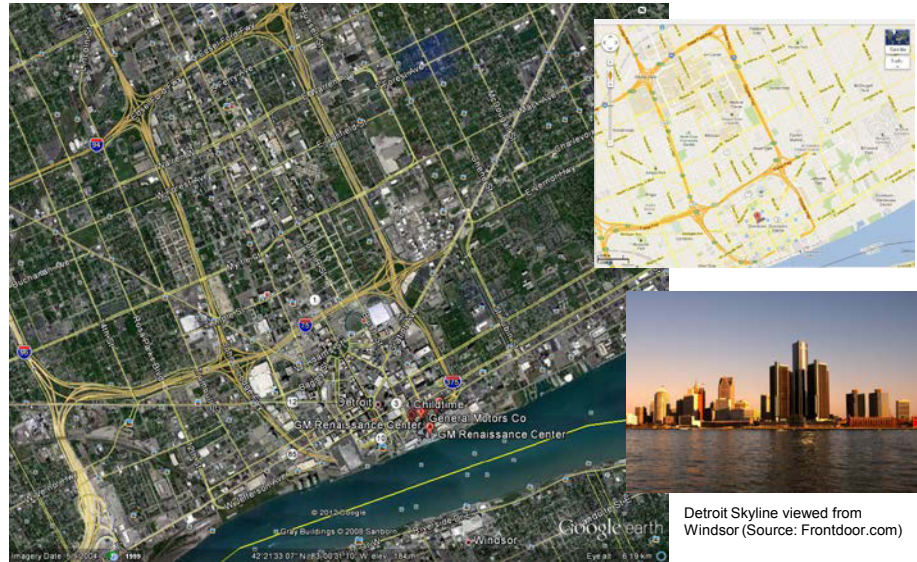
Figure 8.39: Sydney Macquarie Park

Sydney: Housing



Figure 8.41: Sydney Housing

Network Structure : Detroit



Source: Google Earth – Imagery Date 9/5/2009

Figure 8.42: Detroit Network Structure

Observations based extracts from the Key Cities Overview Table for Detroit (**Appendix 5**):

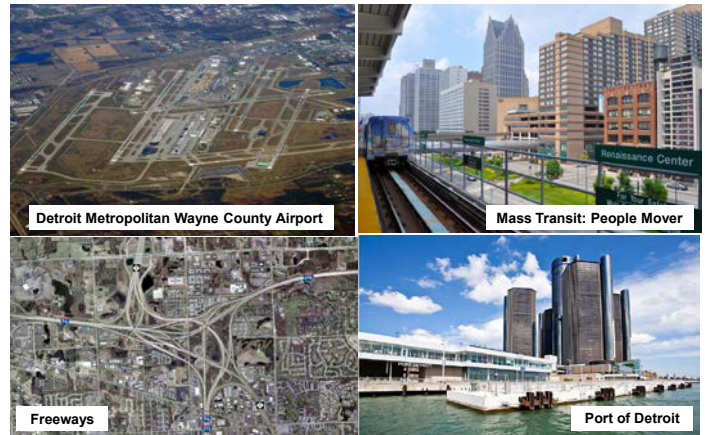
- As an older city, Detroit has found its urban decayed tracts more difficult to revitalise given the housing stock tends to be old/obsolete, poorly maintained with low capital and land values that do not warrant large injections of capital expenditure. There were around 79,725 vacant homes which represented 22.8% of the total housing stock in Detroit City (US Census Bureau 2011a).
- The 78 acre (32 ha) Lafayette Park was built in 1956 by developer Herbert Greenwald and architect Mies van der Rohe. It comprises a number of townhouses and high rise residential apartments located on the Detroit lower east side. With a total construction budget of US\$35M, it has been lauded as a successful urban renewal project.
- Detroit specialises in automobile manufacturing, business and professional services; emerging technologies research and development; banking, finance and insurance; ICT, computer and software development, advertising; medical services, medical, biomedical and science research and education.
- TechTown is a business incubator affiliated with Wayne State University which has assisted biotech startups MitoStem and Asterand.

Detroit: Derelict Buildings and Vacant Lots



Source: smh.com.au, dailymail.co.uk, ecorealtyblogspot.com & voiceofdetroit.net

Network Structure: Transport



Source: flystaralliance.net, somethingfortheeyes.com, wikipedia.org & KMS Photography

Figure 8.43: Detroit Derelict Buildings & Land
Detroit: Major Automobile Manufacturers

Figure 8.44: Detroit Transport Network
Detroit: TechTown & Biotech Firms



Source: GM, Ford & Chrysler websites



Source: psmag.com, crainsdetroit.com & thenewsherald.com

Figure 8.45: Detroit Major Car Manufacturers
Detroit: Hospitals, Medical Research & Universities

Figure 8.46: Detroit TechTown & Biotech Firms
Detroit: Mixed Housing – Lafayette Park



Source: med.wayne.edu, detroitmedicalcentre.org & mybluesperspective.com



Source: freep.com & blog.thedetroittribune.com

Figure 8.47: Detroit Medical R & D

Figure 8.48: Detroit Mixed Housing

Network Structure : New York



Source: Google Earth – Imagery Date 18/6/2010

Figure 8.49: New York Network Structure

Observations based extracts from the Key Cities Overview Table for New York (Appendix 5):

- The **Global Financial Crisis** (GFC) occurred in 2007-2009 and its aftermath which is still be felt globally, had an enormous impact on its epicentre New York as a significant number of global investment banks, other financial institutions, investment markets and unsuspecting home owners and investors were caught in the global financial maelstrom and its systemic effects
- New York predominantly specialises in banking, finance and insurance; business and professional services; health care, biomedical and science research; real estate; ICT and information technology; entertainment, media, film and publishing; and manufacturing.
- “**Silicon Alley**” is host to a number of high tech and media industry clusters located along the Flatiron District down to SoHo and TriBeCa. Silicon Alley has been gaining increasing prominence as a startup leader and is making significant investment inroads compared to Silicon Valley and Route 128 in Boston.

Network Structure: Transport



Source: vosineias.com, 123rf.com, porttechnology.org & wallpaper.com

New York: Finance, Banking & Insurance



Source: flickr.com, clandestinoweb.com, guardianlv.com & businessweek.com

Figure 8.50: New York Transport Structure

Figure 8.51: New York Finance, Banking & Insurance

New York: Homeless Shelters & Luxury Apartments



Source: jplaffont.photoshelter.com, theguardian.com, kbjackson.com & nydesignagenda.com

Figure 8.52: New York Housing

New York: Hospitals, Medical Research & Universities



Source: healthusnews.com, jacobipem.com, cap.bnl.gov & nygenome.org

Figure 8.53: New York Medical R & D

New York: Silicon Alley



Source: iml.jou.ufl.edu & racetalkblog.com

Figure 8.54: New York Silicon Alley

New York: Performing Arts & Museums



Source: macaulay.cuny.edu, opera-is.com, topboxdesign.com & visionaryartistrymag.com

Figure 8.55: New York Performing Arts & Museums

8.4.3 Development Performance Trajectory Benchmarking

As mentioned earlier in section **8.2 Process**, the purpose of Development Performance Trajectory Benchmarking is to gauge the future performance of the key city structures using historical performance.

This is achieved by evaluating whether the projected trend (i.e. **13 FAv**, 13 year Forecasted Average (2013-2025)) is likely to trend above, below or around the historical trend (i.e. **33 HAv**, 33 year Historical Average (1980-2012)).

This comparative approach was undertaken for the POP, GDP, HDI and EMP Velocities as well as Economic, Household and Employment Resiliencies. However for the proof of concept purposes of this analysis and because the economic indicator trends (GDP, HDI and EMP) were similar, only POP and GDP Velocities and Economic Resilience have been showcased in **Table 8.3: Compositional Aspects of City Structure Population: Development Performance Trajectory Benchmarking**. Also included in the table for reference purposes were Population Magnitude and Density figures.

Whilst derived trajectory indicator growth rates have been evaluated, it is also important to note the **Population Magnitude** to assess if growth levels are coming off a low base or whether the city structure has Megacity status – in this instance, both New York and Shanghai qualify as Megacities (greater than 20M).

Whilst New York's city population stands at 20.1M and was the largest of all the key cities in 2010, Shanghai's city population is expected to eclipse the former by 2025 with an annual growth rate of 2.8% at 28.4M people. The largest annual growth rates between 2010-2025 are expected to occur in Bangalore at 3.7% pa where its population is expected to rise to 13.2M and Guangzhou at 3.0% pa where it population will increase to 15.5M people. Over the next 13 years, more developed or obsolescence-decline cities are expected to record much slower annual growth rates: New York at 1.1%, Detroit and 1.4% and Sydney at 1.6%.

Population Density provides insights into how tightly packed inhabitants live within their city structure; reliance on mass transit or public transport system to move residents, workers and visitors in, out and around the city structure; and the capacity to absorb higher population levels in conjunction with evaluating existing and future land, housing, infrastructure and amenity capacity levels.

Whilst population density forecasts were unavailable from Demographia, the 2013 population densities provide an indication of current ranking. Early Emerging city Bangalore had the densest city population at 12,300 people per km² whilst emerging/re-growth cities Shanghai and

Guangzhou followed in the next level. The maturing, mature and obsolescence-decline cities trailed behind the pack with less than 2,000 people per km².

Population Velocity, GDP Velocity and Economic Resilience can also be used to provide useful benchmark information about historical and future city structure development performance i.e. development trajectories.

For example, Shanghai has a historical average POP Velocity of around 391,700 people pa but in 2013-2025, population growth is expected to slow by around 23% with the forecasted average trending lower at 298,200 people pa – this can be attributed to some of its population relocating to newer cities that provide better employment and housing prospects. In contrast, Shanghai's GDP is expected to considerably ramp up where its GDP Velocity is expected to quadruple from 6,600 to 26,200 US\$M pa. As its workforce and residential population learns to adapt and become more economically responsive, its Economic Resilience is expected to significantly improve from 1.5% to 20.9%. Both Guangzhou and Bangalore follow similar trends to Shanghai. Part of the reason for the slowdown in POP Velocity may be that it has witnessed most of its high POP growth in the previous decades and that it cannot continue to sustain such high POP velocities. So whilst the populations for these three cities will continue to grow, the rate of growth or POP Velocity will decline. In reality, potential inhabitants may also be detracted by the lack of affordable housing, large inequalities between rich and poor, the overcrowding, the traffic congestion, etc and/or may find better employment and accommodation prospects in alternative cities.

Sydney's future development performance is expected to continue on a relatively stable growth trajectory where the forecasted trend will hover close to/below the historical trend. Whilst Sydney's population will rise in absolute numbers to 5.6M people, the 13FAv POP Velocity of 32,600 people pa is expected to trend below the 33HAv POP Velocity of 39,200 people pa. Similarly over the next 13 years, GDP Velocity is expected to trend around 15% lower than the historical equilibrium whilst the 13FAv Economic Resilience is expected to stay on par.

Table 8.3: Compositional Aspects of City Structures: Development Performance Trajectory Benchmarking

Compositional Aspects of City Structure Population: Development Performance Trajectory Benchmarking					
City Structure:	Population Magnitude¹ (M, No. of People)	Population Density² (No. of People / km²)	Population Velocity^{3&4} (No. of People pa) Note: 33 Hav (1980-2012) Note: 13 Fav (2013-2025)	GDP Velocity^{3&4} (US\$M pa) Note: 33 Hav (1980-2012) Note: 13 Fav (2013-2025)	Economic Resilience^{3&4} (%) Note: 33 Hav (1980-2012) Note: 13 Fav (2013-2025)
Bangalore	2010: 8.275M 2025: 13.193M	2013: 12,300	33 Hav: 686,900 13 Fav: 420,700	33 Hav: 3,600 13 Fav: 8,900	33 Hav: 0.6 13 Fav: 2.3
Guangzhou	2010: 10.486M 2025: 15.474M	2013: 5,600	33 Hav: 293,800 13 Fav: 153,100	33 Hav: 7,400 13 Fav: 18,200	33 Hav: 4.4 13 Fav: 14.2
Shanghai (Megacity)	2010: 19.554M 2025: 28.404M	2013: 6,200	33 Hav: 391,700 13 Fav: 298,200	33 Hav: 6,600 13 Fav: 26,200	33 Hav: 1.5 13 Fav: 20.9
Sydney	2010: 4.479M 2025: 5.646M	2013: 1,900	33 Hav: 39,200 13 Fav: 32,600	33 Hav: 4,000 13 Fav: 3,400	33 Hav: 10.4 13 Fav: 10.4
Detroit	2010: 4.364M 2025: 5.345M	2013: 1,100	33 Hav: Neg. 11,900 13 Fav: 12,700	33 Hav: Neg. 900 13 Fav: 3,800	33 Hav: Neg. 14.3 13 Fav: 49.3
New York (Megacity)	2010: 20.104M 2025: 23.572M	2013: 1,800	33 Hav: 112,700 13 Fav: 182,200	33 Hav: 16,000 13 Fav: 39,500	33 Hav: 86.5 13 Fav: 21.7

Source: United Nations¹; Demographia²; United Nations²; Oxford Economics³; Research, Methodology & Analysis Developed By Leong Glastris⁴

Note: 33 HAv denotes 33 year Historical Average (1980-2012) and 13 FAv denotes 13 year Forecasted Average (2013-2025).

Both USA cities are expected to see rises in their relative populations and Oxford Economics appears to have factored in an economic comeback for Detroit. Detroit's 13FAv POP Velocity is expected to make a dramatic turnaround averaging 12,700 people pa compared to the 33HAv of negative 11,900 people pa. With an increase in city population, Detroit is also expected to make headway with its 13FAv GDP Velocity of 3,800 US\$M trending significantly higher than its historical counterpart at negative 900 US\$M pa and its 13FAv Economic Resilience also making amends with its 13FAv at 49.3% more than quadrupling its 33HAv at negative 14.3%. New York GDP Velocity is also forecasted to do well where the 13FAv of 39,500 US\$M pa is expected to trend 2.5 times its historical average and the forecasted lower Economic Resilience indicates the Big Apple will have a chance to settle into a relatively less volatile period over the next 13 years.

The ability to use these indicators as development performance benchmarking tools, provides a relatively easy and consistent way to gauge a city structure's future performance trends. As a further extension of investigation and refinement of this research, a range of scenarios modelling the impact of different events would also be a useful aspect to evaluate as it would give a better indication of sensitivities, likely magnitude ranges and recovery times.

8.5 Chapter Conclusion

Chapter 8 Compositional Aspects of City Structure Population is the final proof of concept chapter (Chapters 5-8) and constitutes Analysis B. The chapter supplements the work undertaken in Analysis A (Chapters 5-7) by constructing a methodology and examining the fundamental make-up of city structure population that impacts aspects such as productivity, capacity and resilience.

The knowledge gained from this chapter provides fellow researchers and practitioners with the following insights on city structure development:

- Identifies the 11 remaining Critical Indicators across the Governance, Economic, Social and Environment sectors used in the compositional analysis of city structure population;
- Highlights the critical role of network structures where their development creates knowledge and innovation systems and the intrinsic value of creating intelligent environments within city structures to foster and sustain innovative capacity;
- Provides an evaluation of network structures in Bangalore, Guangzhou, Shanghai, Sydney, Detroit and New York which includes their primary industry clusters and network interactions;
- Develops a development performance benchmarking methodology and uses this methodology to evaluate projected/forecasted performance against historical performance for POP and GDP Velocities and Economic Resilience for the six key cities.

Chapter 9

Conclusions and Recommendations



Sydney CBD Midtown and City Core Precincts

Source: Kyle Willimott

“If you think in terms of a year, plant a seed; if in terms of ten years, plant trees; if in terms of 100 years, teach the people.”

(Confucius, Chinese philosopher, 551BC - 479BC)

9 Conclusions and Recommendations

9.1 Chapter Outline

The final chapter seeks to draw together the key themes and concepts by highlighting major findings; reviews the thesis proposition in light of the initial objectives set by the Candidate and also discusses recommendations for further applications, refinements and investigations. The chapter closes with concluding remarks.

9.2 Conclusions: Key Themes and Concepts

In this section, the key themes and concepts are highlighted from the following key chapters.

9.2.1 Chapter 1 Introduction

The first chapter presented a road map of the thesis by providing an outline of the thesis chapters; a thesis overview; the rationale for undertaking the proposed research; expected outcomes and contribution to the field of knowledge and concluded with a profile of the Doctoral Candidate.

9.2.2 Chapter 2 Literature Review: Evolution of City Structures

The Literature Review draws from the diverse fields of urban geography, urban development and strategic planning and investigations were structured along four stages.

The first stage of the investigation examined definitions for “City” and “City Structure” and for the purposes of the thesis, arrived at developing a new definition for **City Structure** – “*A **city structure** is an evolutionary process determined by its network of functional activities; relationships; capital and knowledge flows which influence its growth and density as it transitions through a series of development stages.*” This definition moves away from the physical configuration based definitions of a city and traditional city structure to reflect the increasingly **critical role of networks** of functional activities, relationships and capital and knowledge flows prevalent in the current phase of city structure evolution.

The second stage of the Literature Review investigated the evolution of city structures. It is advocated city structures have evolved in four distinct phases where significant technological advancements have typically been the catalyst for the start of each new phase. However throughout these phases, the importance of the city structure as a key meeting place for higher order level commerce and the requisite functional (economic, governance, social and environment) activities and networks that formed to shape and support city structure development. The current phase, **knowledge based development**, is

founded on the age of technological transformation; knowledge transformation; speed of information transmittal and dissemination; and space of flows. It is this knowledge based development phase that provides the research impetus for the thesis. The importance of **network capabilities** within city structures was also highlighted in terms of shaping intelligent environments which foster innovation, innovative capability and behaviour.

The third investigative stage reviewed city structure development as a **staged process**. Whilst the Urbanisation Cycle gave a useful breakdown of development stages for countries, it had limited value in tracking well established city structures that were approaching around 75-80% urbanisation levels in the terminal stage of development due to their limited growth rates. Similarly there were limitations in using the stages of development for economic competitiveness advocated by the World Economic Forum as these stages were based at a country level and the city population growth trajectories advocated by Turok and Mykhnenko (2007) which provided useful trend analysis but were limited in its ability to compare city structures at different development stages. Consequently the need for devising a staged development process for city structures was highlighted and later formulated as a **six stage development process as part of the methodology** for the thesis. For the purposes of the thesis, a definition was also constructed for **City Structure Development Performance**: “*Development performance is defined as the manner in which a city structure fulfils and evolves/develops around its functional networks*”.

The fourth stage of the Literature Review investigated the key drivers of city structure development. It was acknowledged there was a diverse range of indicators and based on the indicator investigations, these could be structured across four key sectors – **Governance, Economic, Social** and **Environment**. From the Review, two key drivers emerged – **City Structure Population** and **Economic Growth/GDP**. They are significant because City Structure Population is regarded as a consequence of and influence on urban and economic conditions and economic growth/GDP is a measure of economic productivity within a city. Both act as universal drivers that relate to a wide range of sectoral indicators.

There were two seminal works that influenced the development of the research design – the research undertaken by Turok and Mykhnenko (2007) and by Shen, Peng, Zhang and Wu (2011). From these seminal works, the research gap was identified and the points of departure for development of the proposed research. The development of research encapsulated applying a **rate of change approach** to city population

and key economic indicators at a city structure level; examining **development trends and trajectories** of city structures through four critical indicators and their **development performance derivations**; supplementing this research with an analysis of the **compositional aspects of city structure population** to better understand changes from within a city structure's population that impact its productivity, capacity and resilience.

9.2.3 Chapter 3 Research Methodology and Data Collection

Chapter 3 establishes the **rationale** and **methodological framework** for the thesis. It commences with a discussion on the methodological approach; research framework and design; research methodology and data collection; and concludes with a review of the key assumptions and limitations associated with the proposed research.

The **thesis methodology** proposed was a six stage process which comprised developing the thesis topic, hypothesis, research framework and design; undertaking the literature review; constructing the research methodology and collecting the data; developing the frames of reference; demonstrating the proof of concept by undertaking Analysis A (key indicator analysis; development performance trajectory analysis; city structure development stages and points of confluence) and Analysis B (compositional aspects of city structure population) before making the thesis conclusion and recommendations.

In developing the **thesis topic** and **working hypothesis**, a series of meta and research questions were raised. This in turn informed the **research framework** and **research design** for the proposed thesis. The conceptual framework for the research design (**Figure 3.4**) identified the **inputs, analyses, outputs** and the **independent, control and dependent variables**. The **outcomes from Analyses A and B** are collectively used to explain the development performance of city structures. There was also an iterative process between developing the thesis topic, hypothesis, research framework and design (stage 1) and undertaking the literature review (stage 2) where a feedback loop was used to inform the development and completion of both stages.

The **research methodology** comprised four key stages (indicator selection; city selection; data sources and data treatment) where in turn, each stage involved a detailed process specifically developed for the thesis. The **indicator selection process** (detailed in Sub section **3.4.1 Indicator Selection Process** and charted in **Figure 3.5: Indicator Selection Process**) mapped out a procedure and criteria for selecting indicators for the City Structure Universal Indicator Matrix

and the City Structure Critical Indicator Matrix; explains the rationale (e.g. structural framework, scales of significance, profile overlay and selection criteria employed) for selecting the indicators and the identification of City Structure Population and GDP as key drivers and their correlation with the other 23 critical indicators selected. The distinction was made that key drivers exhibit a universal and strong relationship with each of the critical indicators – this was proved qualitatively (**Appendix 3: City Structure Critical Indicator Matrix**) and quantitatively (**Appendix 4: Correlation Tables – Critical Indicators**). **City selection** was based on applying the Profile Overlay: city Structure Development Stages to select the key and cross reference cities to facilitate the study of the six development stages within a city structure's life cycle and to also ensure appropriate sample representation with regards to development stage and geographic region. **Data was sourced** from institutional sources and included publicly available data at country and/or city level from seven sources (World Bank, United Nations, International Monetary Fund, Demographia, GaWC/Professor Taylor, CBRE and the OECD) and where city level economic and population data was unavailable, customised data was obtained directly from Oxford Economics. Procedures were constructed for **data treatment** with respect to data compilation, screening and normalisation for the 76 indicators in 31 cities, 19 countries and world aggregates for timeframes that varied between 1950-2100.

In terms of **key assumptions**, where available from the data providers definitions, research methodology for constructing the indicator and collecting the data and any other relevant assumptions such as forecast assumptions were summarily noted in the City Structure Universal Indicator Matrix (refer to **Appendix 2**). With regards to **key limitations**, numerous challenges were identified, evaluated and resolved. These included obtaining data over a significant time series; obtaining indicator data at a city level; obtaining appropriate geographic coverage at a city level; resolving different data assumptions and limitations from multiple data sources; challenging research methodologies from data source providers; capturing value from indicator data with a short time series; dealing with the lack of transparency in research methodology for city based indices; and reliability of the data and data methodology. Each of these challenges was overcome and the resolution discussed in Section **3.5 Assumptions and Limitations of Research Methodology and Data Collection**.

9.2.4 Chapter 4 Frames of Reference

The chapter explores the concept of “*Systems Thinking*” and how it can be applied to the research of city structures. This thesis developed concept of Frames of Reference was introduced as a way to **position** (Key Protagonists; City Structure Information System), **store** (City Structure Universal Indicator) and/or **filter** (Scale of Significance; Profile Overlays) **segments of knowledge**.

The first frame of Reference introduced identifies and positions the **Key Protagonists** responsible for driving city structure development and were broadly classified as Regulators, Generators and Actuators (refer to Sub section 4.4 for explanation and flowchart **Figure 4.2**). The second frame of reference, **City Structure Information System**, is used to pull together a vast array of information and analyses in a formalised structure and acts as a wide repository of information across the key sectors and positions those segments of knowledge within a wider universe of knowledge. The **City Structure Universal Indicator Matrix** is the third frame of reference and is primarily used as a repository for the 76 universal indicators and associated data and is used at an intermediary scale before short listing down to the 25 critical indicators for the City Structure Critical Indicator Matrix. The fourth frame of reference developed was the **Scale of Significance** (scales identified: global, trans-regional, country, state, city and market/suburb/precinct) and is used to filter knowledge at a category specific scale to determine the level of scale that an analysis should be undertaken and to identify the level an indicator’s dataset. The fifth and final frame of reference comprises the **Profile Overlays** used as filter templates to compare city structures by different categories.

9.2.5 Chapter 5 Proof of Concept: Key Indicator Analysis

As the first proof of concept, the chapter establishes the basis (process, key assumptions and limitations) for undertaking the longitudinal and cross sectional analyses and presents the results and analyses.

The **key concepts** explored include the process developed to undertake the analyses - this included the identification of 25 Critical Indicators and their pathways and application (refer to **Table 9.1: City Structure Critical Indicator Matrix – Summary List** and to Section 5.2 Process and **Figure 5.1** for further details).

City Structure Critical Indicator Matrix – Summary List	
1) Claims on Central Government (% GDP)	14A) City Structure Population A: Total City Population, POP (000's People)
2) Health Expenditure (% GDP)	14B) City Structure Population B: Population of Urban Agglomerations with 750,000 or More Inhabitants (000's People)
3) Public Spending on Education (% GDP)	15) Prison Population Rate (No. Per 100,000 Inhabitants)
4) Military Expenditure (% GDP)	16) Revenue Multiplier (Sq ft / Person)
5) Current Account Balance (% GDP)	17) Population Density (No. of People / km ²)
6) Inflation, Consumer Prices (Annual %)	18) Net Migration (No. of People pa)
7) Total Investment (% GDP)	19) Total Dependency Ratio (%)
8) Urban Population or Urbanisation Rate (% Total)	20) Completed Tertiary Educational Entertainment (% of Total Population)
9) Research and Development Expenditure (% GDP)	21) City Office Occupancy Costs (US\$ / Sq ft pa)
10) Global Network Connectivity Score	22) Hospital Beds (per 1,000 People)
11) Gross Domestic Product, GDP (US\$M)	23) Energy Use (Kg of Oil Equivalent per Capita)
12) Household Disposable Income, HDI (US\$M)	24) Motor Vehicles (per 1,000 People)
13) Employment, EMP (000's People)	25) Carbon Dioxide Emissions (Metric Tons of CO ² per Capita)
Note: Critical Indicators 11, 12, 13 and 14A were used to calculate the 11 Derived Trajectory Indicators	

Table 9.1: City Structure Critical Indicator Matrix – Summary List

The first stage of *Analysis A: City Structure Development Performance Trajectory Analysis* were the **longitudinal** (eight indicators) and **cross sectional** (two indicators) **analyses**.

The **key assumptions** highlighted the importance of having a fundamental understanding of the evolution of the six key cities (overview information for the key cities presented in Appendix 5). It was also critical to consider the impact of macro/global events, location specific events and structural changes to provide a context when evaluating development trends and patterns of these indicators and to better understand why “blips” were occurring (Sub section **5.3.2 Key Assumptions**).

The **key limitations** highlighted the indicator analyses represented snapshots of the state of the country or city structure economy and population at particular points in time – some were over a short term with historical data of less than 15 years whilst others were over a longer term trend with historical data of 15 years or more. There were

also limited instances where there were missing data points and this was duly noted in the City Structure Universal Indicator Matrix and the subsequent data treatment noted on the graphs and in the analysis.

The **results and analyses** highlighted the trends and patterns occurring with each of the ten indicators across the six key cities and where available the world aggregate, as well as the implications for the development of city structures.

9.2.6 Chapter 6 Proof of Concept: Development Performance Trajectory Analysis

The second proof of concept chapter establishes the basis (process, key assumptions and limitations) for deriving a unique set of formulae for Development Performance Trajectory Indicators to calculate POP, GDP, HDI and EMP permutations for Velocity, Acceleration and Resilience and presents the results and analysis.

Key concepts included the process and formulae developed to derive the 11 City Structure Development Performance Trajectory Indicators (refer to **Table 9.2: City Structure Derived Trajectory Indicators – Summary List** and to Section **6.2 Process** for further details). The first order critical indicators (GDP, HDI, EMP and POP) were used to derive the second order permutations (GDP, HDI, EMP and POP Velocities) to examine growth rates and the third order permutations (GDP, HDI, EMP and POP Accelerations) to examine changes in those growth rates and inflection points. The fourth order permutations (Economic, Household and Employment Resiliencies) were used to evaluate the responsiveness of the GDP, HDI and EMP Velocities with respect to the POP Velocity.

City Structure Derived Trajectory Indicators – Summary List	
1) GDP Velocity (US\$M pa)	7) EMP Acceleration (No. of People pa ²)
2) HDI Velocity (US\$M pa)	8) POP Acceleration (No. of People pa ²)
3) EMP Velocity (No. of People pa)	9) Economic Resilience (%)
4) POP Velocity (No. of People pa)	10) Household Resilience (%)
5) GDP Acceleration (US\$M pa ²)	11) Employment Resilience (%)
6) HDI Acceleration (US\$M pa ²)	
Notes: 1) Critical Indicators 11, 12, 13 and 14A listed in Table 9.1 were used to calculate the 11 Derived Trajectory Indicators 2) GDP = Gross Domestic Product; HDI = Household Disposable Income; EMP = Employment & POP = Population	

Table 9.2: City Structure Derived Trajectory Indicators – Summary List

Key assumptions discussed in Chapter 5 regarding Major Events and Structural Changes (Sub section **5.3.2 Key Assumptions**) still applied to the City Structure Development Performance Trajectory Analysis. It was also noted the timeframe for the analyses covers up to 33 years and includes recent major events, structural changes as well as several business/economic cycles. This permitted an evaluation of the city structure's response to these factors with regards to the Development Performance Trajectory Indicators (velocities, accelerations and resiliencies).

Three **key limitations** were highlighted in undertaking the analysis. First, in reading the population growth trajectories chart where it was found that unlike Turok and Mykhnenko's (2007) single trajectory paths, the majority of city structures often exhibited a combination of two or more trajectory paths over the timeframe examined. Second, there was a difference in the time frequency between city population data points between United Nations and the Oxford Economics datasets – this was duly noted on the graphs, in the analysis and City Structure Universal Indicator Matrix. Thirdly, there were some instances where the geographic boundaries and definitions between the United Nations and Oxford Economics datasets did not match - this occurred primarily for Indian cities Bangalore and Mumbai where the United Nations and other data providers were able to provide data at the city level, however Oxford Economics were only able to provide population and economic data at the state level – again this was noted on the graphs, in the analysis and City Structure Universal Indicator Matrix.

The **results and analyses** highlighted the trends and patterns for each of the four Critical Indicators and 11 Derived Trajectory Indicators across the six key cities and the implications for the development of city structures. The 15 indicators provided a useful evaluative platform and toolkit to undertake both a qualitative and quantitative analysis and enabled a like-for-like comparison across a range of city structures that are developmentally and geographically diverse.

9.2.7 Chapter 7 Proof of Concept: City Structure Development Stages and Points of Confluence

The third proof of concept chapter represents the final stage of Analysis A and establishes the basis (process, key assumptions and limitations) for building on the Development Performance Trajectory Analysis with respect to the six development stages and presents the results in a series of summary tables and charts.

Key concepts included the process of applying the Development Performance Trajectory Analysis across the wider sample of 29 key and cross reference cities to more fully ascertain common performance characteristics associated with the different development stages. This was undertaken in two parts – the first part comprised a compilation of a series of comparative tables and charts which involved taking historical averages as a condensed snapshot in time (1980-2012) to ascertain equilibrium points and to compare city structures at different development stages. The second part involved assessing points of confluence by examining different combinations and subsets of Derived Trajectory Indicators to gain further instructive insights on common characteristics of city structures within certain categories of development stages.

Key assumptions discussed in Chapter 5 regarding Major Events and Structural Changes (Sub section **5.3.2 Key Assumptions**) still applied to the City Structure Development Stages and Points of Confluence analysis. This was illustrated in the discussion of terrorist attacks in London, Manchester and New York and their impact on historical average calculations for City Structure POP and GDP Velocities and Economic, Household and Employment Resiliencies. The ability to cover development trends up to 33 years enabled the analysis to include recent major events, structural changes and a number of business/economic cycles. It was also advocated future performance could be benchmarked against the historical performance and provide a better understanding of the impact of future major macro events on a city structure's future development performance.

There were also **key limitations** associated with the analysis. These were identified and discussed in detail (refer to Sub section **7.3.3**). In evaluating indicative ranges for the development stages based on the City Structure POP and GDP Velocities and Economic, Household and Employment Resiliencies, it was acknowledged these threshold ranges alone were not sufficiently definitive to quantitatively define each development stage due to the lack of city level data. Therefore it was necessary to assess the development stages by looking at different combinations and sub sets of derived trajectory indicators. This approach was adopted in the construction of the Points of Confluence graphs which enabled better identification of the common characteristics across city structures in different development stages.

The **results and analyses** highlighted the valuable insights the development performance trajectory analysis of the key and cross reference cities afforded to the understanding of the development stages and development performance of city structures. By expanding

the “evaluative toolkit” in using historical average data tables and graphs, indicative ranges and points of confluence graphs, a better understanding and quantitative assessment were gained on the different development stages of city structures and their expected performance characteristics.

9.2.8 Chapter 8 Proof of Concept: Compositional Aspects of City Structure Population

The fourth and final proof of concept chapter constitutes Analysis B and establishes the basis (process, key assumptions and limitations) supplementing the work undertaken in Analysis B and presents the results and analyses.

Key concepts included the process developed to undertake the analyses which was undertaken in three stages. The first stage examined the outstanding 11 Critical Indicators which were identified as Compositional Indicators due to their ability to provide a better understanding of the compositional make-up of a city structure population and the changes acting from within the population that potentially impact its productivity, capacity and resilience. The second stage examined the concept of Network Structures and investigated the primary industries and key industry clusters within the six city structures. In the third stage, the concept of Development Performance Trajectory Benchmarking was introduced and developed to gauge the future performance of city structures.

Key assumptions discussed in Chapter 5 regarding Major Events and Structural Changes (Sub section **5.3.2 Key Assumptions**) applied to the Compositional, Network Structure and Development Performance Trajectory Benchmarking Analyses. It was acknowledged that in using the projections/forecasts provided by the United Nations and Oxford Economics, the Development Performance Trajectory Benchmarking Analysis also assumes their growth assumptions and model forecasting methodologies. It was also noted that in using historical performance to benchmark future performance, whilst future major events and structural changes will differ, what is instructive is the city structure’s response to past events and structural changes to better gauge how city structures may respond to similar events/structural changes in the future.

In terms of **key limitations** associated with the adoption of the United Nations and Oxford Economics’ forecasts and model forecasting methodologies was noted. It was also acknowledged using equilibrium points or historical averages over a short timeframe can change

dramatically but over a longer timeframe of 30-60 plus years do not move substantially. Furthermore whilst these historical factors will not be identical in the future, it was advocated there was still inherent value in assessing a city structure's responsiveness to the type, magnitude and range of historical major events and structural changes – this was to gain a better understanding of identifying future risks and developing risk management strategies when major events and structural changes occur of a similar type, magnitude and/or range. This enables Key Protagonists to develop better policy and operational coping mechanisms in the future planning, investment and development of city structures.

The **results and analyses** demonstrated the valuable insights gained in using the remaining 11 Critical Indicators in the Compositional Indicator Analysis – indicators such as the Prison Population Rate, Revenue Multiplier, City Population Densities, Net Migration, Total Dependency Ratio, Completed Tertiary Education Attainment; Energy Use, Number of Hospital Beds and Motor Vehicles, Carbon Dioxide Emissions, etc provide indications of how well a City Structure deals with Governance, economic, Social and Environment issues. The critical role of network structures and their capacity to create knowledge and innovation systems and the intrinsic value of creating intelligent environments to foster innovative capacity was paramount. Network structures in Bangalore, Guangzhou, Shanghai, Sydney, Detroit and New York was evaluated and in particular, their primary industry clusters and network interactions. The preliminary analysis of primary industry clusters and network interactions underscored the critical role networks of relationships, knowledge flows and capital play in shaping city structures. The scope, depth and maturity of these networks enable a city structure to adapt and evolve by gaining synergistic benefits between various industry clusters to achieve greater economic diversity, productivity, innovative capacity and resilience. Finally the Development Performance Trajectory Benchmarking Analysis demonstrated useful insights and predictive value in assessing the historical performance of indicators such as POP and GDP Velocities and Economic Resilience to gauge a city structure's projected/forecasted performance.

9.3 Conclusions: Thesis Proposition - Response

The following sections re-visits the thesis proposition established at the beginning of this research journey with regards to the Meta Questions; Primary Research Questions; Working Hypothesis; Purpose and Objectives; Expected Outcomes; and Contribution to the Field of

Knowledge. The purpose is to highlight how and where these parameters have been addressed and is succinctly undertaken in a series of tables as bullet points substantiated with references to the appropriate sections in the thesis.

The City Structure Information System chart (**Figure 4.3**) discussed in the Frames of Reference chapter (**Section 4.5**) was applied to the study of the *Evaluation of Key Drivers in the Development Performance of City Structures* specifically undertaken for the thesis and is charted in **Figure 9.1: Roadmap - City Structure Information System: Evaluation of Key Drivers in the Development Performance of City Structures** or as an A3 sized chart in **Chapter 10 Appendix 1: Key Reference Charts – vi**) Roadmap - City Structure Information System: Evaluation of Key Drivers in the Development Performance of City Structures. The chart captures and highlights the overall inputs, processes and outcomes in undertaking the proposed research and acts as a “Roadmap” for reference purposes. The Roadmap also maps out key functionalities, the interrelationships of variables/determinants and positions key segments of knowledge (**Figure 9.1**).

It should be noted that Outcomes listed in the Thesis Proposition Response table (**Table 9.3**) are structured across three tiers. The outcomes first tier is tabled as 6A) Expected Thesis Outcomes and are the overall Expected Outcomes prescribed in the Introduction (**Section 1.7**). The outcomes second tier is tabled as 6B) City Structure Development Performance – Key Outcomes from Pre-Analysis Stages and highlight the key outputs produced from the pre-analysis stages i.e. Literature Review, Research Methodology and Data Collection and Frames of Reference. The outcomes third tier is tabled as 6C) City Structure Development Performance – Key Outcomes from Analyses A and B and are the specific outputs used to collectively explain City Structure Development Performance. These are the City Structure Development Performance Outputs/Outcomes referred to in **Figure 3.4: Research Design: Conceptual Framework; Figure 4.3: City Structure Information System** and more specifically in **Figure 9.1: City Structure Information System: Evaluation of Key Drivers in the Development Performance of City Structures**.

The **Contribution to the Field of Knowledge** is broken down into four key categories – 7A) Contribution to Theory; 7B) Contribution to Methodology; 7C) Contribution to Policy and 7D) Contribution to Practice.

Roadmap - City Structure Information System : Evaluation of Key Drivers in the Development Performance of City Structures

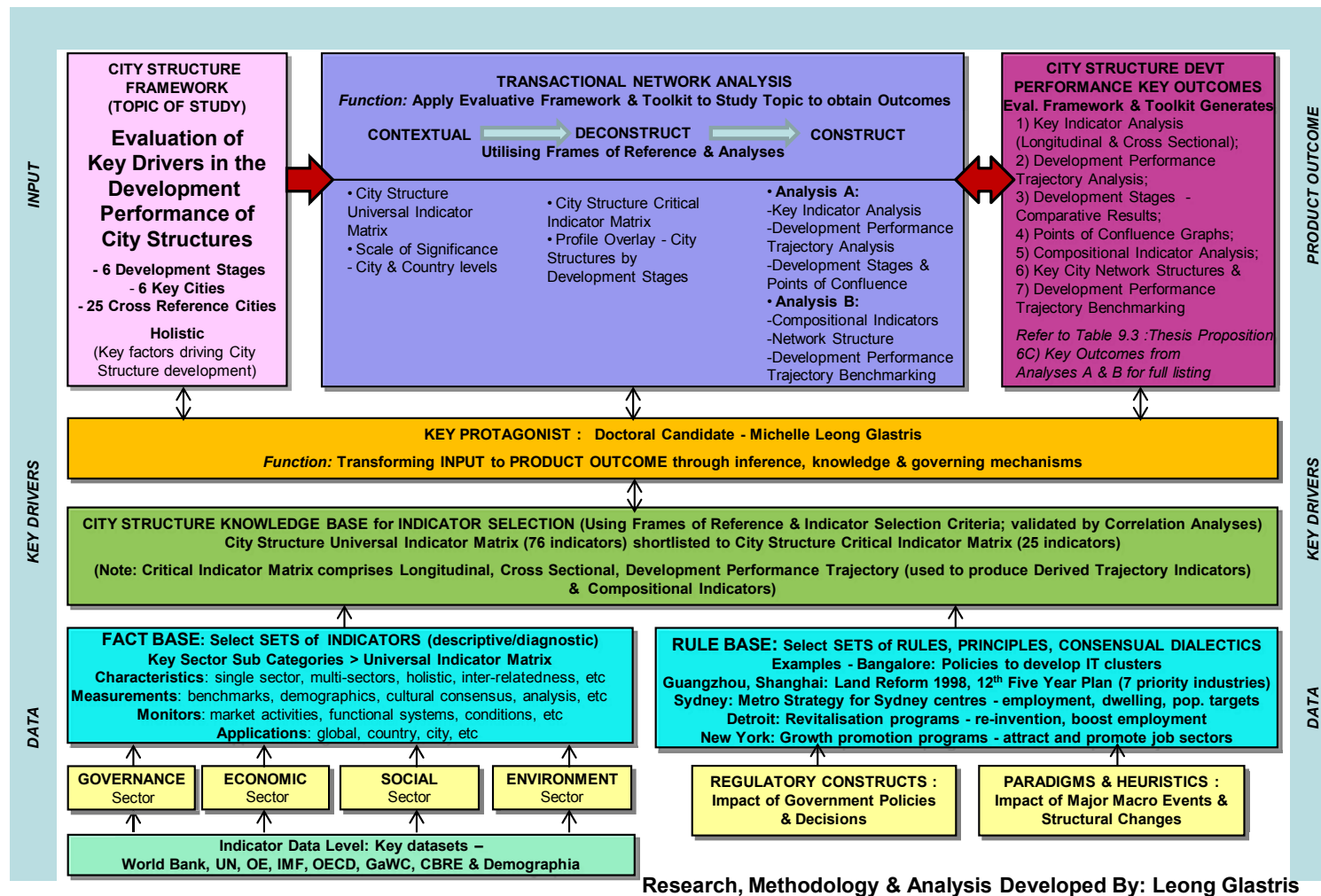


Figure 9.1: Roadmap - City Structure Information System: Evaluation of Key Drivers in the Development Performance of City Structures

Table 9.3: Thesis Proposition - Response

1) Meta Questions: The three meta questions were posed in Section 3.3 Thesis Topic, Hypothesis, Research Framework and Research Design. The intention of the meta questions was to establish an initial focal point to further develop the working hypothesis and research questions and guide the literature review as an iterative process. Whilst it was not intended to answer these questions within the scope of the thesis, the thesis does provide the following broad level response.

Thesis Proposition:	
1) Meta Questions:	
i) What makes a city structure attractive and successful to its inhabitants?	The research undertaken for the thesis confirms City Structures are a product of a complex and dynamic process. This was illustrated in the diverse range of factors used to explain city structure development phenomena e.g. Key Protagonists, the City Structure Information System and Profile Overlays as well as the complex, diverse and constantly evolving network of functional activities, relationships, capital and knowledge flows that develop within city structures. During this research, Key City Structure Overviews were constructed and examples of network structures for the six key cities were discussed and highlighted how these primary industry clusters and network interactions make them successful and attractive. It was found that a city structure's attractiveness and success can also be gauged through a range of Critical Indicators, trends and patterns and its responsiveness to a range of major events and structural changes. A good litmus test is the ability of a city structure to continually attract workers, residents, visitors and other stakeholders to increase population levels, its ability to adapt and be resilient but also to generate longer term economic activity, attract investment and build innovative capacity through its network structure.
ii) What determines the development cycle and performance of city structures?	The research identified how city structures evolved and developed a classification of six stages within the development cycle (Early Emerging, Emerging, Maturing, Mature, Obsolescence-Decline and Obsolescence-Re-Growth). POP, GDP, HDI, EMP and their derivations; the other Critical Indicators specified in the City Structures Critical Indicator Matrix; and compositional aspects of city structure population can be used to gauge their transition into various development stages and their development performance as city structures. The research identified and verified the two key drivers, their derived indicators and the other 23 critical indicators collectively explained the development performance of city structures..
iii) What can be done to redress or enhance a city structure's development trajectory?	The research revealed Critical and Derived Indicators can be used to evaluate historical trends and patterns; benchmark future trends against historical trends and to identify a City Structure's responsiveness to major events and structural changes and identify where improvements can be made.

2) Primary Research Questions: The five primary research questions posed in Section 3.3 Thesis Topic, Hypothesis, Research Framework and Research Design were used to develop and prove the working hypothesis; direct the research design and methodology; and guide the literature review. These questions have been successfully addressed in the following manner:

Thesis Proposition continued...	
2) Primary Research Questions:	
i) What are the key governance, economic, social and environment indicators that drive the development of city structures?	The research revealed there were 76 significant governance, economic, social and environment indicators initially identified in the City Structure Universal Indicator Matrix. Applying the selection criteria specified these were then shortlisted down to the 25 critical indicators in the City Structure Critical Indicator Matrix. In particular, City Structure Population and GDP were identified as the key drivers of city structure development due to their universal and strong relationships with other critical indicators. References within the Thesis include: City Structure Universal Indicator Matrix (Appendix 2), City Structure Critical Indicator Matrix (Appendix 3) and Key Indicator Analysis (Sub section 5.2.2 Validation of City Structure Critical Indicators).
ii) How can these indicators be used to evaluate, gauge and improve the development performance of city structures?	In undertaking the research, the concept of Development Performance was defined as the manner in which a city structure fulfils and evolves/develops around its functional networks. In order to assess how successfully a city structure develops its functional networks, a range of critical and derived indicators were developed for analysis. The distinction was made between key drivers (GDP and City Structure Population) and other critical indicators where key drivers exhibit a strong, universal relationship with critical indicators. An additional 11 indicators were derived from four critical indicators (GDP, POP, HDI and EMP) which built on the “rates of change” understanding of city structures as an evolutionary process. Furthermore the research demonstrated Key Drivers, Derived and Critical Indicators can be collectively used to evaluate a city structure’s historical performance; gauge future performance by benchmarking projected performance trends against historical trends; evaluate network structures and interactions; and gain a better understanding of how a City Structure is anticipated / expected to respond to major events and structural changes. This was demonstrated by the results and implications evaluated in Analyses A and B. Consequently the research confirmed the evaluative platform and toolkit developed could be instructively used to better inform planning, development and investment policies and decisions to either redress current/potential problems and also to enhance current/future performance. References within the Thesis include: Literature Review (Section 2.6 D: Key Drivers and Indicators); Methodology and Data Collection (Sub section 3.4.1.5 Selection of Indicators – City Structure Critical Indicator Matrix); Frames of Reference (Chapter 4); Proof of Concept chapters for Analysis A (Chapters 5-7) and Analysis B (Chapter 8); City Structure Universal Indicator Matrix (Appendix 2); City Structure Critical Indicator Matrix (Appendix 3); Key Cities Overview (Appendix 5); Macro Event GFC and its Impacts (Appendix 6) and Metrics for Intelligent Cities (Appendix 7A and 7&B).

Thesis Proposition continued...	
2) Primary Research Questions continued...	
iii) Can city structure population and economic growth be regarded as lead indicators that signal a transition to each development stage within a city structure's development cycle?	This research confirms City Structure Population and Economic Growth/GDP can be regarded as lead or key indicators. This was initially identified in the Literature Review regarding key drivers and indicators. City Structure Population and GDP were later qualitatively and quantitatively confirmed as key drivers in the selection of Critical Indicators; construction of the City Structure Critical Indicator matrix; and the Correlation Analyses between City Structure POP (both UN and OE), GDP and the other Critical Indicators. This was subsequently borne out in the indicative numerical ranges calculated for POP and GDP Velocities and Resiliencies for each of the six development stages. This was further substantiated by the Points of Confluence graphs which identified common signature characteristics for city structures in different development stages. Collectively these evaluative tools provided sufficient indication of the quantitative thresholds for these development stages. References within the Thesis include: Literature Review (Section 2.6 D: Key Drivers) and Indicators; Methodology and Data Collection (Sub section 3.4.1.5 Selection of Indicators – City Structure Critical Indicator Matrix); Frames of Reference (Chapter 4); Proof of Concept chapters for Analysis A (Chapters 5-7, Figure 5.1: Summary Table of Correlation Analysis for the Key Cities) and Analysis B (Chapter 8); City Structure Universal Indicator Matrix (Appendix 2); City Structure Critical Indicator Matrix (Appendix 3) and Correlation Tables for Six key Cities – Critical Indicators (Appendix 4).

Thesis Proposition continued...	
2) Primary Research Questions continued...	
iv) Does the investigation of development performance trajectory determinants (velocity, acceleration, resilience, etc) with respect to city structure population and economic growth improve our understanding of the development of city structures as a complex and dynamic process?	This research confirms the determinants improve our understanding of how city structures develop. In evaluating these development performance trajectory determinants (POP, GDP, HDI and EMP and their velocity, acceleration and resilience derivations), it was subsequently proved that City Structure development performance can be qualitatively defined and quantitatively measured. City Structure development is indeed a complex and dynamic process as demonstrated by the multi faceted manner in which the research had to be designed to construct different spatial and temporal dimensions required to evaluate the different aspects of city structure development performance. This included: • Identifying a wide range of Governance, Economic, Social and Environment sectoral indicators and constructing Universal and Critical Indicator Matrices; • Evaluating Critical and Derived Indicators with respect to development trajectories and trends; responsiveness to major events and structural changes; and future productivity, capacity and resilience levels; • Examining rates of change through specifically derived indicators and their Velocity, Acceleration and Resilience derivations; • Determining indicative ranges for POP and GDP Velocities and Economic, Household and Employment Resiliencies; • Assessing Network Structure aspects such as primary industry clusters and network interactions. References within the Thesis include: Literature Review (Sections 2.3 C: City Structure Development as a Process, 2.7 Seminal Works, 2.8 Identifying the Research Gap, 2.9 Development of Research); Methodology and Data Collection (Chapter 3, Figure 3.4: Thesis Research Design: Conceptual Framework); Proof of Concept chapters for Analysis A (Chapters 6-7, Table 6.1: City Structure Development Performance Trajectory Formulae) and Analysis B (Chapter 8 – Sub section 8.4.3 Development Performance Trajectory Benchmarking, Table 8.3: Compositional Aspects of City Structures: Development Performance Trajectory Benchmarking); City Structure Critical Indicator Matrix (Appendix 3) and Key Cities Overview (Appendix 5).

Thesis Proposition continued...	
2) Primary Research Questions continued...	
v) To what extent does the evaluation of key indicators, development performance trajectory determinants and the compositional aspects of city structure population (compositional indicators, magnitude, density and development performance trajectory determinants) explain how these factors collectively shape the development performance of city structures?	It was found that collectively these Critical and Derived Indicators and Compositional Aspects of City Structure population explain the evolution and development performance of city structures quite well. From undertaking Analyses A and B, instructive insights were gained on how city structures develop from: • A multi-disciplinary perspective i.e. across Governance, Economic, Social and Environment sectors; • A spatial and temporal perspective with regards to development trajectories and development trends; • An evaluation of six key city structures each representing one of the six different development stages was used to map these development performance characteristics – this analysis was then further broadened to include 23-25 cross reference cities. Collectively the evaluation of this diverse sample of city structures gave further robustness to the Analyses and in verifying these outcomes. • Their responsiveness to the external factors such as macro/global events and structural changes e.g. the extent to which City Structures were affected by and how well and quickly they adapted to the impact of the GFC and its aftermath in terms of development trends, amplitudes and reverberations, etc. • The compositional aspects of the City Structure's population to gauge its productivity, innovative capacity and resilience as well as network structures and interactions and ability to gauge future development performance. References within the Thesis include: Literature Review (Chapter 2); Methodology and Data Collection (Chapter 3); Frames of Reference (Chapter 4); Proof of Concept chapters for Analysis A (Chapters 5-7) and Analysis B (Chapter 8); City Structure Universal Indicator Matrix (Appendix 2); City Structure Critical Indicator Matrix (Appendix 3); Key Cities Overview (Appendix 5); Macro Event GFC and its Impacts (Appendix 6) and Metrics for Intelligent Cities (Appendix 7A and 7B).

3) Working Hypothesis: It was identified in the Literature Review that current analytical methods weakly address the evaluation of key drivers in city structure development performance; city structure population and GDP are regarded as key drivers; and there is a diverse range of sectoral indicators that shape city structure development. Consequently this resulted in developing the working hypothesis, posed in Section 3.3 Thesis Topic, Hypothesis, Research Framework and Research Design, which this research has proven to be valid.

Thesis Proposition continued...	
3) Working Hypothesis:	
Key governance, economic, social and environment drivers and the compositional aspects of city structure population can be used to collectively explain the development performance of city structures.	The working hypothesis was proven to be valid on the following basis: • There are key governance, economic, social and environment drivers that dominate city structure development – Key drivers investigated in the Literature Review; Indicator selection process developed; correlation analyses indicated overall there was a strong correlation between City Structure POP and GDP and the other Critical Indicators across each of the key cities; indicators selected for City Structure Universal Indicator Matrix; key drivers and indicators selected for construction of the City Structure Critical Indicator Matrix; • Some of these key drivers can be derived as city structure development performance trajectory determinants – Adopting a rate of change approach discussed in the Literature Review – Identifying the Research Gap and the Development of Research; developing the methodology to derive the development performance trajectory determinants and undertaking the City Structure Development Performance Trajectory Analysis. • City structure population and economic growth can be regarded as strong indicators of city structure development. In conjunction with development performance trajectory determinants and population compositional aspects, city structure population can be used to instructively explain the development performance of city structures – City Structure Population and GDP identified in Literature Review as key drivers; rate of change concept applied, developed and evaluated as development performance trajectory determinants along with other critical indicators; and compositional aspects of city structure population used to further assess current and future productivity, capacity and resilience aspects; • Collectively city structure key drivers, development performance trajectory determinants and the compositional aspects of city population can be used to gauge the future development performance of city structures – By building on the insights gained from Analysis A (e.g. assessing development trends of Critical Indicators and a city structure's responsiveness to external factors such as major vents and structural changes, evaluating indicative ranges for velocities and resiliencies and common development performance characteristics for the six development stages, etc), Analysis B was used to examine current and future productivity, capacity and resilience aspects by examining the compositional make up of a city structure population, hardwiring of network structures and network interactions. This information was collectively used to determine historical performance in order to benchmark and gauge the future development performance of city structures. References within the Thesis include: Literature Review (Chapter 2); Methodology and Data Collection (Chapter 3); Frames of Reference (Chapter 4); Proof of Concept chapters for Analysis A (Chapters 5-7) and Analysis B (Chapter 8); City Structure Universal Indicator Matrix (Appendix 2); City Structure Critical Indicator Matrix (Appendix 3); Correlation Tables for Six Key cities – Critical Indicators (Appendix 4); Key Cities Overview (Appendix 5); Macro Event GFC and its Impacts (Appendix 6) and Metrics for Intelligent Cities (Appendix 7A and 7&B).

4) Purpose: In setting out to address the hypothesis and research questions, it was important to articulate the purpose of the thesis. This grounded the research and along with the other research parameters that formed the research framework, guided the direction of the research undertaking. The purpose identified in Section 1.6 Purpose and Objectives was addressed in the following way:

Thesis Proposition continued...	
4) Purpose:	
The purpose of the thesis is to identify and assess the key drivers and indicators responsible for the evolution and development performance of city structures.	The research achieved the purpose of identifying and selecting a wide range of sectoral Governance, Economic, Social and Environment indicators for constructing the City Structure Universal Indicator Matrix and the City Structure Critical Indicator Matrix. In developing a methodological approach and an evaluative framework, an evaluative toolkit was constructed and developed which enabled a series of analyses (Analyses A and B) to be conducted to evaluate these Key Drivers, Critical and Derived Indicators and compositional aspects of city structure population. The outcomes from this evaluative assemblage enabled an examination of the development performance of a range of City Structures. References within the Thesis include: Methodological Approach (Section 3.2 and Figure 3.1: PhD Thesis Methodology); Evaluative Framework (Chapter 3 - Section 3.3 Thesis Topic, Hypothesis, Research Framework and Research Design and Figure 3.4: Research Design: Conceptual Framework); City Structure Universal Indicator Matrix (Appendix 2); City Structure Critical Indicator Matrix (Appendix 3); Frames of Reference (Chapter 4); Analysis A (Chapters 5-7); Analysis B (Chapter 8) and Key Cities Overview (Appendix 5).

5) Objectives: As part of the research framework, it was important to set objectives for the thesis. These objectives were structured across the areas of research framework and design; literature review; identifying and assessing key drivers; and developing an evaluative framework and tools using these key drivers and indicators. The four objectives identified in Section 1.6 Purpose and Objectives were achieved as follows:

Thesis Proposition continued...	
5) Objectives continued...	
The objectives are: a) Develop the thesis topic, hypothesis, research framework and design to undertake the proposed research;	In developing the thesis topic, hypothesis, research framework and design as an iterative process, this informed the research undertaken in the Literature Review; enabled development of the methodology and data collection processes; construction of frames of reference to position, store and filter these segments of knowledge. References within the Thesis include: Literature Review (Chapter 2); Methodology and Data Collection (Chapter 3); and Frames of Reference (Chapter 4).

Thesis Proposition continued...	
5) Objectives continued...	
b) Investigate and evaluate current urban geography, planning, land economics/urban development and related literature on the evolution of city structures;	The Literature Review was undertaken across the fields of urban geography, planning, land economics/urban development and other related literature. The research investigated definitions for city and city structure and identified the need to develop a definition specifically for city structures that reflected the current knowledge based development phase. The second component of the literature review examined the evolution of city structures and identified four distinct phases where the fourth/current phase of knowledge based development formed the research impetus for thesis due to the nature of its technological transformation, knowledge transformation, space of flows characteristics and heightened network capabilities. The third component examined city structure development as a process firstly in terms of development stages and identified the need to develop a six stage development process and secondly, in developing a definition for city structure development performance. The fourth component of the literature review examined the key drivers and indicators in the development of city structures and identified four key sectors (Governance, Economic, Social and Environment), GDP and City Structure Population as key drivers as well as a range of other indicators. From the Literature Review, an evaluation of two seminal works identified the research gap and where there would be inherent value on the development of the research. The findings from the Literature Review were also supplemented with additional information and references in the subsequent chapters on methodology and data collection, frames of reference, proof of concept chapters for Analysis A and B and appendices. References within the Thesis include: Literature Review (Chapter 2); Methodology and Data Collection (Chapter 3); Frames of Reference (Chapter 4); Proof of Concept chapters for Analysis A (Chapters 5-7) and Analysis B (Chapter 8); City Structure Universal Indicator Matrix (Appendix 2); City Structure Critical Indicator Matrix (Appendix 3); Key Cities Overview (Appendix 5); Macro Event GFC and its Impacts (Appendix 6) and Metric for Intelligent Cities (Appendix 7).
c) Identify and assess the key drivers of city structure development and determine if these key drivers can be used to explain city structure development performance phenomena;	Please refer back to 2) Primary Research Questions i) to v) for response.

Thesis Proposition continued...	
5) Objectives continued...	
d) Develop an evaluative framework and tools using these key drivers and indicators to assess and gauge the development performance of a selection of six key and cross reference city structures.	Informed by the Literature Review, the evaluative framework and toolkit were constructed and developed in the methodology and data collection, frames of reference and proof of concept chapters. This was then tested, assessed and gauged using six key and 23-25 cross reference city structures in the proof of concept chapters for Analyses A and B. An understanding of the impact of the GFC as an example of a macro event and the importance of creating intelligent cities with innovative capacity also supplemented this understanding. The research verified that collectively the evaluative platform and toolkit could be used to instructively explain the development performance of these city structures and provide predictive insights. References within the Thesis include: Literature Review (Chapter 2); Methodology and Data Collection (Chapter 3); Frames of Reference (Chapter 4); Proof of Concept chapters for Analysis A (Chapters 5-7) and Analysis B (Chapter 8); City Structure Universal Indicator Matrix (Appendix 2); City Structure Critical Indicator Matrix (Appendix 3); Key Cities Overview (Appendix 5); Macro Event GFC and its Impacts (Appendix 6) and Metric for Intelligent Cities (Appendix 7A and 7B).

6A) Expected Thesis Outcomes: Seven expected thesis outcomes in Section 1.7 Expected Outcomes were prescribed in line with the research focus on the key forces that shape city structures; a structured approach to qualitatively and quantitatively assessing how city structures develop; using this approach to meaningfully gauge the development performance of city structures. This ensured alignment with the research parameters established and the outcomes from the research undertaken. The expected thesis outcomes were achieved in the following way:

Thesis Proposition continued...	
6A) Expected Thesis Outcomes:	
At the conclusion of this thesis, the expected outcomes are: 1) Development of a research methodology that supports undertaking the proposed research;	As part of the research undertaking, the research methodology was informed and guided by the Literature Review (refer to 5) Objectives b)) and developing the thesis topic, hypothesis, research framework and design as an iterative process (refer to 5) Objectives a)). Due to the exploratory nature of the thesis where an evaluative platform and toolkit were developed, a new methodology was constructed and tested. Please refer to 7B) Contribution to Methodology for a detailed response on what this involved. References within the Thesis include: Literature Review (Chapter 2); Methodology and Data Collection (Chapter 3); Frames of Reference (Chapter 4); Proof of Concept chapters for Analysis A (Chapters 5-7); Analysis B (Chapter 8); City Structure Universal Indicator Matrix (Appendix 2); City Structure Critical Indicator Matrix (Appendix 3); Key Cities Overview (Appendix 5); Macro Event GFC and its Impacts (Appendix 6) and Metrics for Intelligent Cities (Appendix 7).
2) Investigation and review of current literature on the evolution of city structures;	Please refer back to 5) Objectives b) for response.
3) Definitions for “City Structure” and “Performance Development”;	The research explores new territory in the development performance of city structures. It was evident from the Literature Review there were research gap and it was identified that new definitions for City Structure and Performance Development had to be developed for the purposes of this research. Consequently the following definitions were developed: • City Structure – “A city structure is an evolutionary process determined by its network of functional activities; relationships; capital and knowledge flows which influence its growth and density as it transitions through a series of development stages.” • City Structure Development Performance: “Development performance is defined as the manner in which a city structure fulfils and evolves/develops around its functional networks.” References within the Thesis include: Literature Review (Sub sections 2.3.3 Thesis Definition of “City Structure” and 2.5.2 City Structure Development Performance).

Thesis Proposition continued...	
6A) Expected Thesis Outcomes continued...	
4) Identification and assessment of the key governance, economic, social and environment indicators that drive city structure development;	Please refer back to 2) Primary Research Questions i) to v) for response.
5) Construction of a new evaluative framework and tools to assess city structure development;	Informed by the Literature Review, the evaluative framework and toolkit were constructed and developed in the methodology and data collection and frames of reference chapters. The evaluative framework and toolkit were tested in the analyses undertaken in the proof of concept chapters. In employing the evaluative framework and toolkit in Analyses A and B it was confirmed that collectively they could be used to instructively explain how city structures evolve, the development performance of these city structures and provide predictive insights. References within the Thesis include: Literature Review (Chapter 2); Methodology and Data Collection (Chapter 3); Frames of Reference (Chapter 4); Proof of Concept chapters for Analysis A (Chapters 5-7) and Analysis B (Chapter 8); City Structure Universal Indicator Matrix (Appendix 2); City Structure Critical Indicator Matrix (Appendix 3) and Key Cities Overview (Appendix 5).
6) Application of the evaluative framework and tools through an analysis of key and cross reference city structures to gauge their development performance;	The evaluative framework and toolkit were specifically applied to the six key and 23-25 cross reference city structures to test, assess and gauge development performance in the proof of concept chapters for Analyses A and B. It was concluded from the research that the evaluative framework and toolkit provided useful insights – this included indicator analyses of city structure development performance trajectories for cities and trends across development stage categories; the ability to compare city structures at different development stages and geographic regions by examining signature characteristics of development stage categories; and the predictive insights gained from benchmarking future development performance against historical performance for the key city structures. The research also indicated that using the comparative development stage tables and indicative thresholds alone were not sufficiently definitive to quantitatively define and describe common characteristics of city structures within each development stage. Consequently the assessment of development stages was tackled on multiple fronts and achieved by developing and undertaking the points of confluence analysis and was used to further supplement the analyses. References within the Thesis include: Proof of Concept chapters for Analysis A (Chapters 5-7) and Analysis B (Chapter 8); and City Structure Universal Indicator Matrix (Appendix 2).

Thesis Proposition continued...	
6A) Expected Thesis Outcomes continued...	
7) Provide an indication of the future development performance of city structures.	In examining the historical and projected development trends of these Critical and Derived Indicators; determining indicative ranges for POP and GDP Velocities and Resiliencies; assessing the network structure of the key city structures; and using historical performance to benchmark future performance, the research demonstrated instructive insights were gained on the future development performance of City Structures. An understanding of the impact of the GFC as an example of a macro event and the importance of creating intelligent cities with innovative capacity were used to further supplement this understanding. References within the Thesis include: Proof of Concept chapters for Analysis A (Chapters 5-7) and Analysis B (Chapter 8); City Structure Universal Indicator Matrix (Appendix 2); City Structure Critical Indicator Matrix (Appendix 3); Key Cities Overview (Appendix 5); Macro Event GFC and its Impacts (Appendix 6) and Metric for Intelligent Cities (Appendix 7A and 7B).

6B) City Structure Development Performance - Key Outcomes from Pre-Analysis Stages: In undertaking the research, there were a range of outcomes that were delivered in the Pre-Analysis Stages (i.e. Literature Review; Research Methodology and Data Collection and Frames of Reference stages). For convenience, a list of those key outcomes and where they can be located within the thesis are presented below.

Thesis Proposition continued...	
6B) City Structure Development Performance - Key Outcomes from Pre-Analysis Stages:	
Pre-Analysis Stages:	i) Literature Review: Evolution of City Structures (Chapter 2): • Literature Review Framework and findings from Literature Review (Figure 2.1: Literature Review Framework and Sections 2.2 – 2.7); • Definitions for City, City Structure and Development Performance (Sections 2.3 and 2.5.2); • Seminal Works (Section 2.7); • Identifying the Research Gap and Development of Research (Sections 2.8 and 2.9). ii) Research Methodology and Data Collection (Chapter 3): • Methodological Approach (Figure 3.1: PhD Thesis Methodology and Section 3.2); • Thesis Topic, Hypothesis, Research Framework and Research Design (Figure 3.4: Thesis Research Design: Conceptual Framework and Section 3.3); • Research Methodology and Data Collection – Indicator Selection Process, City Selection, Data Sources, Data Treatment, Assumptions and Limitations (Figure 3.5: Indicator Selection Process, Table 3.1: City Structure Universal Indicator Matrix – Structural Framework, Key Criteria for Universal Indicator Selection, Key Criteria for Critical Indicator Selection, Profile Overlay: City Structure Development Stages – Key and Cross Reference Cities, Sections 3.4 and 3.5, Appendix 2: City Structure Universal Indicator Matrix and Appendix 3: City Structure Critical Indicator Matrix). iii) Frames of Reference (Chapter 4): • Application of Systems Approach to City Structures (Section 4.2); • Frames of Reference (Figure 4.1: Frames of Reference: Hierarchy And Primary Purpose and Section 4.3); • Frame of Reference A: City Structure Key Protagonists (Figure 4.2: City Structure Key Protagonists and Section 4.4); • Frame of Reference B: City Structure Information System (Figure 4.3: City Structure Information System and Section 4.5); • Frame of Reference C: City Structure Universal Indicator Matrix (Appendix 2: City Structure Universal Indicator Matrix and Section 4.6); • Frame of Reference E: Scale of Significance (Figure 4.4: Scale of Significance and Section 4.7); • Frame of Reference E: Profile Overlays (Table 4.1: Profile Overlay – City Structures by Development Stages, Table 4.2: Profile Overlay – City Structures by Geographic Region, Table 4.3: Profile Overlay – City Structures by Primary Economic Industry, Table 4.4: Profile Overlay – City Structures by GaWC City Classification and Section 4.8).

6C) City Structure Development Performance - Key Outcomes from Analyses A and B: It was advocated in Sub section 3.2.2 Research Design that the outcomes from Analyses A and B can collectively explain City Structure Development Performance. The key outcomes produced from these analyses are extensive, cover a range of qualitative and quantitative measures and demonstrate the complex, dynamic nature of city structure development: For convenience, a list of those key outcomes and where they can be located within the thesis are presented below.

Thesis Proposition continued...	
6C) City Structure Development Performance - Key Outcomes from Analyses A and B:	
Analysis A: City Structure Development Performance Trajectory Analysis	i) Key Indicator Analysis (Chapter 5): • City Structure Indicator Pathways and Application (Figure 5.1: City Structure Indicator Pathways and Application and Section 5.2); • Correlation Analyses between City Structure POP and GDP and the other Critical Indicators across each of the key cities (Table 5.1: Summary Table of Correlation Analysis for the Six Key Cities, Section 5.2.2; Appendix 4: Correlation Tables for Six Key cities – Critical Indicators). • Major Events and Structural Changes (Section 5.3 and Appendix 6: Macro Event – GFC and its Impacts); • Longitudinal Analysis (Section 5.4.1 and associated Figures 5.2-5.9); • Cross Sectional Analysis (Section 5.4.2 and associated Figures 5.10-5.11); ii) City Structure Development Performance Trajectory Analysis (Chapter 6): • City Structure Development Trajectory Formulae (Table 6.1: City Structure Development Trajectory Formulae and Section 6.2); • City and Country Correlations between United Nations and Oxford Economics Datasets (Figure 6.1 and Section 6.3.3); • City Structure Population POP (First Order) and its Derivations: Velocity (Second Order), Acceleration (Third Order) (Sub section 6.4.1.1, associated Figures 6.2-6.13 and Table 6.2: City Structure Population Velocities (annual %); • City Structure Gross Domestic Product GDP (First Order) and its Derivations: Velocity (Second Order), Acceleration (Third Order), Economic Resilience (Fourth Order) (Section 6.4.1.2 and associated Figures 6.14-6.17); • City Structure Household Disposable Income HDI (First Order) and its Derivations: Velocity (Second Order), Acceleration (Third Order), Household Resilience (Fourth Order) (Section 6.4.1.3 and associated Figures 6.18-6.21); • City Structure Gross Employment EMP (First Order) and its Derivations: Velocity (Second Order), Acceleration (Third Order), Employment Resilience (Fourth Order) (Section 6.4.1.4 and associated Figures 6.22-6.25);

Thesis Proposition continued...	
6C) City Structure Development Performance - Key Outcomes from Analyses A and B continued...	
Analysis A: City Structure Development Performance Trajectory Analysis continued...	iii) City Structure Development Stages and Points of Confluence (Chapter 7): • Comparative Tables, Graphs and Indicative Ranges for City Structure POP Velocity (Tables 7.1-7.3, Figure 7.1 and Section 7.4.1.1); • Comparative Tables, Graphs and Indicative Ranges for City Structure GDP Velocity (Tables 7.4-7.5, Figure 7.2 and Section 7.4.1.2); • Comparative Tables, Graphs and Indicative Ranges for City Structure Economic, Household and Employment Resiliencies (Tables 7.6-7.7, Figures 7.3-7.5 and Section 7.4.1.3); • Points of Confluence Graphs for POP Velocity vs Economic Resilience; POP Velocity vs Household Resilience; POP Velocity vs Employment Resilience; GDP Velocity vs Economic Resilience; GDP Velocity vs Household Resilience; GDP Velocity vs Employment Resilience; POP Density vs Economic Resilience; POP Density vs Household Resilience; POP Density vs Employment Resilience (Figures 7.6-7.14 and Section 7.4.2).
Analysis B: Compositional Aspects of City Structure Population	i) Compositional Indicators (Chapter 8): • Compositional Indicator analysis (Section 8.4.1 and associated Figures 8.1-8.13 and Table 8.1: Key Socio-Demographic Trends: 1990, 2015 and 2040); ii) Network Structure (Chapter 8): • Network Structure (Section 8.4.2); • Key City Network Structures & Key Cities Overview (Section 8.4.2.3, associated Figures 8.14-8.55 and Appendix 6: Key Cities Overview); • Metrics for Intelligent Cities and Indicator Comparison (Appendix 7A and 7B); ii) Development Performance Trajectory Benchmarking (Chapter 8): ➤ Development Performance Trajectory Benchmarking (Section 8.4.3 and Table 8.3: Compositional Aspects of City Structures: Development Performance Trajectory Benchmarking);

7) Contribution to the Field of Knowledge: The key outcomes produced from this doctoral research constitute a new and unique body of knowledge in the fields of urban development, urban geography and strategic planning. The contribution the thesis makes to the field of knowledge is classified into four broad categories – the contribution to theory; methodology; policy; and practice. These contributions are presented below.

Thesis Proposition continued...	
7) Contribution to the Field of Knowledge:	
7A) Contribution to Theory:	The contribution to Theory includes: ➤ Development of new definitions for city structure; development performance; frames of reference; the various GDP, POP, HDI and EMP derivations for velocity, acceleration and resilience regarding city structures; and points of confluence. ➤ Exploration, identification and testing of the key drivers, derived and critical indicators that impact city structure development; ➤ Investigation of a rate of change approach to city structure development performance which studies relationships of development performance determinants and enabled the development of a methodology to develop City Structure Development Trajectory Formulae; ➤ Development of various Frames of Reference to position, store and filter segments of knowledge; ➤ Identification of 75 Universal and 25 Critical Indicators that shape City Structure development. The critical and derived indicators were tested and evaluated on key and cross reference cities to prove the hypothesis valid and address the research questions and objectives posed. ➤ Identification of accurate, reliable and consistent city and country level data and institutional data source providers. ➤ Knowledge gained about the Critical and Derived Indicators in terms of their development trends, impact on city structure development performance and future implications; ➤ Knowledge gained about the development performance of the key and cross reference city structures analysed; ➤ Knowledge gained on the common characteristics of each of the six key development stages and their respective indicative ranges for GDP and POP Velocities and the three Resiliencies; ➤ Use of the Key Outcomes previously specified (section 6A, 6B and 6C of this table) to build on the current body of knowledge on City Structures; ➤ Use of the Key Outcomes previously specified (section 6A, 6B and 6C of this table) to provide knowledge and the adoption of suggested Further Applications, Refinements and Further Investigation recommendations (refer to the following section 9.4) to guide further research and investigations in the field of City Structures.

Thesis Proposition continued...	
7) Contribution to the Field of Knowledge:	
7B) Contribution to Methodology:	The contribution to Methodology includes: ➤ Developing indicator selection processes and indicator selection criteria for the City Structure Universal and Critical Indicator Matrices; ➤ Formulating a structural framework and constructing the City Structure Universal Indicator Matrix; ➤ Constructing the City Structure Critical Indicator Matrix; ➤ Identifying and evaluating data sources and ensuring appropriate sample composition representation from both development stage and geographic perspectives; ➤ Developing data compilation and treatment procedures to compile, screen and normalise data for 76 indicators for each of the 31 cities, 19 countries and world aggregates over varied timeframes from 1950-2100. ➤ Creating Frames of Reference to position, store and filter segments of knowledge with capacity to operate as a multi-level hierarchal system and/or across multiple scales; ➤ Devising a City Structure Indicator Pathways and Application and a consistent manner for evaluating the results and implications of the critical and derived indicators; ➤ Formulating procedures to validate the City Structure Critical Indicators by assessing the relationships between the key drivers and other critical indicators both qualitatively (City Structure Critical Indicator Matrix) and quantitatively (Correlation Analyses); ➤ Identifying and evaluating the impact of recent Major Events (Macro/Global and Country/City Specific) and Structural Changes on the development of city structures including an assessment of the GFC and its impacts; ➤ Developing, testing and evaluating City Structure Development Performance Trajectory Formulae; ➤ Devising comparative methods to identify and evaluate indicative numerical ranges, signature characteristics and points of confluence analysis for each city structure development stage; ➤ Identifying and creating a approach to evaluate network structures - in particular, comparing relevant Universal Indicators with Metrics for Intelligent Cities; examining primary industry clusters and network interactions; ➤ Formulating a Development Performance Trajectory Benchmarking methodology to evaluate city structure future development performance against historical development performance.

Thesis Proposition continued...	
7) Contribution to the Field of Knowledge continued...	
7C) Contribution to Policy:	Policy derives from legislative actions which initiate political processes that guide decision making to achieve rational outcomes. This research better informs this process in terms of identifying and evaluating critical factors and a range of scenarios. The contribution to Policy includes: ➤ Assessment of development performance typically 20-60 years to provide a reasonable period to capture country/city events and structural changes, several business/economic cycles and gauges how well a city structure responds to macro/global events and structural changes; ➤ A better understanding of historical and future development trends by undertaking Analysis A: City Structure Development Performance Trajectory Analysis and Analysis B: Compositional Aspects of City Structure Population. ➤ Knowledge gained about the development performance; challenges; and policy consequences/implications of the key and cross reference city structures analysed; ➤ Knowledge gained on the common characteristics of each of the six key development stages and their respective indicative ranges can be drip fed into land use models; ➤ Knowledge gained on the future development performance trends of the key city structures and what aspects of historical performance can be used to benchmark future performance; ➤ Knowledge gained on how to analyse a city structure's network structure, its primary industry clusters and network interactions and how its innovative capabilities can be inculcated and fostered; ➤ Provision of a unique evaluative platform and toolkit to gain further analysis, forecast/scenario modelling and other insights on city structures and inform investment and policy decisions e.g. use and application of this knowledge for sensitivity forecast modelling for different urban development scenarios, staging of major network structure and infrastructure development projects; ➤ Use of the Key Outcomes previously specified (section 6A, 6B and 6C of this table) to provide knowledge and the adoption of suggested Further Applications, Refinements and Further Investigation recommendations (refer to the following section 9.4) to guide policy formulation and strategy work in the field of City Structures.

Thesis Proposition continued...	
7) Contribution to the Field of Knowledge continued...	
7D) Contribution to Practice:	The contribution to Practice includes: ➤ Knowledge gained about the Critical and Derived Indicators in terms of their development trends, impact on city structure development performance and future implications and how the research can be applied to identify and rationalise challenges and growth opportunities; ➤ Knowledge gained about the development performance; challenges; investment, strategic planning and development imperatives and consequences of the key and cross reference city structures analysed; ➤ Knowledge gained on the common characteristics of each of the six key development stages and their respective indicative ranges can be drip fed into land use, development feasibility, property market and econometric models to better gauge development staging of major projects, economic impacts and investment risks and returns; ➤ Knowledge gained on the future development performance trends of the key city structures and what aspects of historical performance can be used to benchmark future performance; ➤ Knowledge gained on how to analyse a city structure's network structure, its primary industry clusters and network interactions and how its innovative capabilities can be used to raise greater awareness amongst all Key Protagonists and stakeholders and engender a more multidisciplinary response in the design, planning, investment and development of city structures to ensure greater levels of productivity, innovative capacity and resilience; ➤ Provision of a unique evaluative platform and toolkit to facilitate further analysis, forecast/scenario modelling and other insights on city structures and inform investment, planning, development and design decisions; ➤ Use of the Key Outcomes previously specified (section 6A, 6B and 6C of this table) to provide knowledge and the adoption of suggested Further Applications, Refinements and Further Investigation recommendations (refer to the following section 9.4) to guide further research, modelling, investment, planning and development in the field of City Structures.

9.4 Recommendations

In undertaking this research journey, extensive trans-disciplinary ground was covered. Instructive insights were gained in developing a unique evaluative platform and toolkit to examine the key drivers in the development performance of city structures.

In producing the key outcomes in this research undertaking, a distinction was made between the contribution to knowledge the thesis presents (presented in the **Table 9.3 Thesis Proposition Response section 7) Contribution to the Field of Knowledge**) and how the findings from the research could be applied to provide further insights into city structure development. The latter is discussed in the following Sub section **9.4.1 Recommendations: Further Applications**.

It is acknowledged however that there were certain areas outside the scope of this thesis and/or that were not practical to conduct further analysis. These areas were identified in the thesis and warrant refinement and further investigations. The following Sub sections **9.4.2 Recommendations: Refinements** and **9.4.3 Recommendations: Further Investigations** respectively outline these areas.

9.4.1 Recommendations: Further Applications

More specifically, some examples of how the knowledge contributions from the thesis could be used by the following categories of Key Protagonists (as developed and defined by the Candidate in Section **4.4 Frame of Reference A: City Structure Key Protagonists**).

i) Regulators:

- Use of the key findings and outcomes from Analyses A and B to better understand how and why city structures develop; what are the key drivers/indicators that drive their development performance; what aspects of development performance need to be addressed/redressed to improve development performance and to enhance the network structure capabilities of city structures;
- Use the knowledge gained from the development performance of the key and cross reference city structures analysed and apply the evaluative platform and toolkit for further analysis and insights on their city structure(s) to inform their stakeholder discussions; regulatory decisions and policy formulation.

ii) Generators:

- Use of the key findings and outcomes from Analyses A and B to better understand how and why city structures develop, what are the key drivers/indicators that drive their development performance, what makes some city structures more attractive and successful to locate to and/or invest in; how will the existing network structure strategically support their business and/or provide an attractive investment climate; what primary industry clusters and network interactions can be utilised; better identify the development performance challenges, benefits, impact of future macro events and structural changes, responsiveness of a city structural to changes in various factors (e.g. critical indicators, macro events, etc) and risks associated with these city structures to better calibrate their business/investment/financial models and risk mitigation strategies;
- Use the knowledge gained from the development performance of the key and cross reference city structures analysed and apply the evaluative platform and toolkit for further analysis and insights on their city structure(s) and provide a like-for-like comparison of other city structure location/investment options to inform their stakeholder discussions; corporate, investment and operational decisions; and business/investment strategy formulation.

iii) Actuators:

- Use of the key findings and outcomes from Analyses A and B to better understand how and why city structures develop, what are the key drivers/indicators that drive their development performance, what critical indicators, network structure and population compositional aspects need to be developed based on their city structure's development stage to enhance future development performance;
- Use the knowledge gained from the development performance of the key and cross reference city structures analysed and apply the evaluative platform and toolkit for further analysis and insights on their city structure(s) to inform their stakeholder discussions; urban development, economic, planning and design decisions; development and investment scenario and land use planning analyses; and masterplanning, economic and urban development strategy formulation.

9.4.2 Recommendations: Refinements

In undertaking this research, the analysis raised further questions outside the scope of the thesis and may warrant further refinement. Suggested refinements include:

- **Widening the study sample** of key and cross reference cities to include third and fourth tier city structures i.e. cities in what Taylor terms Sufficient Cities and also cities in what the World Economic Forum term as Factor Driven Economy Countries as well Obsolescence-Decline and Obsolescence-Re-Growth city structures to get a further insights on cities at the extreme ends of the development spectrum;
- Where appropriate city level data is available, incorporate more of the indicators cited in the World Economic Forum **World Competitiveness Index** in the City Structure Critical Indicator Matrix to more closely evaluate competitive capabilities/potential.
- Where appropriate city level data is available, incorporate more of the indicators cited in Komninos' **Metrics for Intelligent Cities** in the City Structure Critical Indicator Matrix to more closely evaluate innovative capabilities/potential.
- Undertake a more **detailed Correlation Analysis** and a **Cluster Analysis** of the Critical Indicators to gauge synergies and clustering patterns and effects between indicators.

9.4.3 Recommendations: Further Investigations

In undertaking this research, the analysis raised further questions beyond the scope of the thesis and may warrant further investigation. Suggested further investigations include:

- **Exploring future directions to capture and manage large datasets on cities** – these include the use of city level data websites responsible for consolidating, updating and disseminating data from multiple sources; use of data clouds to store and access information centrally; improving processes and developing software applications to streamline data updates from multiple institutional data sources; and establishing city research associations and online forums to address research queries, advance city data capture, management and associated research methodologies.

- **Exploring a wider range of indicators** for both the City Structure Universal Indicator Matrix and the City Structure Critical Indicator Matrix;
- **Further exploring the concept of rates of change** – work is currently underway by the Candidate in developing further development performance trajectory concepts regarding the vitality of city structures;
- **Investigate Equilibrium Point/Range of Population Densities** when city structures transition into the Mature development stage where there is a counter play of factors of attraction and dispersion;
- **Investigate the roles of population inequality and equality and their impact** on the sustainability of city development performance; their clustering effects and the efficacy of performance analytics such as Equivalence Scales, Lorenz Curves, Gini Coefficients, Genuine Progress Indicator, etc in the Development Performance of City Structures;
- **Investigate scenarios and constructs** based on structural changes, macro and location specific events to gauge potential quantum/amplitude and reverberation impacts on various city structures to position designed responses to improve and fortify their resilience, productivity and capacity levels.

9.5 Concluding Remarks

It is acknowledged that to date, the perception is cities as a structural institution, have little capacity to control their destiny and can be considered victims of circumstance. The thesis presents a different definition of city structure and contends there are a set of key governance, economic, social and environment drivers that can be consistently used to evaluate and guide city structure development performance. Whilst macro and location specific events and structural changes may not be controlled directly, these key drivers can:

- Signal impending forces/changes;
- Predict, gauge and guide future performance;
- Mitigate adverse impacts and risks; and
- Orchestrate change to improve a city structure's future capacity, responsiveness and resilience.

Key Protagonists can impact these drivers and are able to influence and set in motion decisions and actions to affect changes in a city structure's development performance.

As presented in this chapter, the undertaking for the thesis has been considerable in terms of:

- The scope and depth of the thesis and the multi disciplinary nature of the topic of study;
- Addressing the research parameters of the thesis proposition;
- Delivering the key outcomes identified;
- Making a contribution to the field of knowledge.

The key outcomes, significance and implications from the research constitute a new and unique body of knowledge that provides valuable insights into key development performance determinants, the development stages and trends that drive the development of city structures and how these elements can be structured into an integrated, multidisciplinary evaluative framework.

This proposed evaluative framework and toolkit present a robust manner for decoding and encoding information based on a multi disciplinary approach. This in turn captures the dynamic and complex nature of how city structures adapt and evolve. The evaluative framework and toolkit:

- Enable information to be separated, ordered and integrated;
- Handle discrete data, overlapping information, signatures and contradistinctive issues;
- Augments the knowledge base on city structures and the application of performance analytics;
- Identifies areas for further research and investigations;
- Contributes towards a greater understanding and determination of the complexities of City Structure Development.

The evaluative framework and toolkit comprises a wide array of determinants. The critical common denominator underlying these determinants is the impact on how city structures evolve and their development performance with respect to a city structure's functional activities, relationships, capital and knowledge flows and how the rates of growth enable city structures to undergo/transition various development stages. Collectively these aspects have been examined, integrated and applied through the proposed evaluative framework and toolkit.

The thesis delves into a research field that has yet to be fully defined and where research approaches, methodologies and evaluation processes are still evolving. This presents numerous challenges and limitations. Given the exploratory and multi-disciplined nature of the thesis' research focus and the acknowledged lack of city level data, it is

difficult (nor is it the thesis purpose) to definitively ascertain all aspects of city structure development performance. In light of the assumptions, limitations and methodology identified in the thesis, a research methodology and evaluative platform have been developed, assessed and validated as a proof of concept and have withstood an acceptable level of rigorous analysis. At this initial stage and in light of the paucity of city level data, the Candidate has utilised reasonably available historical and forecasted institutional data. This has enabled both a qualitative and quantitative exploration of development performance city structure key drivers, their trajectories and trends to be undertaken and to benchmark future performance of city structures at different development stages. Points of confluence were also used to determine signature characteristics of the six development stages of city structures. Based on this new proof of concept, these findings collectively provide and validate an evaluative platform to assess and guide the development performance of city structures.

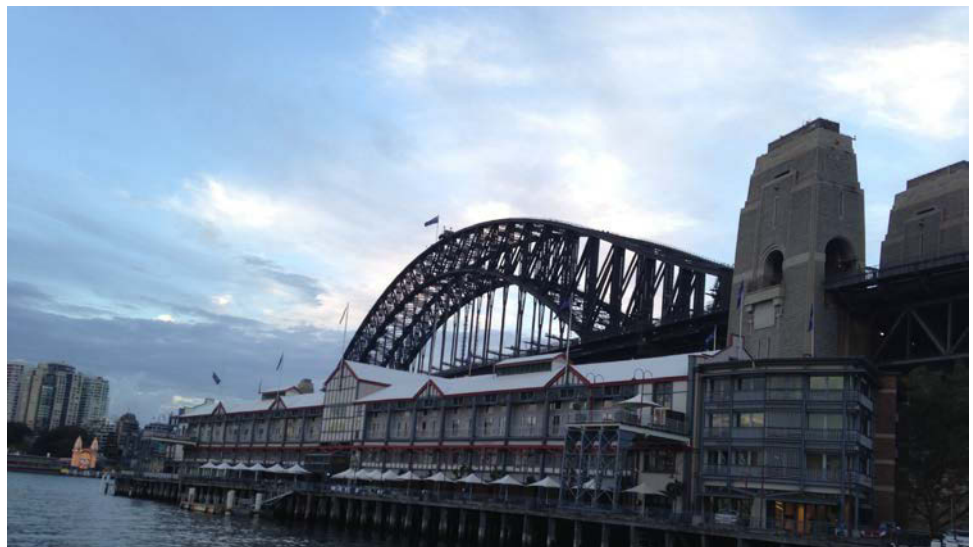
It is envisaged the proposed body of knowledge will offer a structured and integrated approach in the monitoring, evaluation and the proactive encouragement of the development performance of city structures. Consequently it is anticipated the thesis will facilitate further critical discourse and investigations into the development of city structures at a strategic level.

In light of this early stage of research, it is anticipated the complementary knowledge contributions from academia, policy and practice may be the most productive, insightful and expedient way to progress research and knowledge in this field. For example, in further investigating city structure development performance through scenario analysis and model simulations, policy and practice empirical data can be fed into a research driven model to refine modelling processes, feedback loops, predictive variables, outputs and improve the accuracy of development performance forecasts. In the candidate's experience, the most productive alliances have been an iterative and collaborative approach between academia and industry (policymakers/regulators and practitioners). Thus the value of these collaborations is underscored in the recommendations.

The contribution to the field of knowledge and suggested further applications, recommendations for further applications, research refinements and further investigations pave the way for further work to be undertaken beyond this thesis and merit consideration to build on this challenging, complex and interesting work and to gain further valuable insights into city structure development performance phenomena.

Chapter 10

Appendices



View of Sydney Harbour Bridge & Luna Park from Walsh Bay

Source: Leong Glastris

"For the wise man looks into space and he knows there is no limited dimensions."

(Lao Tzu, Chinese philosopher (Zhou Dynasty, 6th century))

10 Appendices

10.1 Appendix 1: Key Reference Charts

- PhD Thesis Methodology
- Research Design: Conceptual Framework
- City Structure Indicator Pathways & Application
- Frames of Reference: Hierarchy & Primary Purpose
- City Structure Information System

10.2 Appendix 2: City Structure Universal Indicator Matrix

- City Structure Universal Indicator Matrix

10.3 Appendix 3: City Structure Critical Indicator Matrix

- City Structure Critical Indicator Matrix

10.4 Appendix 4: Correlation Tables – Critical Indicators

- Sydney, Australia
- New York and Detroit, USA
- Guangzhou and Shanghai, China
- Bangalore, India

10.5 Appendix 5: Key Cities Overview

- Bangalore
- Guangzhou
- Shanghai
- Sydney
- New York
- Detroit

10.6 Appendix 6: Macro Event – Global Financial Crisis & its Impacts

- GFC Timeline
- Preliminary Analysis – City Structure Information System: Impact of GFC

10.7 Appendix 7: Metric for Intelligent Cities

- Metric for Intelligent Cities
- Indicator Comparison

10.1 Appendix 1: Key Reference Charts

- PhD Thesis Methodology
- Research Design: Conceptual Framework
- City Structure Information System
- City Structure Indicator Pathways & Application
- City Structure Development Performance Trajectory Formulae
- City Structure Information System: Evaluation of Key Drivers in the Development Performance of City Structures

10.2 Appendix 2: City Structure Universal Indicator Matrix

➤ City Structure Universal Indicator Matrix

CITY STRUCTURE UNIVERSAL INDICATOR MATRIX:		
INDICATORS BY SECTOR & CATEGORY:		<i>Note: Salmon pink highlighted indicator denotes a Critical Indicator.</i>
Scale of Significance: NATIONAL - Country	Scale of Significance: NATIONAL - City	Notes:
1) GOVERNANCE AND REGULATORY CONSTRUCTS:	1) GOVERNANCE AND REGULATORY CONSTRUCTS:	1) GOVERNANCE AND REGULATORY CONSTRUCTS:
i) Governance	i) Governance	
a) Regimes of Financial Capital Accumulation and Consumption	a) Regimes of Financial Capital Accumulation and Consumption	
Modes of Accumulation: Means by which capital is accumulated and circulated	Modes of Accumulation: Means by which capital is accumulated and circulated	
1	* Gross Capital Formation (% of GDP) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Bank national accounts data, and OECD National Accounts data files)	Gross Capital Formation (% of GDP): Governance & Economic Indicator > Proxy for GOVERNANCE - <u>Regimes of Financial Accumulation & Consumption - Modes of Accumulation</u> & Fiscal Management as well as ECONOMIC - Key Economic Drivers & Forms of Capital. <i>Useful in determining to what extent gross capital is accumulated/formed with respect to GDP.</i> World Bank defines the term as "Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress." According to the 1993 SNA, net acquisitions of valuables are also considered capital formation." (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Bank national accounts data, and OECD National Accounts data files). Historical data extends back circa 1960 (China, India) /1965 (most countries) / 1970 (World) & includes World data. (Ref: R109,237 Aust)
2	* Broad Money (M3, % of GDP) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Monetary Fund, International Financial Statistics and data files, and World Bank and OECD GDP estimates)	Money Aggregates - Broad Money (M3, % GDP): Governance & Economic Indicator > Proxy for GOVERNANCE - <u>Regimes of Financial Accumulation & Consumption - Modes of Accumulation</u>, Liquidity & Fiscal Management as well as ECONOMIC - Key Economic Drivers & Forms of Capital. <i>Looks at how Broad Money M3 is accumulated & circulated. The World Bank defines Broad Money as "the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and traveler's checks; and other securities such as certificates of deposit and commercial paper".</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Monetary Fund, International Financial Statistics and data files, and World Bank and OECD GDP estimates). Historical data extends back circa 1961/1965 (most countries & World) /1978 (China) & includes World data. (Ref: R24,367 Aust) but EXCLUDES France, Germany & Greece.

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Governance Indicators continued...

	Liquidity:	Liquidity:	
3	* Real Interest Rate (%) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Monetary Fund, International Financial Statistics and data files using World Bank data on the GDP deflator.)		Real Interest Rate (%): Governance & Economic Indicator > Proxy for GOVERNANCE - Regimes of Financial Accumulation & Consumption - Modes of Accumulation, <u>Liquidity</u> & Fiscal Management as well as ECONOMIC - Key Economic Drivers & Forms of Capital. <i>Is the lending interest charged by banks to prime customers adjusted for inflation (i.e. Real Interest Rate = Nominal Interest Rate - Inflation Rate) - Reflects a country's range of expectations/confidence in future growth, inflation, returns and risks in the investment and financial markets globally. The World Bank defines this: "Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator.".</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Monetary Fund, International Financial Statistics and data files using World Bank data on the GDP deflator.). Historical data extends back circa 1971 (US) /1975 (Australia) / 1978 (India) / 1980 (China) but INCLUDES World data. (Ref: R261,511 Aust) & PATCHY for Brazil, Canada, France, Germany & Greece.
	b) Modes of Governance and Meta-Governance	b) Modes of Governance and Meta-Governance	
	Capacity to achieve economic efficiencies, collective goal attainment and social cohesion through forms of Government	Capacity to achieve economic efficiencies, collective goal attainment and social cohesion through forms of Government	
4	* Gross National Expenditure (% of GDP) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Bank national accounts data, and OECD National Accounts data files)		Gross National Expenditure (% of GDP): Governance & Economic Indicator > Proxy for GOVERNANCE - <u>Modes of Governance and Meta-Governance</u> - <u>Capacity</u>< Market Maturity & Government Fiscal Management as well as ECONOMIC - Key Economic Drivers and Investment & Business Climate. <i>Identifies to what extent a country is living/spending beyond its capacity to generate income/economic growth - reflection of how fiscally responsible the Government operates, how the government debt impacts funding within the economy, market maturity and the investment/business climate. . World Bank defines this: "Gross national expenditure (formerly domestic absorption) is the sum of household final consumption expenditure (formerly private consumption), general government final consumption expenditure (formerly general government consumption), and gross capital formation (formerly gross domestic investment)".</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Bank national accounts data, and OECD National Accounts data files). Historical data extends back circa 1960 (India) /1965 (Australia & US) / 1970 (China) but INCLUDES World data. (Ref: R114,895 Aust)
5	* Claims on Central Government (% of GDP) - Country (Sources: World Bank - World Development Indicators 1960-2012 > International Monetary Fund, International Financial Statistics and data files, and World Bank and OECD GDP estimates)		Claims on Central Government, etc (% of GDP): Governance & Economic Indicator > Proxy for GOVERNANCE - <u>Modes of Governance and Meta-Governance</u> - <u>Capacity</u>< Market Maturity & Government Fiscal Management as well as ECONOMIC - Key Economic Drivers and Investment & Business Climate. <i>Identifies to what extent a country's central government has claims/loans (which is net of deposits) & is indebted relative to its income/economic growth - reflection of how fiscally responsible the Government operates, how the government debt impacts funding within the economy and the investment/business climate. World Bank defines this: "Claims on central government include loans to central government institutions net of deposits".</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Monetary Fund, International Financial Statistics and data files, and World Bank and OECD GDP estimates). Historical data extends back circa 1960 (India, USA & World) /1965 (Australia) / 1977 (China) & includes World data. (Ref: R36,175 Aust)

Governance Indicators continued...

	c) Market Maturity	c) Market Maturity	
6	* Risk Premium on Lending (Prime Rate Minus Treasury Bill Rate, %) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Monetary Fund, International Financial Statistics database)		Risk Premium on Lending (Prime Rate Minus Treasury Bill Rate, %): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Liquidity, <u>Market Maturity</u>, Political Stability & Fiscal Management as well as ECONOMIC - Key Economic Driver, Investment & Business Climate & Forms of Capital as well as Social - Urban Concepts wrt housing affordability and household wealth/disposable income. Reflects the Premium consumers and investors place on the risks associated with the the cost of lending - therefore reflects a country's range of expectations/confidence in future growth, inflation, returns and risks in the investment and financial markets globally. The World Bank defines this as "Risk premium on lending is the interest rate charged by banks on loans to prime private sector customers minus the "risk free" treasury bill interest rate at which short-term government securities are issued or traded in the market. In some countries this spread may be negative, indicating that the market considers its best corporate clients to be lower risk than the government.". (Sources: World Bank - World Development Indicators 1960-2012 > International Monetary Fund, International Financial Statistics database). Historical data extends back circa 1960 (US) / 1975 (Australia) but EXCLUDES China, India, Indonesia, UAE & World data. (Ref: R265,693 Aust)
7	* Time Required To Start a Business (Days) - Country (Sources: World Bank World Development Indicators 1960-2012 (July 2013 Update) > World Bank, Doing Business project)		Time Required To Start a Business (Days): Governance & Economic Indicator > Proxy for Proxy for GOVERNANCE - Modes of Governance & Meta-Governance, <u>Market Maturity</u> and Regulatory Constructs - Regulatory Frameworks as well as ECONOMIC - Comparative Advantage & Investment and Business Climate. Measures the average time it takes to start a business and therefore indicates how conducive & mature the business market is and how well the government encourages start up businesses. The World defines this: "Time required to start a business is the number of calendar days needed to complete the procedures to legally operate a business. If a procedure can be speeded up at additional cost, the fastest procedure, independent of cost, is chosen." (Sources: World Bank World Development Indicators 1960-2012 (July 2013) > World Bank, Doing Business project). Historical data extends back circa 2003 (Most countries & World) & includes World data. (Ref: R297,427 Aust)
8	* Time to Resolve Insolvency (Years) - Country (Sources: World Bank World Development Indicators 1960-2012 (July 2013 Update) > World Bank, Doing Business project)		Time to Resolve Insolvency (Years): Governance & Economic Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance, <u>Market Maturity</u> and Regulatory Constructs - Regulatory Frameworks as well as ECONOMIC - Investment and Business Climate. Looks how long it takes to resolve company insolvency - Reflects regulatory and business transparency & efficiencies. The World Bank defines the measure: "Time to resolve insolvency is the number of years from the filing for insolvency in court until the resolution of distressed assets." Historical series from 2003-2011. (Sources: World Bank World Development Indicators 1960-2012 (July 2013) > World Bank, Doing Business project). Historical data extends back circa 2003 (Most Countries & World) and includes World data. (Ref: R298,411 Aust)

Governance Indicators continued...

	d) Leadership and Vision	e) Leadership and Vision	
	National Political Leadership and Vision	State Political Leadership and Vision	
9	* Health Expenditure, Total (% of GDP) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Health Organization National Health Account database (www.who.int/nha/en) supplemented by country data)		Health Expenditure, Total (% of GDP): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - <u>Leadership & Vision</u> and Government Fiscal Management; ECONOMIC - Workforce and Investment & Business Climate as well as SOCIAL - Collective Values, Socio-Demographic Trends and Health & Education. <i>Identifies the leadership vision, measure of importance & financial support the Government gives to the provision of health associated services for the entire population – impacts on general health and well being and reflects access to health infrastructure & services by the country's workers, residents & visitors. The World Bank defines this: "Total health expenditure is the sum of public and private health expenditure. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation."</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > World Health Organization National Health Account database (www.who.int/nha/en) supplemented by country data). Historical data extends back circa 1995 (most countries & World) & includes World data but EXCLUDES HK data. (Ref: R120,061 Aust)
10	* Public Spending on Education, Total (% of GDP) - National (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics)		Public Spending on Education, Total (% of GDP): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - <u>Leadership & Vision</u> and Government Fiscal Management; ECONOMIC - Competitive Advantage, Workforce and Investment & Business Climate as well as SOCIAL - Collective Values, Socio-Demographic Trends and Health & Education. <i>Identifies the leadership vision, measure of importance & financial support the Government gives to the provision of education and associated services for the entire population - impacts on the general education of the population and reflects the knowledge based capacity of the country's workers and residents. The World Bank defines this: "Public expenditure on education consists of current and capital public expenditure on education includes government spending on educational institutions (both public and private), education administration as well as subsidies for private entities (students/households and other private entities)."</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics). Historical data extends back circa 1971 (most countries) / 1975 (World) but PATCHY & includes World data. (Ref: R256,837 Aust)

Governance Indicators continued...

11	* Military Expenditure (% of GDP) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > Stockholm International Peace Research Institute (SIPRI), Yearbook: Armaments, Disarmament and International Security & World Bank - World Development Indicators 1960-2010)	Military Expenditure (% of GDP): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Political Stability, <u>Leadership & Vision</u> and Government Fiscal Management; ECONOMIC - Investment & Business Climate as well as SOCIAL - Collective Values and Social Trade-Offs. <i>Identifies the leadership vision, measure of importance & financial support the Government gives to the provision of military and defence associated services for the entire population - impacts on the country's political stability, government's fiscal management, investment/business climate and reflects country's collective values on peace keeping and defending the nation in relation to other key priorities and social trade-offs (i.e. military money that could be directed on health or education, etc). World Bank defines this: "Military expenditures data from SIPRI are derived from the NATO definition, which includes all current and capital expenditures on the armed forces, including peacekeeping forces; defense ministries and other government agencies engaged in defense projects; paramilitary forces, if these are judged to be trained and equipped for military operations; and military space activities. Such expenditures include military and civil personnel, including retirement pensions of military personnel and social services for personnel; operation and maintenance; procurement; military research and development; and military aid (in the military expenditures of the donor country). Excluded are civil defense and current expenditures for previous military activities, such as for veterans' benefits, demobilization, conversion, and destruction of weapons. This definition cannot be applied for all countries, however, since that would require much more detailed information than is available about what is included in military budgets and off-budget military expenditure items. (For example, military budgets might or might not cover civil defense, reserves and auxiliary forces, police and paramilitary forces, dual-purpose forces such as military and civilian police, military grants in kind, pensions for military personnel, and social security contributions paid by one part of government to another.)"</i> (Sources: World Bank - World Development Indicators 1960-2012 > Stockholm International Peace Research Institute (SIPRI), Yearbook: Armaments, Disarmament and International Security & World Bank - World Development Indicators 1960-2012 (July 2013). Historical data extends back circa 1988 (most countries) / 1989 (World) & includes World data but EXCLUDES HK data. (Ref: R173,443 Aust)
12	e) Fiscal Management * Current Account Balance (% of GDP) - Country (Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Monetary Fund, Balance of Payments Statistics Yearbook and data files, and World Bank and OECD GDP estimates; 2) IMF - World Economic Outlook (April 2013 Update) > 2013-2018 Forecasts)	f) Fiscal Management Current Account Balance (% of GDP): Governance & Economic Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity & <u>Fiscal Management</u> as well as ECONOMIC - Key Economic Driver, Comparative Advantage and Investment & Business Climate. <i>Measures the difference between national savings and investment. Reflects how well the Government & economy operates; the overall productivity of the economy; whether this produces a conducive investment/business climate & what comparative advantage the country has over others in competing for business. Reflects how well the Government & economy operates; the overall productivity of the economy; whether this produces a conducive investment/business climate & what comparative advantage the country has over others in competing for business. The World Bank defines this: "Current account balance is the sum of net exports of goods, services, net income, and net current transfers."</i> (Sources: Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013) > International Monetary Fund, Balance of Payments Statistics Yearbook and data files, and World Bank and OECD GDP estimates; 2) IMF - World Economic Outlook (April 2013 Update) > 2013-2018 Forecasts). Historical data extends back circa 1965 (Australia) / 1970 (USA) / 1975 (India) / 1982 (China) & EXCLUDES World & UAE data. (WDI Ref: R59,545 Aust). However IMF provides World data for 1980-2010 China data 1980-2010 & use IMF forecasts for countries & World 2013-2018 (WEO Ref: R17 Aust)

Governance Indicators continued...

	ii) Regulatory Constructs	ii) Regulatory Constructs	
	a) Regulatory Frameworks	b) Regulatory Frameworks	
	National Regulatory Transparency of Market Frameworks - Legal, Financial, Business/Investment	State Regulatory Transparency of Market Frameworks - Legal, Financial, Business/Investment	
13	* Time Required to Enforce a Contract (Days) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Bank, Doing Business project)		Time Required to Enforce A Contract: Governance & Economic Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance, Market Maturity and <u>Regulatory Constructs - Regulatory Frameworks</u> as well as ECONOMIC - Comparative Advantage & Investment and Business Climate. <i>Measures the time required to enforce a legal contract - indicates how efficient/cumbersome the legal system is and how this would be conducive to attracting business investment. The World Bank defines this: "Time required to enforce a contract is the number of calendar days from the filing of the lawsuit in court until the final determination and, in appropriate cases, payment."</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > World Bank, Doing Business project). Historical data extends back circa 2003 (Most countries & World) & includes World data. (Ref: R296,443 Aust)
	iii) Governance Trade-Offs	ii) Regulatory Constructs	
14	* Prison Population Rate (No. per 100,000 Inhabitants) - Country (Sources: OECD Factbook 2010 - Crime> Prison Population)		Prison Population Rate (No. per 100,000 Inhabitants): Governance & Social Indicator > Proxy for GOVERNANCE - Leadership & Vision, Modes of Governance and Meta - Governance, Government Fiscal Management & <u>Governance Trade-Offs</u> as well as SOCIAL - Collective Values, Socio-Demographic Trends and Social Trade-Offs. <i>In measuring the number of prisoners as a proportion of the total population – it is an indicator of crime and lawlessness. It reflects a Governance Trade-Off and a Social Trade-Off, leadership vision, the importance & financial support the Government gives to the provision of crime prevention and incarceration services for the entire population. It also reflects a country's collective values on crime and incarceration in relation to other key priorities and governance and social trade-offs (i.e. money spent on prisons that could otherwise be directed on health or education, etc).</i> OECD defines this "Prison Population Rate based on the number per 100,000 inhabitants". (Sources: OECD Factbook 2010 - Crime> Prison Population). Historical data extends back 1992 but intermittent intervals (1992,1995,1998,2001,2004 & 2009) & EXCLUDES HK, Singapore, UAE & World data & SUBSTITUTED OECD Average as a representative proxy for World data for comparative/reference purposes.

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

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2) ECONOMIC:		2) ECONOMIC:
i) Key Economic Drivers		i) Key Economic Drivers
15	* Gross Domestic Product (\$USM, Constant 2005 Prices), Country Level (Source: Oxford Economics, March 2013 Customised Data for M Glastris)	Gross Domestic Product (\$US, Constant 2005 Prices): Governance & Economic Indicator > Proxy for GOVERNANCE - Regimes of Financial Accumulation & Consumption - Modes of Accumulation, Market Maturity & Fiscal Management as well as ECONOMIC - <u>Key Economic Drivers</u>, Comparative Advantage & Investment and Business Climate. <i>Measures total economic activity with respect to constant prices and is useful for tracking developments over time (Stutely 2003). In this instance, the Production Approach is used to calculate GDP where intermediate consumption (e.g. cost of materials, supplies, services, etc used to produce final goods and services) is deducted from the Gross Value of domestic Output from various economic activities (Wikipedia 2013). It is regarded as a universal indicator with multiplier effects (e.g. increased employment, increased consumption and investment, etc). It reflects how slow/fast a country/city's economy is growing. Developing cities and countries have a relatively higher capacity for faster GDP growth than more developed/mature cities/countries (circa 3% real GDP growth pa) (Stutely 2003). Oxford Economics defines this: "Gross domestic product (GDP) is an aggregate measure of production equal to the sum of the gross values added of all resident institutional units engaged in production (plus any taxes, and minus any subsidies, on products not included in the value of their outputs). It is also the sum of the final uses of goods and services (all uses except intermediate consumption) measured in purchasers' prices, less the value of imports of goods and services, or the sum of primary incomes distributed by resident producer units".</i> (Sources: 1) Oxford Economics ~1980-2025 (March 2013) Customised data for M Glastris > Annual data provided at Country and City levels, generally more historical data available at country level. Historical data provided circa 1980-2013 and forecasted data provided 2014-2025 on an annual basis. Where no city data is available, comparable data at a state, provincial or equivalent level is provided e.g. No city data available for Banglaore & Mumbai, thereofre state data for Karnataka & Maharashtra are provided respectfully. No data available for UAE, Dubai, Israel & Tel-Aviv.
16	* GDP Growth (Annual %) (Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Bank national accounts data, and OECD National Accounts data files; 2) IMF - World Economic Outlook April 2013 Update > 2013-2018 Forecasts)	Gross Domestic Product Growth (Annual %): Governance & Economic Indicator > Proxy for GOVERNANCE - Regimes of Financial Accumulation & Consumption - Modes of Accumulation, Market Maturity & Fiscal Management as well as ECONOMIC - <u>Key Economic Drivers</u>, Comparative Advantage & Investment and Business Climate. <i>Measures how slow/fast a country's economy is growing. The World Bank defines this: "Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2000 U.S. dollars. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources" & IMF defines this "Annual percentages of constant price GDP are year-on-year changes; the base year is country-specific. Expenditure-based GDP is total final expenditures at purchasers' prices (including the f.o.b. value of exports of goods and services), less the f.o.b. value of imports of goods and services. [SNA 1993]"</i>. (Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013) > World Bank national accounts data, and OECD National Accounts data files; 2) IMF - World Economic Outlook April 2013 Update Constant Prices Annual growth > 2013-2018 Forecasts). Historical data extends back circa 1961 (China, India) /1966 (Australia) / 1971 (US & World) & includes World data (Ref: R98,413 Aust) and IMF forecasts 2013-2018 (Ref: R4,529 Aust).

Economic Indicators continued...

17	* GDP Per Capita (Current US \$) (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Bank, International Comparison Program database); 2) IMF - World Economic Outlook (April 2013 Update) > 2013-2018 Forecasts)	Gross Domestic Product Per Capita (Current US \$): Governance & Economic Indicator > Proxy for GOVERNANCE - Regimes of Financial Accumulation & Consumption - Modes of Accumulation, Market Maturity & Fiscal Management as well as ECONOMIC - <u>Key Economic Drivers</u>, Comparative Advantage & Investment and Business Climate. Measures how slow/fast a country's economy is growing in terms of its economic growth per capita. The World Bank defines this: "GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars". The IMF also defines this: "GDP is expressed in current U.S. dollars per person. Data are derived by first converting GDP in national currency to U.S. dollars and then dividing it by total population". (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > World Bank national accounts data, and OECD National Accounts data files). Historical data extends back circa 1980 (Most Countries) & includes World data. (Ref: R99,397 Aust) and IMF forecasts 2013-2018 but no World IMF forecasts available (Ref: R4,529 Aust).
18	* Inflation, Consumer Prices (Annual %) - National. (Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Monetary Fund, International Financial Statistics and data files; 2) IMF - World Economic Outlook (April 2013 Update) > 2013-2018 Forecasts)	Inflation, Consumer Prices (Annual %): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Regimes of Financial Capital Accumulation and Consumption in terms of Liquidity; Modes of Governance & Meta-Governance in terms of Capacity; market Maturity; Fiscal Management & Regulatory Constructs with respect to Regulatory Frameworks as well as ECONOMIC - <u>Key Economic Drivers</u> and Investment & Business Climate as well as SOCIAL - Urban Concepts, Socio-Demographic Trends & Social Trade-Offs. Most popular measure of price inflation in retail goods & services as it determines how much consumers pay for goods & services, affects the cost of doing business, impacts on personal & corporate investments, influences the quality of life, housing affordability and household wealth/disposable income and the inflation outlook affects labour contracts and government fiscal policy. World Bank defines this: "Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used." (Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013) > International Monetary Fund, International Financial Statistics and data files; 2) IMF - World Economic Outlook (April 2013 Update) > 2013-2018 Forecasts). Historical data extends back circa 1961 (Australia, India & USA) / 1987 (China) but EXCLUDES World & UAE data. (Ref: R136,051 Aust). However IMF provides World data for 1980-2009 & China data 1980-2009 & use IMF forecasts for countries & world 2011-2017 (Ref: R5,845 Aust).

Economic Indicators continued...

	ii) Economic Competitiveness	ii) Economic Competitiveness
19	* Research and Development Expenditure (% of GDP) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics)	Research & Development Expenditure (% of GDP): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Market Maturity, Leadership & Vision and Fiscal Management as well as ECONOMIC - <u>Economic Competitiveness</u> - <u>Comparative Advantage</u>, Technology Transfer, Investment & Business Climate and Forms of Capital as well as SOCIAL - Education. Measure of how much is spent on Research and Development and therefore reflects extent the government and private sector drives the development of intellectual capital, what sort of a leading edge does a country have in the provision creating/developing/improving future goods/services, what sort of a competitive advantage does this provide to a country's investment and business sectors and the impact it may have on educating knowledge workers. The World Bank defines this: "Expenditures for research and development are current and capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture, and society, and the use of knowledge for new applications. R&D covers basic research, applied research, and experimental development." (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics). Historical data extends back circa 1996 (Most countries), includes World data but EXCLUDES UAE data. (Ref: R264,217 Aust)
20	Global Competitiveness Index (GCI=1-7, where 7 is the highest) - COUNTRY (Source: World Economic Forum World Competitiveness Report (2013-14, 2012-13, 2011-12, 2010-11, 2009-2010, 2008-09 Updates)	Global Competitiveness Index (GCI=1-7, where 7 is the highest): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Market Maturity, Leadership & Vision, Fiscal Management & Regulatory Frameworks as well as ECONOMIC - <u>Economic Competitiveness</u>, Workforce, Technology Transfer, Investment & Business Climate, Infrastructure Support and Forms of Capital as well as SOCIAL - Health & Education. GCI is an aggregated index which comprises indicators compiled across 12 pillars ([FACTOR DRIVEN ECONOMIES: 1) Institutions; 2) Infrastructure; 3) Macroeconomic environment; 4) Health and primary education]; [EFFICIENCY DRIVEN ECONOMIES: 5) Higher education and training; 6) Goods market efficiency; 7) Labor market efficiency; 8) Financial market development; 9) Technological readiness; 10) Market size]; [INNOVATION DRIVEN ECONOMIES: 11) Business sophistication; 12) Innovation]) and provides both a score used here as well as a ranking. The World Economic Forum defines this: "the set of institutions, policies, and factors that determine the level of productivity of a country. The level of productivity, in turn, sets the level of prosperity that can be reached by an economy. The productivity level also determines the rates of return obtained by investments in an economy, which in turn are the fundamental drivers of its growth rates. In other words, a more competitive economy is one that is likely to grow faster over time. The concept of competitiveness thus involves static and dynamic components. Although the productivity of a country determines its ability to sustain a high level of income, it is also one of the central determinants of its returns on investment, which is one of the key factors explaining an economy's growth potential." (World Economic Forum World Competitiveness Report (2013-14, 2012-13, 2011-12, 2010-11, 2009-2010, 2008-09 Updates) Historical data extends back circa 2006 but was unable to obtain 2006-07 & 2007-08 reports. Data coverage for all key and cross reference countries.

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21	* Lead Time To Export, Median Case (Days) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Bank and Turku School of Economics, Logistic Performance Index Surveys)	Lead Time To Export, Median Case (Days): Governance & Economic Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, & Regulatory Constructs with respect to Regulatory Frameworks as well as ECONOMIC - <u>Economic Competitiveness</u>, Investment & Business Climate and Infrastructure Support. <i>Provides an indication of speed to Export market - reflects governance & regulatory climate, influences a country's competitive advantage over another in terms of delivery/lead times, impacts on the business & investment climate in terms of delivery of products to be exported and also reflects logistics efficiencies. The World Bank defines this: "Lead time to export is the median time (the value for 50 percent of shipments) from shipment point to port of loading. Data are from the Logistics Performance Index survey. Respondents provided separate values for the best case (10 percent of shipments) and the median case (50 percent of shipments). The data are exponentiated averages of the logarithm of single value responses and of midpoint values of range responses for the median case."</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > World Bank and Turku School of Economics, Logistic Performance Index Surveys). Historical data extends back circa 2006 > 2006 & 2009 SNAPSHOTS only (Most countries) & includes World data. (Ref: R153,271 Aust)
22	* Lead Time To Import, Median Case (Days) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Bank and Turku School of Economics, Logistic Performance Index Surveys)	Lead Time To Import, Median Case (Days): Governance & Economic Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, & Regulatory Constructs with respect to Regulatory Frameworks as well as ECONOMIC - <u>Economic Competitiveness</u>, Investment & Business Climate and Infrastructure Support. <i>Provides an indication of speed to Import market - reflects governance & regulatory climate, influences a country's competitive advantage over another in terms of delivery/lead times, impacts on the business & investment climate in terms of delivery of products to market and also reflects logistics efficiencies. The World Bank defines this: "Lead time to import is the median time (the value for 50 percent of shipments) from port of discharge to arrival at the consignee. Data are from the Logistics Performance Index survey. Respondents provided separate values for the best case (10 percent of shipments) and the median case (50 percent of shipments). The data are exponentiated averages of the logarithm of single value responses and of midpoint values of range responses for the median case."</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > World Bank and Turku School of Economics, Logistic Performance Index Surveys). Historical data extends back circa 2006 > 2006 & 2009 SNAPSHOTS only (Most countries) & includes World data. (Ref: R153,517 Aust)
23	* High-Technology Exports (% of Manufactured Exports) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > United Nations, Comtrade database)	High-Technology Exports (% of Manufactured Exports): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Market Maturity, Leadership & Vision and Fiscal Management as well as ECONOMIC - <u>Economic Competitiveness</u>, Technology Transfer, Investment & Business Climate and Forms of Capital as well as SOCIAL - Education. <i>Measures what proportion of high technology goods/exports are exported as a total of manufactured exports. Therefore reflects extent government encourages development of value add manufactured capital, what sort of a leading edge does a country has in the provision improving/creating future high tech goods, what sort of a competitive advantage does this provide to a country's investment and business sectors and the impact it may have on educating knowledge & manufacturing workers. The World Bank defines this: "High-technology exports are products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery."</i> (Sources: World Bank - World Development Indicators 1960-2011 > United Nations, Comtrade database). Historical data extends back circa 1988 (Australia, India) / 1989 (US & World) / 1992 (China) & includes World data. (Ref: 214730 Aust)

Economic Indicators continued...

24	* Trade in Services (% of GDP) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Monetary Fund, Balance of Payments Statistics Yearbook and data files, and World Bank and OECD GDP estimates)	Trade in Services (% of GDP): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Market Maturity, Leadership & Vision and Fiscal Management as well as ECONOMIC - <u>Economic Competitiveness</u>, Workforce, Technology Transfer, Investment & Business Climate, Infrastructure Support and Forms of Capital as well as SOCIAL - Education. <i>Measures what proportion of trade in services occurs as a proportion of GDP. Therefore reflects extent government encourages development of services sector, tertiarisation rates, how heavily a country relies on the provision of services to generate economic growth, what sort of a competitive advantage does this provide to a country's investment and business sectors, reliance on connectivity/infrastructure support, value of intellectual capital & value add services and the impact it may have on educating knowledge & service workers. The World Bank defines this: "Trade in services is the sum of service exports and imports divided by the value of GDP, all in current U.S. dollars"</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > International Monetary Fund, Balance of Payments Statistics Yearbook and data files, and World Bank and OECD GDP estimates). Historical data extends back circa 1965 (Australia) /1970 (US) /1975 (India & World) /1982 (China), includes World data but EXCLUDES UAE data. (Ref: 301,363 Aust)
25	* Manufacturing, Value Added (% of GDP) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Bank national accounts data, and OECD National Accounts data files)	Manufacturing, Value Added (% of GDP): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Market Maturity, Leadership & Vision and Fiscal Management as well as ECONOMIC - <u>Economic Competitiveness</u>, Workforce, Technology Transfer, Investment & Business Climate, Infrastructure Support and Forms of Capital as well as SOCIAL - Education. <i>Measures the extent of value added manufacturing contributes towards GDP. Therefore reflects extent government encourages development of manufacturing sector, tertiarisation rates, how heavily a country relies on the provision of value added manufacturing to generate economic growth, what sort of a competitive advantage does this provide to a country's investment and business sectors, reliance on connectivity/infrastructure support, value of manufacturing processes, capital and value add services. The World Bank defines this: "Manufacturing refers to industries belonging to ISIC divisions 15-37. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Note: For VAB countries, gross value added at factor cost is used as the denominator."</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > World Bank national accounts data, and OECD National Accounts data files). Historical data extends back circa 1960 (India) /1965 (China) / 1970 (USA) / 1980 (World) / 1990 (Australia), includes World data but excludes Israel data. (Ref: R163,357 Aust)

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26	* Industry, Value Added (% of GDP) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Bank national accounts data, and OECD National Accounts data files)	Industry, Value Added (% of GDP): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Market Maturity, Leadership & Vision and Fiscal Management as well as ECONOMIC - <u>Economic Competitiveness</u>, Workforce, Technology Transfer, Investment & Business Climate, Infrastructure Support and Forms of Capital as well as SOCIAL - Education. <i>Measures the extent of value added industry contributes towards GDP. Differs from "Manufacturing, Value Added (% of GDP)" because it includes value added from manufacturing sector as well resources, utilities and construction sectors/industries. Reflects extent government encourages development of industry based sectors, tertiarisation rates, how heavily a country relies on the provision of value added industry sectors to generate economic growth, what sort of a competitive advantage does this provide to a country's investment and business sectors, reliance on connectivity/infrastructure support, value of industry based processes, capital and value add services. The World Bank defines this: "Industry corresponds to ISIC divisions 10-45 and includes manufacturing (ISIC divisions 15-37). It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Note: For VAB countries, gross value added at factor cost is used as the denominator."</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > World Bank national accounts data, and OECD National Accounts data files). Historical data extends back circa 1960 (China, India) / 1970 (USA, World) / 1972 (Australia), includes World data but excludes Israel data. (Ref: R134,575 Aust)
	iii) Workforce	iii) Workforce
27	* Employment ('000s, People), Country Level (Source: Oxford Economics, March 2013 Customised Data for M Glastris)	Employment ('000s, People): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance - Capacity; Market Maturity Leadership & Vision as well as ECONOMIC - <u>Workforce</u>; Key Economic Drivers; Economic Competitiveness - Comparative Advantage; Investment & Business Climate, Infrastructure Support and Forms of Capital as well as SOCIAL - Urban Concepts and Education. <i>Measures how the employment level within a city/country and is a form of capital. It reflects government's policies to raise employment, the market maturity with respect to the proportion of workers employed in knowledge based jobs, the economic comparative advantage a city may have over others in terms of a skilled workforce and labour wages/salaries. It impacts on the levels of technology transfer and infrastructure support needed to support employment and on social aspects such as work-lifestyle balance and tertiary education attainment. Oxford Economics defines this: "Employment usually identifies those employed according to the geographical location of their work, for example if a person is employed in London but commutes in from Essex, they would be counted in London's workplace employment. This is the most common measure of employment and is usually calculated from company surveys. For some countries however, this measure is not available and a residence-based measure is used instead, which is normally based on LFS surveys (e.g. Australia, Canada)".</i> (Sources: 1) Oxford Economics ~1980-2025 (March 2013) Customised data for M Glastris > Annual data provided at Country and City levels, generally more historical data available at country level. Historical data provided circa 1980-2013 and forecasted data provided 2014-2025 on an annual basis. Where no city data is available, comparable data at a state, provincial or equivalent level is provided e.g. No city data available for Bangalore & Mumbai, therefore state data for Karnataka & Maharashtra are provided respectfully. No data available for UAE, Dubai, Israel & Tel-Aviv.

Economic Indicators continued...

	iii) Workforce	iii) Workforce	
27	* Employment ('000s, People), Country Level (Source: Oxford Economics, March 2013 Customised Data for M Glastris)	* Employment ('000s, People), City Level (Source: Oxford Economics, March 2013 Customised Data for M Glastris)	Employment ('000s, People): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance - Capacity; Market Maturity Leadership & Vision as well as ECONOMIC - <u>Workforce</u>; Key Economic Drivers; Economic Competitiveness - Comparative Advantage; Investment & Business Climate, Infrastructure Support and Forms of Capital as well as SOCIAL - Urban Concepts and Education. Measures how the employment level within a city/country and is a form of capital. It reflects government's policies to raise employment, the market maturity with respect to the proportion of workers employed in knowledge based jobs, the economic comparative advantage a city may have over others in terms of a skilled workforce and labour wages/salaries. It impacts on the levels of technology transfer and infrastructure support needed to support employment and on social aspects such as work-lifestyle balance and tertiary education attainment. Oxford Economics defines this: "Employment usually identifies those employed according to the geographical location of their work, for example if a person is employed in London but commutes in from Essex, they would be counted in London's workplace employment. This is the most common measure of employment and is usually calculated from company surveys. For some countries however, this measure is not available and a residence-based measure is used instead, which is normally based on LFS surveys (e.g. Australia, Canada)". (Sources: 1) Oxford Economics ~1980-2025 (March 2013) Customised data for M Glastris > Annual data provided at Country and City levels, generally more historical data available at country level. Historical data provided circa 1980-2013 and forecasted data provided 2014-2025 on an annual basis. Where no city data is available, comparable data at a state, provincial or equivalent level is provided e.g. No city data available for Bangalore & Mumbai, therefore state data for Karnataka & Maharashtra are provided respectfully. No data available for UAE, Dubai, Israel & Tel-Aviv.
28	* Unemployment ('000s, People), Country Level (Source: Oxford Economics, March 2013 Customised Data for M Glastris)	* Unemployment ('000s, People), City Level (Source: Oxford Economics, March 2013 Customised Data for M Glastris)	Unemployment ('000s, People): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Market Maturity, Leadership & Vision and Fiscal Management as well as ECONOMIC - Economic Competitiveness - Comparative Advantage, <u>Workforce</u>, Technology Transfer, Investment & Business Climate, Infrastructure Support and Forms of Capital as well as SOCIAL - Education. Measures how slow/fast a country/city's unemployment level is growing. Oxford Economics defines this: "Unemployment comprises all persons above a specified age who during the reference period were: 1) - without work, that is, were not in paid employment or self employment during the reference period; 2) - currently available for work, that is, were available for paid employment or self-employment during the reference period; and; 3) - seeking work, that is, had taken specific steps in a specified recent period to seek paid employment or self-employment. " (Sources: 1) Oxford Economics ~1980-2025 (March 2013) Customised data for M Glastris > Annual data provided at Country and City levels, generally more historical data available at country level. Historical data provided circa 1980-2013 and forecasted data provided 2014-2025 on an annual basis. Where no city data is available, comparable data at a state, provincial or equivalent level is provided e.g. No city data available for Bangalore & Mumbai, therefore state data for Karnataka & Maharashtra are provided respectfully. No data available for UAE, Dubai, Israel & Tel-Aviv.

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29	* Employment in Industry (% of Total Employment) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Labour Organization, Key Indicators of the Labour Market database)	Employment in Industry (% of Total Employment) : Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Market Maturity, Leadership & Vision and Fiscal Management as well as ECONOMIC - Economic Competitiveness - Comparative Advantage, <u>Workforce</u>, Technology Transfer, Investment & Business Climate, Infrastructure Support and Forms of Capital as well as SOCIAL - Education. <i>Therefore reflects extent government encourages development of industry based sectors, tertiarisation rates, extent the provision of industry based activities (includes manufacturing, mining, construction & public utilities) contributes towards a country's economic growth, what sort of a competitive advantage does this provide to a country's investment and business sectors, reliance on connectivity/infrastructure support, value of intellectual capital & value add services, the impact it may have on educating industry based workers, higher education/training levels attained. The World Bank defines this: "Employees are people who work for a public or private employer and receive remuneration in wages, salary, commission, tips, piece rates, or pay in kind. Industry corresponds to divisions 2-5 (ISIC revision 2) or tabulation categories C-F (ISIC revision 3) and includes mining and quarrying (including oil production), manufacturing, construction, and public utilities (electricity, gas, and water)."</i> (Sources: World Bank - World Development Indicators 1960-2011 > International Labour Organization, Key Indicators of the Labour Market database). Historical data extends back circa 1980 (most countries) /1987 (China) but LIMITED data for India & World. (Ref. 180447 Aust)
30	* Employment in Services (% of Total Employment) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Labour Organization, Key Indicators of the Labour Market database)	Employment in Services (% of Total Employment) : Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Market Maturity, Leadership & Vision and Fiscal Management as well as ECONOMIC - Comparative Advantage, <u>Workforce</u>, Technology Transfer, Investment & Business Climate, Infrastructure Support and Forms of Capital as well as SOCIAL - Education. <i>Therefore reflects extent government encourages development of services based sectors, tertiarisation rates, extent the provision of services (includes wholesale & retail trade, restaurants & hotels; transport, storage & communications; finance, insurance, real estate & business services; community, social & personal services) contributes towards a country's economic growth, what sort of a competitive advantage does this provide to a country's investment and business sectors, reliance on connectivity/infrastructure support, value of intellectual capital & value add services, the impact it may have on educating services based workers, higher education/training levels attained. The World Bank defines this: "Employees are people who work for a public or private employer and receive remuneration in wages, salary, commission, tips, piece rates, or pay in kind. Services correspond to divisions 6-9 (ISIC revision 2) or tabulation categories G-P (ISIC revision 3) and include wholesale and retail trade and restaurants and hotels; transport, storage, and communications; financing, insurance, real estate, and business services; and community, social, and personal services."</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > International Labour Organization, Key Indicators of the Labour Market database). Historical data extends back circa 1980 (most countries) /1987 (China) but LIMITED data for India & World. (Ref. R76,027 Aust)
31	* Employment in Industry & Services (% of Total Employment) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Labour Organization, Key Indicators of the Labour Market database)	Employment in Industry & Services (% of Total Employment) : Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Market Maturity, Leadership & Vision and Fiscal Management as well as ECONOMIC - Economic Competitiveness - Comparative Advantage, <u>Workforce</u>, Technology Transfer, Investment & Business Climate, Infrastructure Support and Forms of Capital as well as SOCIAL - Education. <i>Therefore reflects extent government encourages development of industry & services based sectors, tertiarisation rates, extent the provision of services (includes wholesale & retail trade, restaurants & hotels; transport, storage & communications; finance, insurance, real estate & business services; community, social & personal services) contributes towards a country's economic growth, what sort of a competitive advantage does this provide to a country's investment and business sectors, reliance on connectivity/infrastructure support, value of intellectual capital & value add services, the impact it may have on educating services based workers, higher education/training levels attained. CALCULATED BY ADDING Employment in Industry (% of Total) and Employment in Services (% of Total). Refer to respective World Bank definitions above.</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > International Labour Organization, Key Indicators of the Labour Market database). Historical data extends back circa 1980 (most countries) /1987 (China) but EXCLUDES data for India & World. (No Reference - Calculated)

Economic Indicators continued...

	iv) Technology Transfer	iv) Technology Transfer	
32	* Internet Users (per 100 people) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Telecommunication Union, World Telecommunication/ICT Development Report and database, and World Bank estimates.)		Internet Users (per 100 people): Governance & Economic Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Regulatory Constructs with respect to Regulatory Frameworks, Market Maturity, Leadership & Vision as well as ECONOMIC - Economic Competitiveness - Competitive Advantage, Workforce, <u>Technology Transfer</u>, Investment & Business Climate and Infrastructure Support. <i>Measures the number of internet users as a proportion of the total population - reflects governance & regulatory climate, extent government supports/encourages internet infrastructure, influences a country's competitive advantage over another in terms of the population's access and connectivity to the internet, impacts on the business & investment climate in terms of national/global connectivity/technology transfer and also reflects infrastructure support, coverage and efficiencies. The World Bank defines this: "Internet users are people with access to the worldwide network".</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > International Telecommunication Union, World Telecommunication/ICT Development Report and database, and World Bank estimates.) Historical data extends back circa 1990 (Australia, US, World) /1992 (India) /1993 (China) and includes World data. (Ref: R145,891 Aust)
33	* Mobile Cellular Subscriptions (per 100 people) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Telecommunication Union, World Telecommunication/ICT Development Report and database, and World Bank estimates.)		Mobile Cellular Subscriptions (per 100 people): Governance & Economic Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Regulatory Constructs with respect to Regulatory Frameworks, Market Maturity, Leadership & Vision as well as ECONOMIC - Economic Competitiveness - Competitive Advantage, Workforce, <u>Technology Transfer</u>, Investment & Business Climate and Infrastructure Support. <i>Measures the number of mobile phone subscribers as a proportion of the total population - reflects governance & regulatory climate, extent government supports/encourages mobile phone infrastructure, influences a country's competitive advantage over another in terms of the population's telecommunication access and connectivity, impacts on the business & investment climate in terms of national/global connectivity/technology transfer and also reflects infrastructure support, coverage and efficiencies. The World Bank defines this: "Mobile cellular telephone subscriptions are subscriptions to a public mobile telephone service using cellular technology, which provide access to the public switched telephone network. Post-paid and prepaid subscriptions are included".</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > International Telecommunication Union, World Telecommunication/ICT Development Report and database, and World Bank estimates.) Historical data extends back circa 1980 (World) /1984 (US) /1987 (Australia, China) /1995 (India) and includes World data. (Ref: 174,427 Aust)

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Economic Indicators continued...

	v) Investment and Business Climate	v) Investment and Business Climate
34	* Total Investment (% GDP) - Country (Sources: IMF - World Economic Outlook 1980-2018, (April 2013 update))	Total Investment (% GDP): Governance & Economic Indicator > Proxy for GOVERNANCE - Regimes of Financial Accumulation & Consumption - Modes of Accumulation, Modes of Governance & Meta-Governance - Capacity, Market Maturity, Fiscal Management, Regulatory Constructs - Regulatory Frameworks as well as ECONOMIC - Key Economic Drivers, Economic Competitiveness - Comparative Advantage, <u>Investment & Business Climate</u> and Forms of Capital. <i>Total Investments measures the extent of money invested in a country with respect to its economic growth. It impacts the productivity and capacity of the country, is a form of capital with multiplier effects (e.g. increased employment, increased consumption and investment, etc). It also reflects the attractiveness of the investment and business climate, market risks and returns, the maturity of the market, governance and regulatory environment. The IMF defines this: "Expressed as a ratio of total investment in current local currency and GDP in current local currency. Investment or gross capital formation is measured by the total value of the gross fixed capital formation and changes in inventories and acquisitions less disposals of valuables for a unit or sector. [SNA 1993]."</i> (Sources: IMF - World Economic Outlook 1980-2017, (April 2013 update)). Historical data extends back circa 1980 (Australia, US, China, India, World, etc), EXCLUDES WORLD and forecasts 2013-2018 (Ref. 7,153 Aust).
35	* Foreign Direct Investment, Net Inflows (% GDP) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Monetary Fund, International Financial Statistics and Balance of Payments databases, World Bank, Global Development Finance, and World Bank and OECD GDP estimates)	Foreign Direct Investment, Net Inflows (% GDP): Governance & Economic Indicator > Proxy for GOVERNANCE - Regimes of Financial Accumulation & Consumption - Modes of Accumulation, Modes of Governance & Meta-Governance in terms of Capacity, Regulatory Constructs with respect to Regulatory Frameworks, Market Maturity, Leadership & Vision as well as ECONOMIC - Key Economic Drivers, Comparative Advantage, <u>Investment & Business Climate</u> and Forms of Capital. <i>FDI Net Inflows measure the the foreign ownership of productive assets (eg factories, mines, land, etc) and is a measure of growing economic globalisation. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital indicated in the balance of payments. It usually involves participation in management, joint-venture, transfer of technology and expertise. The World Bank defines this: "Foreign direct investment are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, and is divided by GDP."</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > International Monetary Fund, International Financial Statistics and Balance of Payments databases, World Bank, Global Development Finance, and World Bank and OECD GDP estimates). Historical data extends back circa 1970 (Australia, US, World) /1975 (India) /1982 (China) and includes World data but LIMITED UAE data. (Ref. 94,969 Aust).
36	* Market Capitalization of Listed Companies (% of GDP) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > Standard & Poor's, Global Stock Markets Factbook and supplemental S&P data)	Market Capitalization of Listed Companies (% of GDP): Governance & Economic Indicator > Proxy for GOVERNANCE - Regimes of Financial Accumulation & Consumption - Modes of Accumulation, Modes of Governance & Meta-Governance in terms of Capacity, Regulatory Constructs with respect to Regulatory Frameworks, Market Maturity, Leadership & Vision as well as ECONOMIC - Key Economic Drivers, Comparative Advantage, <u>Investment & Business Climate</u> and Forms of Capital. <i>Market Capitalisation measures the current market value of listed companies and reflects the investment's markets' expectations for listed companies investment returns with regards to their profitability, governance and management performance as well as a reflection of the broader business investment and regulatory/governance environment for that country. The World Bank defines this: "Market capitalization (also known as market value) is the share price times the number of shares outstanding. Listed domestic companies are the domestically incorporated companies listed on the country's stock exchanges at the end of the year. Listed companies does not include investment companies, mutual funds, or other collective investment vehicles."</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > Standard & Poor's, Global Stock Markets Factbook and supplemental S&P data). Historical data extends back circa 1988 (Australia, India, US, World) /1991 (China) and includes World data. (Ref. 165,079 Aust).

Economic Indicators continued...

37	* Global Network Connectivity in the World City Network (GNC Proportionate Connectivity Score or GNC Ranking) - Measures how well connected a city is within the world city network (Sources: Globalisation and World Cities (GaWC) Data for 2000, 2004 & 2008)	Global Network Connectivity in the World City Network (GNC Proportionate Connectivity Score): Economic Indicator > Proxy for ECONOMIC - Economic Competitiveness - Comparative & Competitive Advantages, Workforce, Technology Transfer, Investment & Business Climate, Infrastructure Support and Forms of Capital. <i>Measures how well connected a city is within the world city network in terms of connectivity to "Advanced Producer Services". This reflects the development of intellectual capital, what sort of a comparative and competitive advantages does this city provide to its investment and business sectors and the impact it may have on advancing the skills of a city's knowledge workers. Taylor et al define this as an "indirect measurement of flows; information and knowledge linking offices within a firm....the model can estimate potential working flows between all pairs of cities in a firm's office network. Aggregating all of these estimates for all firms provides an indirect measure of total flows between every pair of cities. Adding up an individual city's potential working flows with every other city provides an estimate of the network connectivity of that city. This is an indicator of the degree of integration of a given city into the world city network".</i> NB - DATA LIMITATION: Series commenced in 1998 but 1998 data not comparable to 2000, 2004 & 2008 data so only have 3 snapshots/small historical series. (Sources: Globalisation and World Cities (GaWC) Data for 2000, 2004 & 2008)
38	* Revenue Multiplier (Sqft / Person) - M GLATRIS CALCULATED (Sources: Oxford Economics and CBRE)	Revenue Multiplier (Sqft / Person) : Economic & Social Indicator > Proxy for ECONOMIC - Investment & Business Climate; Economic Competitiveness - Comparative & Competitive Advantages; Workforce; Infrastructure Support; Forms of Capital as well as SOCIAL - Collective Values and Urban Concepts. <i>The calculation was developed by M Glastris to identify the value in economic productivity relative to the office occupancy cost i.e. is it worthwhile locating an office executive in a particular city given the expected GDP output. It can be regarded as the cost of doing business globally. It reflects an economic and urban development premium, worker productivity as well as the investment/business attractiveness of the city, level of infrastructure support provided and the supply-demand dynamics of the office market. It also reflects social collective values and urban concepts regarding the desire for workers to relocate to a city with an attractive urban life style e.g. good access to cultural activities, affordable housing, schools, hospitals, etc.</i> Defined by M Glastris: Calculated by: Revenue Multiplier = GDP per Capita (US\$ per Person) / Total Office Occupancy Costs (US\$ per sqft pa). NB - DATA LIMITATION: May only be able to obtain 2-6 years of historical data as public access to long historical series for office occupancy costs is restricted. Recently corresponded with Dr. Ray Torto CBRE (25.5.2012) who advised the methodology for the office occupancy costs series was revised in 2011, no 2011 is available and a new series will be released in June 2012 - Given data is being primarily compared against other cities at certain points in time, the changes to methodology are not critical, so have taken the average of 2010 & 2012 data to obtain 2011 data. CBRE stopped reporting on Detroit from 2011-2013 in their publication, therefore used CBRE modified Detroit gross asking rents in 2011-2013. (Sources: CBRE Global Market View: Office Occupancy Costs 2008-2013; CBRE US Office Occupier View 2011-2013 & CBRE Detroit Office Market View 2013 and Oxford Economics Customised Data for M Glastris (1980-2025)). Unable to calculate Revenue Multiplier for Dubai and Tel Aviv-Jaffa as Oxford Economics were unable to provide city level data for GDP.

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Economic Indicators continued...

	vi) Infrastructure Support	vi) Infrastructure Support
39	* ICT Service Exports (% of Service Exports, BoP) (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Monetary Fund, Balance of Payments Statistics Yearbook and data files)	ICT Service Exports (% of Service Exports, BoP): Governance & Economic Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Regulatory Constructs with respect to Regulatory Frameworks, Market Maturity, Leadership & Vision as well as ECONOMIC - Economic Competitiveness - Competitive Advantage, Workforce, Technology Transfer, Investment & Business Climate and <u>Infrastructure Support</u>. <i>Measures what proportion of Information & Communications Technology services exports account for service exports of BoP - reflects governance & regulatory climate, maturity of ICT infrastructure development, influences a country's competitive advantage over another in terms of the population's access and connectivity to ICT technology, impacts on the business & investment climate in terms of national/global connectivity/technology transfer and indicates level of infrastructure support, coverage and efficiencies. World Bank defines this "Information and communication technology service exports include computer and communications services (telecommunications and postal and courier services) and information services (computer data and news-related service transactions)".</i> (World Bank - World Development Indicators 1960-2012 (July 2013) > International Monetary Fund, Balance of Payments Statistics Yearbook and data files). Historical data extends back circa 1986 (US) / 1991 (Aust) / 1997 (China & World) / 2000 (India) and includes World data but EXCLUDES UAE data. (Ref. 10749 Aust).
	vii) Forms of Capital	vii) Forms of Capital
40	* Changes in Inventories (Current US\$) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Bank national accounts data, and OECD National Accounts data files)	Changes in Inventories (Current US\$): Governance & Economic Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Market Maturity as well as ECONOMIC - Economic Competitiveness - Competitive Advantage, Investment & Business Climate, <u>Forms of Capital</u> and Economic Trade-Offs. <i>Measures inventory stock levels held by companies as a supply buffer - reflects supply-demand dynamics under current economic conditions and activeness/sluggishness of economy in the take up of goods. The World Bank defines this: "Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress." Data are in current U.S. dollars."</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > World Bank national accounts data, and OECD National Accounts data files). Historical data extends back circa 1960 (India) / 1965 (Australia, USA) / 1978 (China) & EXCLUDES World data. (Ref. 28,549 Aust).
41	* Household Disposable Income (\$USM, Constant 2005 Prices), Country Level (Source: Oxford Economics, March 2013 Customised Data for M Glastris)	Household Disposable Income (\$USM, Constant 2005 Prices): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Regimes of Financial Accumulation & Consumption - Modes of Consumption and Market Maturity; ECONOMIC - <u>Forms of Capital</u>. Key Economic Drivers, Investment and Business Climate as well as SOCIAL - Urban Concepts with regards to Household Debt and Discretionary/Disposable Income, Socio-Demographic Trends & Social Trade-Offs. <i>Measures how much a household has to spend in disposable income and reflects the level of household disposable/discretionary wealth and to what extent household consumption (and household debt) will drive economic activity. It gauges the city/country's general level of household prosperity i.e. generally the higher the disposable income, the more developed and prosperous the household. Oxford Economics defines this: "Total income is the broadest measure of income and in this sense refers to regular receipts such as wages and salaries, income from self-employment, interest and dividends from invested funds, pensions or other benefits from social insurance and other current transfers receivable. Household disposable income is the amount of money that households have available for spending and saving after income taxes have been accounted for".</i> (Sources: 1) Oxford Economics ~1980-2025 (March 2013) Customised data for M Glastris > Annual data provided at Country and City levels, generally more historical data available at country level. Historical data provided circa 1980-2013 and forecasted data provided 2014-2025 on an annual basis. Where no city data is available, comparable data at a state, provincial or equivalent level is provided e.g. No city data available for Bangalore & Mumbai, therefore state data for Karnataka & Maharashtra are provided respectfully. No data available for UAE, Dubai, Israel & Tel-Aviv.

Economic Indicators continued...

42	* Household Final Consumption Expenditure, etc. (% of GDP) - Country (Sources: World Development Indicators 1960-2012 (July 2013 Update) - World Bank national accounts data, and OECD National Accounts data files)	Household Final Consumption Expenditure, etc. (% of GDP): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Regimes of Financial Accumulation & Consumption - Modes of Consumption and Regulatory Constructs with respect to Modes of Regulation and Regulatory Frameworks; ECONOMIC - Key Economic Drivers, Investment and Business Climate, <u>Forms of Capital</u> as well as SOCIAL - Urban Concepts with regards to Household Debt and Discretionary/Disposable Income, Socio-Demographic Trends & Social Trade-Offs. <i>Measures how much a household has to spend in disposable income in real terms - reflects level of household disposable/discretionary wealth and to what extent household consumption will drive economic activity. The World Bank defines this: "Household final consumption expenditure (formerly private consumption) is the market value of all goods and services, including durable products (such as cars, washing machines, and home computers), purchased by households. It excludes purchases of dwellings but includes imputed rent for owner-occupied dwellings. It also includes payments and fees to governments to obtain permits and licenses. Here, household consumption expenditure includes the expenditures of nonprofit institutions serving households, even when reported separately by the country. This item also includes any statistical discrepancy in the use of resources relative to the supply of resources."</i> (Sources: World Development Indicators 1960-2012 (July 2013) - World Bank national accounts data, and OECD National Accounts data files). Historical data extends back circa 1960 (India) /1965 (Australia, US) /1970 (China, World) /1982 (China) and includes World data. (Ref: 123,013 Aust).
43	* Patent Applications, Residents - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Intellectual Property Organization (WIPO), World Intellectual Property Indicators and www.wipo.int/econ_stat)	Patent Applications, Residents: Governance & Economic Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Market Maturity, Leadership & Vision and Fiscal Management as well as ECONOMIC - Comparative Advantage, Workforce, Technology Transfer, Investment & Business Climate, Infrastructure Support, <u>Forms of Capital</u> and Economic Trade-Offs. <i>Measures the number of patent applications lodged - reflects extent government encourages development of intellectual capital, what sort of a leading edge does a country have in the provision improving/creating future goods/services, what sort of a competitive advantage does this provide to a country's investment and business sectors, extent of technology transfer and infrastructure support and reflects the economic potential lost if the business and government support for these patents and R & D is insufficient and the investor has to be develop the technology overseas. The World Bank defines this: "Patent applications are worldwide patent applications filed through the Patent Cooperation Treaty procedure or with a national patent office for exclusive rights for an invention—a product or process that provides a new way of doing something or offers a new technical solution to a problem. A patent provides protection for the invention to the owner of the patent for a limited period, generally 20 years."</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > World Intellectual Property Organization (WIPO), World Intellectual Property Indicators and www.wipo.int/econ_stat). PATCHY DATA > Historical data extends back circa 1960 (USA) /1963 (Australia, India) / 1985 (China, World) & includes World data but EXCLUDES UAE data. (Ref: 211,573 Aust).

Economic Indicators continued...

	viii) Economic Trade-Offs	viii) Economic Trade-Offs	
44	* Unemployment, Total (% of Total Labour Force) - Country (Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Labour Organization, Key Indicators of the Labour Market database; 2) IMF - World Economic Outlook (April 2013 Update) > 2013-2018 Forecasts)		Unemployment, Total (% of Total Labour Force): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Market Maturity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Key Economic Driver, Workforce, Investment & Business Climate & <u>Economic Trade-Offs</u> as well as SOCIAL - Collective Values, Socio-Demographic Trends & Social Trade-Offs. Measures unemployment within the labour force. The World Bank defines this: "Unemployment refers to the share of the labor force that is without work but available for and seeking employment. Definitions of labor force and unemployment differ by country." (Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013) > International Labour Organization, Key Indicators of the Labour Market database; 2) IMF - World Economic Outlook April 2013 Update > 2013-2018 Forecasts). Historical data extends back circa 1980 (most countries) /1994 (India & World) but INDIA DATA IS PATCHY. (Ref. 6,777 Aust). Substituted this indicator for "Long Term Unemployment (% of Total Unemployment)" due to patchy data and limited data for China, India or World. However IMF provides China data for 1980-2009, EXCLUDES India, UAE & World data & use IMF forecasts for country data 2013-2018 (Ref. 7,341 Aust).
45	* Unemployment Rate (% of Total Labour Force), Country Level (Source: Oxford Economics, March 2013 Customised Data for M Glastris)	* Unemployment Rate (% of Total Labour Force), City Level (Source: Oxford Economics, March 2013 Customised Data for M Glastris)	Unemployment Rate (% of Total Labour Force): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Market Maturity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Key Economic Driver, Workforce, Investment & Business Climate & <u>Economic Trade-Offs</u> as well as SOCIAL - Collective Values, Socio-Demographic Trends & Social Trade-Offs. Measures how slow/fast a country/city's unemployment rate is growing. Oxford Economics defines this: "Total labour force (or workforce) comprises all persons who fulfil the requirements for inclusion among the employed or the unemployed during a specified brief reference period. Unemployment rate represents the unemployed persons as a percentage of the labour force (the total number of people employed plus unemployed)." (Sources: 1) Oxford Economics ~1980-2025 (March 2013) Customised data for M Glastris > Annual data provided at Country and City levels, generally more historical data available at country level. Historical data provided circa 1980-2013 and forecasted data provided 2014-2025 on an annual basis. Where no city data is available, comparable data at a state, provincial or equivalent level is provided e.g. No city data available for Bangalore & Mumbai, therefore state data for Karnataka & Maharashtra are provided respectfully. No data available for UAE, Dubai, Israel & Tel-Aviv.

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3) SOCIAL:		3) SOCIAL:
i) Collective Values		i) Collective Values
ii) Urban Concepts		ii) Urban Concepts
Liveability, Amenity, Work and Lifestyle Trends		Liveability, Amenity, Work and Lifestyle Trends
		Net Migration (No. of People): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance - Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs - Regulatory Frameworks; ECONOMIC - Key Economic Drivers, Economic Competitiveness - Competitive Advantage, Workforce, Investment & Business Climate and Forms of Capital as well as SOCIAL - <u>Urban Concepts</u>, Collective Values, Socio-Demographic Trends and Social Trade-Offs & and ENVIRONMENT - Urban Environment, Transportation, Water & Energy, Sustainability, Pollution and Environment Trade-Offs. Measures net migration - reflects government's ability to provide a supportive regulatory and fiscal policy framework for migration, comparative productivity levels, skilled migrant labour, cultural & religious diversity, community & cultural identity, migration trends and social trade-offs/benefits. The World Bank defines this: "Net migration is the net total of migrants during the period, that is, the total number of immigrants less the annual number of emigrants, including both citizens and noncitizens. Data are five-year estimates. To derive estimates of net migration, the United Nations Population Division takes into account the past migration history of a country or area, the migration policy of a country, and the influx of refugees in recent periods. The data to calculate these official estimates come from a variety of sources, including border statistics, administrative records, surveys, and censuses. When no official estimates can be made because of insufficient data, net migration is derived through the balance equation, which is the difference between overall population growth and the natural increase during the 1990-2000 intercensal period." (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) > United Nations Population Division, World Population Prospects 2011). Historical data extends back circa 1960 (most countries) AT 5 YEAR INTERVALS but EXCLUDES World data. (Ref: 194,353 Aust). NOTE: Interpolated annual data between 5 year intervals for Social Population based data.
* Net Migration (No. of People), (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > United Nations Population Division, World Population Prospects 2012)		
iii) Socio-Demographic Trends		iii) Socio-Demographic Trends
		Total Population ('000s, People): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance - Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs - Regulatory Frameworks; ECONOMIC - Key Economic Drivers, Workforce, Investment & Business Climate, Forms of Capital and Economic Trade-Offs as well as SOCIAL - Collective Values, Socio-Demographic Trends, Health & Education and Social Trade-Offs & ENVIRONMENT - Urban Environment, Transportation, Water & Energy, Sustainability, Pollution and Environment Trade-Offs. Measures total city population/urban agglomeration. It reflects government's ability to provide a supportive policy and regulatory framework to encourage city population growth. This impacts on economic productivity and capacity levels, tertiarisation and education levels, workforce composition, cultural & religious diversity, community & cultural identity, health and education support and social trade-offs/benefits and the city's ability to attract residents, workers, visitors, etc. Oxford Economics defines this: "Total population of the city/country consists of all persons falling within the scope of the census. In the broadest sense, the total may comprise either all usual residents of the city/country or all persons present in the city/country at the time of the census. The total of all usual residents is generally referred to as the de jure population and the total of all persons present as the de facto population". (Sources: 1) Oxford Economics ~1980-2025 (March 2013) Customised data for M Glastris > Annual data provided at Country and City levels, generally more historical data available at country level. Historical data provided circa 1980-2013 and forecasted data provided 2014-2025 on an annual basis. Where no city data is available, comparable data at a state, provincial or equivalent level is provided e.g. No city data available for Bangalore & Mumbai, therefore state data for Karnataka & Maharashtra are provided respectfully. No data available for UAE, Dubai, Israel & Tel-Aviv.
* Total Country Population ('000s, People), Country Level (Source: Oxford Economics, March 2013 Customised Data for M Glastris)		* CITY STRUCTURE POPULATION A: Total City Population ('000s, People), City Level (Source: Oxford Economics, March 2013 Customised Data for M Glastris)

Social Indicators continued...

47B	CITY STRUCTURE POPULATION B: Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011 (000's, People) - Individual City (Sources: United Nations (WUP 2011 Revision (April 2012 Update))	Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011 (Thousands) - Individual City: Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance - Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs - Regulatory Frameworks; ECONOMIC - Key Economic Drivers, Workforce, Investment & Business Climate, Forms of Capital and Economic Trade-Offs as well as SOCIAL - Collective Values, <u>Socio-Demographic Trends</u>, Health & Education and Social Trade-Offs & ENVIRONMENT - Urban Environment, Transportation, Water & Energy, Sustainability, Pollution and Environment Trade-Offs. <i>Measures the number of a country's people who agglomerate around urban centres/cities. It reflects government's ability to provide a supportive policy and regulatory framework to encourage city population growth. This impacts on economic productivity and capacity levels, tertiarisation and education levels, workforce composition, cultural & religious diversity, community & cultural identity, health and education support and social trade-offs/benefits and the city's ability to attract residents, workers, visitors, etc. The United Nations defines this: "Refers to the de facto population contained within the contours of a contiguous territory inhabited at urban density levels without regard to administrative boundaries. It usually incorporates the population in a city or town plus that in the sub-urban areas lying outside of but being adjacent to the city boundaries".</i> (Sources: UN World Population Prospects UN Table F12). Extensive historical data extends back circa 1950 (for large capital cities & calculated for World) & provides FORECASTS to 2025 AT 5 YEAR INTERVALS. UN Ref: R 26-30 Aust). NOTE: Interpolated annual data between 5 year
48	Growth in Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011 (Annual %) - Individual City (Sources: United Nations (WUP 2011 Revision (April 2012 Update))	Growth in Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011 (Annual %) - Individual City: Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Key Economic Drivers, Workforce, Investment & Business Climate, Forms of Capital and Economic Trade-Offs/Benefits as well as SOCIAL - Collective Values, <u>Socio-Demographic Trends</u>, Health & Education and Social Trade-Offs/Benefits & ENVIRONMENT - Climate & Natural Environment, Urban Environment, Transportation, Water & Energy, Sustainability, Pollution and Environment Trade-Offs. <i>CALCULATED as an annual average by dividing the five-year growth by 5. Refer to World Bank definitions for "Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011".</i> (Sources: UN World Population Prospects). Extensive historical data extends back circa 1950 (for large capital cities & calculated for world) & provides FORECASTS to 2025 AT 5 YEAR INTERVALS. (No Reference - Calculated). NOTE: Interpolated annual data between 5 year intervals for Social Population based data.

Social Indicators continued...

47B	CITY STRUCTURE POPULATION B: Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011 (000's, People) - Individual City (Sources: United Nations (WUP 2011 Revision (April 2012 Update))	Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011 (Thousands) - Individual City: Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance - Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs - Regulatory Frameworks; ECONOMIC - Key Economic Drivers, Workforce, Investment & Business Climate, Forms of Capital and Economic Trade-Offs as well as SOCIAL - Collective Values, <u>Socio-Demographic Trends</u>, Health & Education and Social Trade-Offs & ENVIRONMENT - Urban Environment, Transportation, Water & Energy, Sustainability, Pollution and Environment Trade-Offs. <i>Measures the number of a country's people who agglomerate around urban centres/cities. It reflects government's ability to provide a supportive policy and regulatory framework to encourage city population growth. This impacts on economic productivity and capacity levels, tertiarisation and education levels, workforce composition, cultural & religious diversity, community & cultural identity, health and education support and social trade-offs/benefits and the city's ability to attract residents, workers, visitors, etc. The United Nations defines this: "Refers to the de facto population contained within the contours of a contiguous territory inhabited at urban density levels without regard to administrative boundaries. It usually incorporates the population in a city or town plus that in the sub-urban areas lying outside of but being adjacent to the city boundaries".</i> (Sources: UN World Population Prospects UN Table F12). Extensive historical data extends back circa 1950 (for large capital cities & calculated for World) & provides FORECASTS to 2025 AT 5 YEAR INTERVALS. UN Ref. R 26-30 Aust). NOTE: Interpolated annual data between 5 year
48	Growth in Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011 (Annual %) - Individual City (Sources: United Nations (WUP 2011 Revision (April 2012 Update))	Growth in Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011 (Annual %) - Individual City: Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Key Economic Drivers, Workforce, Investment & Business Climate, Forms of Capital and Economic Trade-Offs/Benefits as well as SOCIAL - Collective Values, <u>Socio-Demographic Trends</u>, Health & Education and Social Trade-Offs/Benefits & ENVIRONMENT - Climate & Natural Environment, Urban Environment, Transportation, Water & Energy, Sustainability, Pollution and Environment Trade-Offs. CALCULATED as an annual average by dividing the five-year growth by 5. Refer to World Bank definitions for "Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011". (Sources: UN World Population Prospects). Extensive historical data extends back circa 1950 (for large capital cities & calculated for world) & provides FORECASTS to 2025 AT 5 YEAR INTERVALS. (No Reference - Calculated). NOTE: Interpolated annual data between 5 year intervals for Social Population based data.

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

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Social Indicators continued...

49	* Population, Total (Number of People) - Country (Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013 Update) > (i) United Nations Population Division. 2011. World Population Prospects: The 2011 Revision. New York, United Nations, Department of Economic and Social Affairs (advanced Excel tables). Available at http://esa.un.org/unpd/wpp2008/index.htm. (ii) Census reports and other statistical publications from national statistical offices, (iii) Eurostat: Demographic Statistics, (iv) Secretariat of the Pacific Community: Statistics and Demography Programme, (v) U.S. Census Bureau: International Database, and (vi) World bank estimates based on the data from the sources above, household surveys conducted by national agencies, Macro International, the U.S. Centers for Disease Control and Prevention, and refugees statistics from the United Nations High Commissioner for Refugees; 2) IMF - World Economic Outlook April 2013 Update > 2013-2018 Forecasts.) 3) United Nations - Historical (1950 & 1955) & Projected data for 2020 - 2050 at 5 year intervals referenced from United Nations World Urbanization Prospects: 2011 Revision (April 2012 Update).	Environment > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Key Economic Drivers, Workforce, Investment & Business Climate, Forms of Capital and Economic Trade-Offs/Benefits as well as SOCIAL - Collective Values, Socio-Demographic Trends, Health & Education and Social Trade-Offs/Benefits and ENVIRONMENT - Climate & Natural Environment, Urban Environment, Transportation, Water & Energy, Sustainability, Pollution and Environment Trade-Offs. Measures total population - reflects government's ability to provide a supportive regulatory and fiscal policy framework for population growth, comparative productivity levels, tertiarisation and education levels, workforce composition, cultural & religious diversity, community & cultural identity, health and education support and social trade-offs/benefits and the country/city's ability to attract residents, workers, visitors, etc. The World Bank defines this: "Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship—except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of their country of origin. The values shown are midyear estimates." (Sources: Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013) > (i) United Nations Population Division. 2012 World Population Prospects: The 2012 Revision. New York, United Nations, Department of Economic and Social Affairs (advanced Excel tables). Available at http://esa.un.org/unpd/wpp2008/index.htm. (ii) Census reports and other statistical publications from national statistical offices, (iii) Eurostat: Demographic Statistics, (iv) Secretariat of the Pacific Community: Statistics and Demography Programme, (v) U.S. Census Bureau: International Database, and (vi) World bank estimates based on the data from the sources above, household surveys conducted by national agencies, Macro International, the U.S. Centers for Disease Control and Prevention, and refugees statistics from the United Nations High Commissioner for Refugees; 2) IMF - World Economic Outlook April 2013 Update > 2013-2018 Forecasts.). Historical data extends back circa 1960 (most countries & world) & includes World data. (WB Ref: 221,905 Aust). However whilst IMF EXCLUDES World data, use IMF forecasts for countries 2013-2018 (IMF Ref:R6,777 Aust). Further projected data for 2020 - 2050 referenced from United Nations World Urbanization Prospects: 2011 Revision (2012 Update). (UN Ref: R254) 3)
50	* Total Population Growth (Annual %) - Country (Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013 Update) > (i) United Nations Population Division. 2012 World Population Prospects: The 2011 Revision (April 2012 Update). New York, United Nations, Department of Economic and Social Affairs (advanced Excel tables). Available at http://esa.un.org/unpd/wpp2008/index.htm. (ii) Census reports and other statistical publications from national statistical offices, (iii) Eurostat: Demographic Statistics, (iv) Secretariat of the Pacific Community: Statistics and Demography Programme, (v) U.S. Census Bureau: International Database, and (vi) World bank estimates based on the data from the sources above, household surveys conducted by national agencies, Macro International, the U.S. Centers for Disease Control and Prevention, and refugees statistics from the United Nations High Commissioner for Refugees; 2) IMF - World Economic Outlook April 2013 Update > 2013-2018 Forecasts.) 3) United Nations - Projected data for 2020 - 2050 referenced from United Nations World Urbanization Prospects: 2011 Revision (2012 Update).	Total Population Growth (Annual %): Governance, Economic & Social Indicator > Proxy for Governance - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; Economic - Key Economic Drivers, Workforce, Investment & Business Climate, Forms of Capital and Economic Trade-Offs/Benefits as well as Social - Collective Values, Socio-Demographic Trends, Health & Education and Social Trade-Offs/Benefits. Measures total population - reflects government's ability to provide a supportive regulatory and fiscal policy framework for population growth, comparative productivity levels, tertiarisation and education levels, workforce composition, cultural & religious diversity, community & cultural identity, health and education support and social trade-offs/benefits. CALCULATED as Annual Percentage Growth. Refer to World Bank Definition for "Population, Total (Number of People)". (Sources: Sources: 1) World Bank - World Development Indicators 1960-2010 > (i) United Nations Population Division. 2012. World Population Prospects: The 2011 Revision. New York, United Nations, Department of Economic and Social Affairs (advanced Excel tables). Available at http://esa.un.org/unpd/wpp2008/index.htm. (ii) Census reports and other statistical publications from national statistical offices, (iii) Eurostat: Demographic Statistics, (iv) Secretariat of the Pacific Community: Statistics and Demography Programme, (v) U.S. Census Bureau: International Database, and (vi) World bank estimates based on the data from the sources above, household surveys conducted by national agencies, Macro International, the U.S. Centers for Disease Control and Prevention, and refugees statistics from the United Nations High Commissioner for Refugees; 2) IMF - World Economic Outlook Sept 2011 Update > 2011-2017 Forecasts.). Historical data extends back circa 1960 (most countries & world) & includes World data. (No Reference - Calculated). However whilst IMF EXCLUDES World data, use IMF forecasts for countries 2011-2017. 3) United Nations: Projected data for 2020 - 2050 (5 year intervals) referenced from United Nations World Urbanization Prospects: 2011 Revision (2012 Update) (No Reference - Calculated). NOTE: Interpolated annual data between 5 year intervals for Social Population based data.

Social Indicators continued...

51	* Population Density (People per sq. km of land area) - Country (Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013) > Food and Agriculture Organization and World Bank population estimates 2) United Nations - Projected data for 2015 - 2100 referenced from United Nations World Urbanization Prospects: 2011 Revision (April 2012 Update)		Population Density (People per sq. km of land area) : Governance, Economic & Social Indicator > Proxy for Governance - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; Economic - Key Economic Drivers, Workforce, Investment & Business Climate, Forms of Capital and Economic Trade-Offs/Benefits as well as Social - Collective Values, <u>Socio-Demographic Trends</u>, Health & Education and Social Trade-Offs/Benefits. Measures population density with respect to land area - reflects government's ability to provide a supportive regulatory and fiscal policy framework for sustainable population densities, overall population growth, comparative productivity levels, tertiarisation and education levels, workforce composition, cultural & religious diversity, community & cultural identity, health and education support and social trade-offs/benefits. The World Bank defines this: "Population density is midyear population divided by land area in square kilometers. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship--except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of their country of origin. Land area is a country's total area, excluding area under inland water bodies, national claims to continental shelf, and exclusive economic zones. In most cases the definition of inland water bodies includes major rivers and lakes." (Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013) > Food and Agriculture Organization and World Bank population estimates). Historical data extends back circa 1961 (most countries & world) & includes World data. (WB Ref: R219,937 Aust) & 2) United Nations - MEDIUM VARIANT Historical data 1950, 1955 & 1960 & MEDIUM VARIANT Projected data for 2015 - 2100 (5 yearly intervals) referenced from United Nations World Urbanization Prospects: 2010 Revision (2011 Update) (UN Ref: R15398 Aust)). NOTE: Interpolated annual data between 5 year intervals for Social Population based data.
52		* Population Density (People per sq. km of land area) - City (Source: 1) Demographia (Compilation from 2005, 2007, 2008, 2009, 2010, 2011, 2012 & 2013 publications)	Population Density (People per sq. km of land area) : Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance - Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs - Regulatory Frameworks; ECONOMIC - Key Economic Drivers, Workforce, Investment & Business Climate, Forms of Capital as well as SOCIAL - Collective Values, Urban Concepts, <u>Socio-Demographic Trends</u>, Health & Education and Social Trade-Offs & ENVIRONMENT - Urban Environment, Transportation, Water & Energy, Sustainability, Pollution and Environment Trade-Offs. Measures urban population density with respect to urban land area - reflects government's ability to provide a supportive regulatory and fiscal policy framework for sustainable population densities. It impacts on overall city population capacity, workforce composition, cultural & religious diversity, community & cultural identity, health and education support and social trade-offs/benefits. Increased population density levels also impact on the built environment (higher density housing, schools & infrastructure required), living sustainably, transport system, consumption of water and energy, pollution, etc. Demographia defines this: "Urban Population Density: This report provides average urban population density data. It is not possible to coordinate the dates of current population estimates with land area estimates. As a result, population densities (calculated using current estimates) are expressed in rounded numbers (to the nearest 100). Thus, the urban population densities should be considered reasonable approximation, rather than precise". (Sources: 1) Demographia "Demographia World - Urban Areas (World Agglomerations) - Compilation from 2005, 2007, 2008, 2009, 2010, 2011, 2012 & 2013 publications). NOTE: 2006 publication unavailable, interpolated 2006 data between 2005 and 2007 datapoints.

Social Indicators continued...

53	* Median Age (Years) - Country (Sources: UN World Population Prospects 2012 Revision (July 2013 Update))	Median Age (Years): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Key Economic Drivers, Workforce, Investment & Business Climate, Forms of Capital and Economic Trade-Offs/Benefits as well as SOCIAL - Collective Values, <u>Socio-Demographic Trends</u>, Health & Education and Social Trade-Offs/Benefits. <i>Measures median age of population - reflects government's ability to provide a supportive regulatory and fiscal policy framework for various population age segments, comparative productivity levels, workforce composition, health and education support and social trade-offs/benefits.</i> > Extensive historical data extends back circa 1950 (most countries & world) & provides FORECASTS to 2100 AT 5 YEAR INTERVALS & includes World data. Need to combine "Estimates" which comprise historical data 1950-2010 and "MEDIUM VARIANT" which comprise forecasted data 2015-2100 based on a medium fertility variant. All historical and forecasted data provided AT 5 YEAR INTERVALS. Note also available are "Low, High and Constant" forecasts. Opted to use the "MEDIUM VARIANT" case forecasts to assume some small-moderate fertility growth in population. (Sources: UN World Population Prospects- July 2012 Revision (July 2013 Update). (UN Ref. R238 Aust).
54	* Urban Population (Number of People) - Urban Areas (Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Bank Staff estimates based on United Nations, World Urbanization Prospects & 2) United Nations - Historical (1950 & 1955) & Projected (2015-2050) data referenced from United Nations World Urbanization Prospects: 2012 Revision (April 2013 Update))	Urban Population (Number of People): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Key Economic Drivers, Workforce, Investment & Business Climate, Forms of Capital and Economic Trade-Offs/Benefits as well as SOCIAL - Collective Values, <u>Socio-Demographic Trends</u>, Health & Education and Social Trade-Offs/Benefits and ENVIRONMENT - Climate & Natural Environment, Urban Environment, Transportation, Water & Energy, Sustainability, Pollution and Environment Trade-Offs. <i>Measures the number of a country's people who agglomerate around urban areas - reflects urbanisation population levels which need to be supported by governance, economic, social and urban development policy framework as well as fiscal, economic, social and environment measures. The World Bank defines this: "Urban population refers to people living in urban areas as defined by national statistical offices. It is calculated using World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects."</i>. (Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013) > World Bank Staff estimates based on United Nations, World Urbanization Prospects). Historical data extends back circa 1960 (most countries & world) & includes World data. & 2) United Nations - Historical (1950 & 1955) & Projected (2015-2050) data at 5 year intervals referenced from United Nations World Urbanization Prospects UN Table F03: 2012 Revision (April 2013 Update)). (WB Ref: R310,711 Aust & UN Ref: R254 Aust). NOTE: World Bank may be underestimating Urban Population (1960-2010) compared to United Nations figures for JAPAN & UAE > Smoothing required. NOTE: Interpolated annual data between 5 year intervals for Social Population based data.
55	* Urban Population Growth (Annual %) - Urban Areas (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Bank Staff estimates based on United Nations, World Urbanization Prospects)	Urban Population Growth (Annual %): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Key Economic Drivers, Workforce, Investment & Business Climate, Forms of Capital and Economic Trade-Offs/Benefits as well as SOCIAL - Collective Values, <u>Socio-Demographic Trends</u>, Health & Education and Social Trade-Offs/Benefits & ENVIRONMENT - Climate & Natural Environment, Urban Environment, Transportation, Water & Energy, Sustainability, Pollution and Environment Trade-Offs. <i>Measures the annual growth in the number of a country's people who agglomerate around urban areas - reflects urbanisation population levels which need to be supported by governance, economic, social and urban development policy framework as well as fiscal, economic, social and environment measures. The World Bank defines this: "Urban population refers to people living in urban areas as defined by national statistical offices. It is calculated using World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects."</i>. (Sources: 1) World Bank - World Development Indicators 1960-2011 (April 2012 Update) > World Bank Staff estimates based on United Nations, World Urbanization Prospects). Historical data extends back circa 1960 (most countries) / 1961 (World) & includes World data. (No Ref. since calculated). NOTE: Interpolated annual data between 5 year intervals for Social Population based data.

Social Indicators continued...

56	* Urban Population (% of Total) - Urban Areas (Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013 Update) & 2) United Nations, World Urbanization Prospects 2011 Revision (April 2012 Update))	Urban Population or Urbanisation Rate (% of Total): Governance, Economic & Social Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance - Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs - Regulatory Frameworks; ECONOMIC - Key Economic Drivers, Workforce, Investment & Business Climate, Forms of Capital and Economic Trade-Offs as well as SOCIAL - Collective Values, Urban Concepts, <u>Socio-Demographic Trends</u> and Social Trade-Offs & ENVIRONMENT - Urban Environment, Transportation, Water & Energy, Sustainability, Pollution and Environment Trade-Offs. <i>Measures the number of people within the country who agglomerate around urban areas as a percentage of the total population. The indicator reflects the government's ability to provide a supportive regulatory and fiscal policy framework for increased urbanisation, comparative productivity levels, skilled migrant labour, cultural & religious diversity, community & cultural identity, migration trends and social trade-offs/benefits. Increased urbanisation levels also impacts the built environment (e.g. more housing, schools, hospitals & infrastructure required), transport system, consumption of water and energy, pollution, etc. The World Bank defines this: "Urban population refers to people living in urban areas as defined by national statistical offices. It is calculated using World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects."</i> (Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013) & 2) United Nations, World Urbanization Prospects 2011 Revision (April 2012 Update)). Historical data extends back circa 1960 (most countries & world) & includes World data & 2) United Nations - Calculated from Historical (1950 & 1955) & Projected data for 2015-2050 (5 year intervals) referenced from United Nations World Urbanization Prospects: 2011 Revision (April 2012 Update)). (WB Ref: R310,957 Aust & UN Ref: Calculated Aust). NOTE: World Bank may be underestimating Urban Population (1960-2010) compared to United Nations figures for JAPAN & UAE which subsequently impacts on Urbanisation Rate Calcs > Smoothing required. NOTE: Interpolated annual data between 5 year intervals for Social Population based data.
57	* Total Dependency Ratio (per 100 People Aged 20-64 Years) - Country (Source: UN World Population Prospects: 2012 Revision (June 2013 Update))	Total Dependency Ratio (per 100 People Aged 20-64 Years): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance - Capacity, Leadership & Vision and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Workforce, Infrastructure Support and Economic Trade-Offs as well as SOCIAL - Collective Values, Urban Concepts, <u>Socio-Demographic Trends</u>, Health and Social Trade-Offs & ENVIRONMENT - Urban Environment & Sustainability. <i>Measures proportion of children and elderly dependents of the total population - reflects social burden on independent/working population which need to be supported. Reflects government's ability to provide a supportive regulatory and fiscal policy framework families with young &/or elderly dependents. Impacts on workforce participation, family's income earning capacity, the importance placed on caring for young/elderly dependents and the necessary infrastructure to support their needs (e.g. child care centres, schools, community centres, assisted living, retirement & nursing homes, etc) and living sustainably. The United Nations define this "Total dependency ratio (<20 & 65+)/(>20-64) by major area, region and country, 1950-2100 (ratio of population 0-19 and 65+ per 100 population)."</i> > Need to combine "Estimates" which comprise historical data 1950-2010 and "Medium" which comprise forecasted data 2015-2100 based on a medium fertility variant. All historical and forecasted data provided AT 5 YEAR INTERVALS. Note also available are "Low, High and Constant" forecasts. Opted to use the "Medium" case forecasts to assume some small-moderate fertility growth in population. (Source: UN World Population Prospects: 2012 Revision - June 2013 Update). (UN Ref: R238 Aust). NOTE: Interpolated annual data between 5 year intervals for Social Population based data.

Social Indicators continued...

	iv) Health and Education	iv) Health and Education
58	* Completed Secondary Educational Attainment (% of Total Population) (Sources: World Bank - Education Statistics 1970-2011 > Robert J. Barro and Jong-Wha Lee: http://www.barrolee.com/)	Completed Secondary Educational Attainment (% Total Population): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Market Maturity, Leadership & Vision and Fiscal Management as well as ECONOMIC - Economic Competitiveness - Comparative Advantage, Workforce, Investment & Business Climate and Forms of Capital as well as SOCIAL - Socio-Demographic Trends and Health & <u>Education</u> & ENVIRONMENT - Urban Environment, Transportation and Environment Trade-Offs. Measures graduate/completion level for Secondary Education - reflects extent government encourages secondary education attainment, literacy rates, tertiarisation rates, provision of knowledge and services workers, competitive ability to tap into a local skilled workforce, growth in intellectual capital & value add services, the impact it may have on educating knowledge & service workers, higher education/training and income levels attained. For historical data used the "Barro-Lee: Percentage of population by educational attainment, age 15+, total, completed secondary" which the World Bank defines as: "Percentage of population, 15+, total, completed secondary is the percentage of people over age 15 who have completed secondary education." and for projected data used "IIASA/VID Projection: Proportion of population by educational attainment, age 15+, total, secondary" which the World Bank defines as "Proportion, 15+, total, secondary is the proportion of the population over age 15 with secondary education." (Sources: World Bank - Education Statistics (EdStats) > For historical stats (1970-2010) used Robert J. Barro and Jong-Wha Lee: http://www.barrolee.com/. Historical indicator stats provided at five year intervals & EXCLUDES World data. (WB Hist Ref: R34842 Aust). NOTE: Interpolated annual data between 5 year intervals for Social Population based data.
59	* Completed Tertiary Educational Attainment (% of Total Population) (Sources: World Bank - Education Statistics 1970-2050 > Robert J. Barro and Jong-Wha Lee: http://www.barrolee.com/ & International Institute for Applied Systems Analysis (IIASA))	Completed Tertiary Educational Attainment (% Total Population): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Market Maturity, Leadership & Vision as well as ECONOMIC - Economic Competitiveness - Comparative Advantage, Workforce, Technology Transfer, Investment & Business Climate, Infrastructure Support and Forms of Capital as well as SOCIAL - Socio-Demographic Trends and Health & <u>Education</u> & ENVIRONMENT - Urban Environment. Measures graduate/completion level for Tertiary Education - reflects extent government encourages tertiary education attainment, tertiarisation rates, provision of knowledge and services workers, competitive ability to tap into a local skilled workforce, growth in intellectual capital & value add services, the impact it may have on educating knowledge & service workers, higher education/training and income levels attained with increased expectations of a higher standard of living (e.g. access to housing, universities, better amenities and infrastructure). For historical data used the "Barro-Lee: Percentage of population by educational attainment, age 15+, total, completed tertiary" which the World Bank defines as: "Percentage of population by educational attainment, 15+, total, completed tertiary is the percentage of people over age 15 who have completed tertiary education." and for projected data used "IIASA/VID Projection: Proportion of population by educational attainment, age 15+, total, tertiary" which the World Bank defines as "Proportion, 15+, total, tertiary is the proportion of the population over age 15 with tertiary education." (Sources: World Bank - Education Statistics (EdStats) > For historical stats (1970-2010) used Robert J. Barro and Jong-Wha Lee: http://www.barrolee.com/ & for projected stats (2015-2050) used International Institute for Applied Systems Analysis (IIASA)). Historical and projected indicator stats (1970-2050) provided at five year intervals & EXCLUDES World data (both historical & projected data), Israel & UAE (projected data). (WB Hist Ref: R35089 Aust & WB Proj Ref: R308024 Aust). NOTE: Interpolated annual data between 5 year intervals for Social Population based data.

Social Indicators continued...

60	* Fertility Rate, Total (Births per Woman) - Country (Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013 Update) 1960-2012 annual data 2) United Nations World Population Prospects 2012 Revision (June 2013 Update) for 1955 & 2015-2100 data at 5 year intervals)	Fertility Rate, Total (Births per Woman): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Workforce, Investment & Business Climate and Forms of Capital; SOCIAL - Socio-Demographic Trends, <u>Health</u> & Education and Social Trade-Offs/Benefits as well as ENVIRONMENT - Climate & Natural Environment, Urban Environment, Transportation, Water & Energy, Sustainability, Pollution and Environment Trade-Offs. Measures total births per woman and gives an indicative population replacement ratio - reflects extent government, economy, society and the environment encourages family growth/population replacement. The World Bank defines this: "Total fertility rate represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with current age-specific fertility rates.". (Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013) for 1960-2012 annual data > (i) United Nations Population Division. 2010. World Population Prospects: The 2012 Revision. New York, United Nations, Department of Economic and Social Affairs (advanced Excel tables). Available at http://esa.un.org/unpd/wpp2008/index.htm. (ii) Census reports and other statistical publications from national statistical offices, (iii) Eurostat: Demographic Statistics, (iv) Secretariat of the Pacific Community: Statistics and Demography Programme, (v) U.S. Census Bureau: International Database, and (vi) household surveys conducted by national agencies, Macro International, and the U.S. Centers for Disease Control and Prevention.). Historical data extends back circa 1960 (most countries & world) & includes World data. & 2) United Nations World Population Prospects 2012 Revision (June 2013 Update) for 1955 & 2015-2100 data at 5 year intervals). (WB Ref: R87,835 Aust & UN Ref: R238 Aust).
	v) Social Trade-Offs	v) Social Trade-Offs
61	* Life Expectancy At Birth, Total (Years) - Country (Sources: 1) World Bank - World Development Indicators 1960-2012 (July 2013 Update) 1960-2012 annual data 2) United Nations World Population Prospects 2012 Revision (June 2013 Update) for 1955 & 2015-2100 data at 5 year intervals)	Life Expectancy At Birth, Total (Years): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Workforce, Investment & Business Climate and Forms of Capital; SOCIAL - Socio-Demographic Trends, Health & Education and <u>Social Trade-Offs</u> as well as ENVIRONMENT - Urban Environment, Water & Energy, Pollution and Environmental Trade-Offs. Measures average life expectancy of a person at birth - reflects a range of governance, economic, social and environment factors. The World Bank defines this: "Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.". (Sources: World Bank - World Development Indicators 1960-2012 (July 2013) for 1960-2011 annual data > Derived from male and female life expectancy at birth. Male and female life expectancy source: (i) United Nations Population Division. 2012. World Population Prospects: The 2012 Revision. New York, United Nations, Department of Economic and Social Affairs (advanced Excel tables), (ii) Census reports and other statistical publications from national statistical offices, (iii) Eurostat: Demographic Statistics, (iv) Secretariat of the Pacific Community: Statistics and Demography Programme, and (v) U.S. Census Bureau: International Database.) Historical data extends back circa 1960 (most countries & world) & includes World data. 2) United Nations World Population Prospects 2012 Revision (June 2013 Update) for 1955 & 2015-2100 data at 5 year intervals). (WB Ref: R154,501 Aust & UN Ref: R238 Aust).

Environment Indicators:

	4) ENVIRONMENT:	4) ENVIRONMENT:	4) ENVIRONMENT:
	i) Climate & Natural Environment	i) Climate & Natural Environment	
62	Forest Area (% of Land Area) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > Food and Agriculture Organization, electronic files and web site)		Forest Area (% of Land Area): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Investment & Business Climate and Economic Trade-Offs; SOCIAL - Collective Values & Urban Concepts as well as ENVIRONMENT - <u>Climate & Natural Environment</u>, Sustainability, Pollution and Environment Trade-Offs. <i>Measures the amount of forest land as a percentage of the total land area - reflects rates of deforestation, global warming as well as sustainability and pollution levels all of which need to be supported by governance, economic, social and environment & urban development policy frameworks as well as economic, social and environment measures. The World Bank defines this: "Forest area is land under natural or planted stands of trees of at least 5 meters in situ, whether productive or not, and excludes tree stands in agricultural production systems (for example, in fruit plantations and agroforestry systems) and trees in urban parks and gardens."</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > Food and Agriculture Organization, electronic files and web site). Historical data extends back circa 1990 (most countries & world) but PATCHY (1990, 2000, 2005, 2010 snapshots) & includes World data but EXCLUDES HK data. (WB Ref: R95,707 Aust)
63	* Arable Land (% of Land Area) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > Food and Agriculture Organization, electronic files and web site)		Arable Land (% of Land Area): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Investment & Business Climate, Forms of Capital and Economic Trade-Offs; SOCIAL- Collective Values & Urban Concepts as well as ENVIRONMENT - <u>Climate & Natural Environment</u>, Transportation, Sustainability, Pollution and Environment Trade-Offs. <i>Measures the amount of arable land available as a percentage of the total land area - reflects urban/rural development potential which need to be supported by governance, economic, social and environment & urban development policy frameworks as well as economic, social and environment measures. The World Bank defines this: "Arable land includes land defined by the FAO as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is excluded."</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > Food and Agriculture Organization, electronic files and web site). Historical data extends back circa 1961 (most countries) / 1992 (World) & includes World data but EXCLUDES HK data. (WB Ref: R15,019 Aust)

Environment Indicators continued...

	ii) Urban Environment	ii) Urban Environment
64	* Hospital Beds (per 1,000 People) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Health Organization, OECD, supplemented by country data)	Hospital Beds (per 1,000 People): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance - Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs - Regulatory Frameworks; ECONOMIC - Workforce, Investment & Business Climate & Infrastructure Support; SOCIAL - Socio-Demographic Trends, Health & Education and Social Trade-Offs as well as ENVIRONMENT - <u>Urban Environment</u> . <i>Measures the number of hospital beds per 1,000 people. It reflects the ability and capacity to provide for those in need of hospital care as well as the needs of an ageing demographic segment as they require greater hospital care; population growth pressures & the capacity of social infrastructure/hospital support. It also reflects the Government's leadership and vision in planning for the future hospital needs of the population in their policies and public expenditure and the community's expectations to be able to access a hospital in a timely and efficient manner. Access to infrastructure such as hospitals and schools are also a consideration for young families and older/elderly couples when locating to cities. The World Bank defines this: "Hospital beds include inpatient beds available in public, private, general, and specialized hospitals and rehabilitation centres. In most cases beds for both acute and chronic care are included".</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Health Organization, OECD, supplemented by country data). Historical data extends back circa 1960 (most countries) / 1965 (China) / 1970 (World) & includes World data. (WB Ref: R121,045 Aust)
65		City Office Occupancy Costs (US\$/Sft per Annum) : Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance - Capacity, Leadership & Vision and Regulatory Constructs - Regulatory Frameworks; ECONOMIC - Economic Competitiveness - Comparative and Competitive Advantages, Workforce, Technology Transfer, Investment & Business Climate, Infrastructure Support, Forms of Capital and Economic Trade-Offs; SOCIAL - Urban Concepts and Socio-Demographic Trends as well as ENVIRONMENT - <u>Urban Environment</u> & Transportation. <i>Measures the cost of providing prime quality office accommodation within a city (cost of doing business). It reflects an economic and urban development premium as well as the investment/business attractiveness of the city and the supply-demand dynamics of the office market. This impacts on urban development, planning and transport policies, economic productivity and capacity levels, workforce composition, built environment (i.e. office buildings, share office facilities, etc), infrastructure support required and the city's ability to attract workers.</i> CBRE define this: "Local office costs are reported in U.S. dollars on a per annum basis. This number reflects all occupancy costs, and therefore corresponds to "gross" rents for all markets. All occupancy cost figures are standardized to a net internal area basis of measurement". <u>NB - DATA LIMITATION:</u> May only be able to obtain 2-6 years of historical data as public access to long historical series is restricted. Recently corresponded with Dr. Ray Torto CBRE (25.5.2012) who advised the methodology for the office occupancy costs series was revised in 2011, no 2011 is available and a new series will be released in June 2012 - Given data is being primarily compared against other cities at certain points in time, the changes to methodology are not critical, so have taken the average of 2010 & 2012 data to obtain 2011 data. CBRE stopped reporting on Detroit from 2011-2013 in their publication, therefore used CBRE modified gross asking rents in 2011-2013. (Sources: CBRE Global Market View: Office Occupancy Costs 2008-2013; CBRE US Office Occupier View 2011-2013 & CBRE Detroit Office Market View 2013) * City Office Occupancy Costs (US\$/Sft per Annum) (Sources: CBRE)

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

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Environment Indicators continued...

iii) Transportation		iii) Transportation
66	* Motor Vehicles (per 1,000 people) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Road Federation, World Road Statistics and data files)	* Motor Vehicles (per 1,000 people): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance - Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs - Regulatory Frameworks; ECONOMIC - Economic Competitiveness - Comparative and Competitive Advantages, Workforce, Investment & Business Climate, Infrastructure Support and Economic Trade-Offs; SOCIAL - Collective Values & Urban Concepts as well as ENVIRONMENT - Urban Environment, <u>Transportation</u>, Sustainability, Pollution and Environment Trade-Offs. <i>Reflects a country's car reliance, motor vehicle consumption, journey to work/speed to markets and urban sprawl trends. It also reflects the Government's leadership and vision in planning for future needs in Government urban development, planning and transport policies and expenditures. It also reflects the efficiency of the public transport system, community and business values and expectations of transport efficiencies, living sustainably, and environment trade-offs e.g. urban sprawl, traffic congestion and pollution. The World Bank defines this: "Motor vehicles include cars, buses, and freight vehicles but do not include two-wheelers. Population refers to midyear population in the year for which data are available".</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Road Federation, World Road Statistics and data files). Historical data extends back circa 2003 (most countries) but PATCHY DATA & includes World data. (WB Ref: R178,117 Aust)
67	* Air Transport, Passengers Carried (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Civil Aviation Organization, Civil Aviation Statistics of the World and ICAO staff estimates)	* Air Transport, Passengers Carried: Governance, Economic & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Economic Competitiveness - Comparative and Competitive Advantages, Workforce, Investment & Business Climate, Infrastructure Support and Economic Trade-Offs; as well as ENVIRONMENT - Urban Environment, <u>Transportation</u>, Sustainability, Pollution and Environment Trade-Offs. <i>Measures the volume of air passengers travelling domestically and internationally to/from and within Australia - reflects air reliance, speed to markets and globalisation trends which need to be supported by governance, economic, social and environment/urban development policy frameworks as well as economic and environment measures. The World Bank defines this: "Air passengers carried include both domestic and international aircraft passengers of air carriers registered in the country."</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Civil Aviation Organization, Civil Aviation Statistics of the World and ICAO staff estimates.). Historical data extends back circa 1970 (most countries & World) / 1974 (China) & includes World data. (WB Ref: R12,805 Aust)
68	* Container Port Traffic (TEUs) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > Containerisation International, Containerisation International Yearbook)	* Container Port Traffic (TEUs): Governance, Economic & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Economic Competitiveness - Comparative and Competitive Advantages, Workforce, Investment & Business Climate, Infrastructure Support and Economic Trade-Offs; as well as ENVIRONMENT - Urban Environment, <u>Transportation</u>, Sustainability, Pollution and Environment Trade-Offs. <i>Measures the volume of twenty-foot equivalent units/containers from land to sea transport modes and vice versa - reflects sea/land freight reliance, speed to markets and globalisation trends which need to be supported by governance, economic, social and environment/urban development policy frameworks as well as economic and environment measures. The World Bank defines this: "Port container traffic measures the flow of containers from land to sea transport modes, and vice versa, in twenty-foot equivalent units (TEUs), a standard-size container. Data refer to coastal shipping as well as international journeys. Transshipment traffic is counted as two lifts at the intermediate port (once to off-load and again as an outbound lift) and includes empty units."</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > Containerisation International, Containerisation International Yearbook). Historical data extends back circa 2000 (most countries & World) & includes World data but EXCLUDES HUNGARY data. (WB Ref: R49,705 Aust)

Environment Indicators continued...

	iv) Water and Energy	iv) Water and Energy
69	* Energy Use (kg of oil equivalent per capita) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Energy Agency (IEA Statistics © OECD/IEA, http://www.iea.org/stats/index.asp))	* Energy Use (kg of oil equivalent per capita): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Economic Competitiveness - Comparative and Competitive Advantages, Workforce, Investment & Business Climate, Infrastructure Support and Economic Trade-Offs; SOCIAL - collective Values & Urban Concepts as well as ENVIRONMENT - Urban Environment, <u>Water & Energy</u>, Sustainability, Pollution and Environment Trade-Offs. <i>The indicator specifically measures energy consumption but also provides a broad level indication of energy consumption intensive countries, accessibility to energy, energy efficiency and sustainability measures that maybe employed as well as quality of living and globalisation trends. It reflects the Government's leadership and vision in planning for future energy needs in urban development, planning, energy and environmental policies and expenditures. It also reflects community and business values and expectations of energy consumption and efficiencies, living sustainably, and environment trade-offs e.g. pollution, green house gas emissions, etc. The World Bank defines this: "Energy use refers to use of primary energy before transformation to other end-use fuels, which is equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport".</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Energy Agency (IEA Statistics © OECD/IEA, http://www.iea.org/stats/index.asp). Historical data extends back circa 1960 (Australia, US) / 1971 (China, India) / 1990 (World) & includes World data. (WB Ref: R78,487 Aust)
70	* Improved Water Source, Urban (% of Urban Population with Access) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Health Organization and United Nations Children's Fund, Joint Measurement Programme (JMP) (http://www.wssinfo.org/))	* Improved Water Source, Urban (% of Urban Population with Access): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Economic Competitiveness - Comparative and Competitive Advantages, Workforce, Investment & Business Climate, Infrastructure Support and Economic Trade-Offs/Benefits; SOCIAL - Urban Concepts and Health as well as ENVIRONMENT - Urban Environment, <u>Water & Energy</u>, Sustainability, Pollution and Environment Trade-Offs/Benefits. <i>Measures percentge of urban population with access to improved water sources per capita - reflects improved water accessibility & sustainability, health, quality of living and globalisation trends which need to be supported by governance, economic, social and environment/urban development policy frameworks as well as economic, social and environment measures. The World Bank defines this: "Access to an improved water source refers to the percentage of the population with reasonable access to an adequate amount of water from an improved source, such as a household connection, public standpipe, borehole, protected well or spring, and rainwater collection. Unimproved sources include vendors, tanker trucks, and unprotected wells and springs. Reasonable access is defined as the availability of at least 20 liters a person a day from a source within one kilometer of the dwelling."</i> (Sources: Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > World Health Organization and United Nations Children's Fund, Joint Measurement Programme (JMP) (http://www.wssinfo.org/)). Historical data extends back circa 1990 (most countries) on ~3-5 year intervals & includes World data but EXCLUDES HK data. (WB Ref: R132,115 Aust)

Environment Indicators continued...

	v) Sustainability	v) Sustainability
71	* Alternative and Nuclear Energy (% of total energy use) (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Energy Agency (IEA Statistics © OECD/IEA, http://www.iea.org/stats/index.asp))	* Alternative and Nuclear Energy (% of total energy use): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Economic Competitiveness - Comparative and Competitive Advantages, Workforce, Investment & Business Climate, Infrastructure Support and Economic Trade-Offs/Benefits; SOCIAL - Collective Values and Urban Concepts as well as ENVIRONMENT - Urban Environment, <u>Sustainability</u>, Pollution and Environment Trade-Offs. Measures what percentage of alternative and nuclear energy is generated of total energy use - reflects energy consumption, energy accessibility & sustainability, quality of living and globalisation trends which need to be supported by governance, economic, social and environment/urban development policy frameworks as well as economic, social and environment measures. The World Bank defines this: "Clean energy is noncarbohydrate energy that does not produce carbon dioxide when generated. It includes hydropower and nuclear, geothermal, and solar power, among others." (Sources: World Bank - World Development Indicators 1960-2011 (April 2012 Update) > International Energy Agency (IEA Statistics © OECD/IEA, http://www.iea.org/stats/index.asp)). Historical data extends back circa 1960 (Australia, US, World) / 1971 (China, India) & includes World data. (WB Ref: R13,297 Aust)
	vi) Pollution	vi) Pollution
72	* Carbon Dioxide (CO₂) Emissions, (metric tons of CO₂ per capita) - Country (Sources: World Bank World Development Indicators 1960-2012 (July 2013 Update) > Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory, Tennessee, United States)	* Carbon Dioxide (CO₂) Emissions, (metric tons of CO₂ per capita): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance - Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs - Regulatory Frameworks; ECONOMIC - Workforce, Investment & Business Climate and Economic Trade-Offs/Benefits; SOCIAL - Collective Values & Urban Concepts as well as ENVIRONMENT - Urban Environment, Sustainability, <u>Pollution</u> and Environment Trade-Offs. Measures one of the main Greenhouse gases carbon dioxide emissions and reflects global warming/Greenhouse Effect, pollution, adverse health side effects & quality of living trends. It reflects the Government's leadership and vision in planning for protecting the environment in urban development, planning, energy and environmental policies and expenditures. It also reflects community and business values and expectations of reducing green house gas emissions, living sustainably, and environment trade-offs e.g. global warming. The World Bank defines this: "Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring". (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory, Tennessee, United States). Historical data extends back circa 1960 (Most countries & World) & includes World data. (WB Ref: R38,143 Aust)

Environment Indicators continued...

73	* Industrial Nitrous Oxide (NO_x) Emissions (Thousand metric tons of CO₂ equivalent) - Country (World Bank World Development Indicators 1960-2012 (July 2013 Update) > International Energy Agency (IEA Statistics © OECD/IEA, http://www.iea.org/stats/index.asp))	* Industrial Nitrous Oxide (NO_x) Emissions (Thousand metric tons of CO₂ equivalent): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Economic Competitiveness - Comparative and Competitive Advantages, Workforce, Investment & Business Climate, Infrastructure Support and Economic Trade-Offs; SOCIAL - Urban Concepts as well as ENVIRONMENT - Urban Environment, Sustainability, <u>Pollution</u> and Environment Trade-Offs. Measures Nitrous Oxide emissions which are pollutants burnt off from industrial processes and when NO_x reacts with water molecules, forms one type of acid rain - reflects acid rain levels, pollution, adverse health side effects & quality of living trends which need to be supported by governance, economic, social and environment/urban development policy frameworks as well as economic, social and environment measures. The World Bank defines this: "Industrial nitrous oxide emissions are emissions produced during the manufacturing of adipic acid and nitric acid." (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > International Energy Agency (IEA Statistics © OECD/IEA, http://www.iea.org/stats/index.asp)). Historical data extends back circa 1990 (Most countries) but PATCHY DATA (1990, 1995, 2000, 2005 - 5 year snapshots) & EXCLUDES World data. (WB Ref: R134,329 Aust)
74	* Water Pollution, Chemical Industry (% of Total BOD Emissions) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > 1998 study by Hemamala Hettige, Muthukumara Mani, and David Wheeler, "Industrial Pollution in Economic Development: Kuznets Revisited" (available at www.worldbank.org/nipr). The data were updated by the World Bank's Development Research Group using the same methodology as the initial study)	* Water Pollution, Chemical Industry (% of Total BOD Emissions): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Comparative and Competitive Advantages, Workforce, Investment & Business Climate, Infrastructure Support and Economic Trade-Offs/Benefits; SOCIAL - Urban Concepts as well as ENVIRONMENT - Urban Environment, Sustainability, <u>Pollution</u> and Environment Trade-Offs/Benefits. Measures the extent of chemical pollution in water sources in terms of Total BOD Emissions - reflects pollution, adverse health side effects & quality of living trends which need to be supported by governance, economic, social and environment/urban development policy frameworks as well as economic, social and environment measures. The World Bank defines this: "Industry shares of emissions of organic water pollutants refer to emissions from manufacturing activities as defined by two-digit divisions of the International Standard Industrial Classification (ISIC), revision 2: chemicals (35). Emissions of organic water pollutants are measured by biochemical oxygen demand, which refers to the amount of oxygen that bacteria in water will consume in breaking down waste. This is a standard water-treatment test for the presence of organic pollutants." (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > 1998 study by Hemamala Hettige, Muthukumara Mani, and David Wheeler, "Industrial Pollution in Economic Development: Kuznets Revisited" (available at www.worldbank.org/nipr). The data were updated by the World Bank's Development Research Group using the same methodology as the initial study). Historical data extends back circa 1997 (US) / 2003 (China) but PATCHY DATA & EXCLUDES Australia, India, World, Brazil, Hong Kong & UAE data. (Ref: R314,401 China)

Environment Indicators continued...

	vii) Environment Trade-Offs	vii) Environmental Trade-Offs	
75	* PM10, Country Level (Micrograms per Cubic Metre) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > 1998 study by Hemamala Hettige, Muthukumara Mani, and David Wheeler, "Industrial Pollution in Economic Development: Kuznets Revisited" (available at www.worldbank.org/nipr). The data were updated by the World Bank's Development Research Group using the same methodology as the initial study)		* PM10, Country Level (Micrograms per Cubic Metre) : Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Comparative and Competitive Advantages, Workforce, Investment & Business Climate, Infrastructure Support and Economic Trade-Offs; SOCIAL - Urban Concepts as well as ENVIRONMENT - Urban Environment, Sustainability, Pollution and <u>Environment Trade-Offs</u>. <i>Measures the volume concentration of particulate matter pollutants - reflects pollution, adverse health side effects & quality of living trends which need to be supported by governance, economic, social and environment/urban development policy frameworks as well as economic, social and environment measures. The World Bank defines this: "Particulate matter concentrations refer to fine suspended particulates less than 10 microns in diameter (PM10) that are capable of penetrating deep into the respiratory tract and causing significant health damage. Data for countries and aggregates for regions and income groups are urban-population weighted PM10 levels in residential areas of cities with more than 100,000 residents. The estimates represent the average annual exposure level of the average urban resident to outdoor particulate matter. The state of a country's technology and pollution controls is an important determinant of particulate matter concentrations."</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > Kiren Dev Pandey, David Wheeler, Bart Ostro, Uwe Deichmann, Kirk Hamilton, and Katherine Bolt. "Ambient Particulate Matter Concentrations in Residential and Pollution Hotspot Areas of World Cities: New Estimates Based on the Global Model of Ambient Particulates (GMAPS)," World Bank, Development Research Group and Environment Department (2006)). Historical data extends back circa 1990 (Most Countries & World) & includes World data but EXCLUDES HK data. (WB Ref. R215,263 Australia)
76	* Adjusted Savings: Particulate Emission Damage (% of GNI) - Country (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > Kiran D. Pandey and others' "The Human Costs of Air Pollution: New Estimates for Developing Countries" (2006).)		* Adjusted Savings: Particulate Emission Damage (% of GNI): Governance, Economic, Social & Environment Indicator > Proxy for GOVERNANCE - Modes of Governance & Meta-Governance in terms of Capacity, Leadership & Vision, Fiscal Management and Regulatory Constructs with respect to Regulatory Frameworks; ECONOMIC - Economic Competitiveness - Comparative and Competitive Advantages, Workforce, Investment & Business Climate, Infrastructure Support and Economic Trade-Offs; SOCIAL - Urban Concepts as well as ENVIRONMENT - Urban Environment, Sustainability, Pollution and <u>Environment Trade-Offs</u>. <i>Measures the financial cost associated with avoiding deaths attributed to particulate emissions and represents an environmental, social and economic trade-off. The World Bank defines this: "Particulate emissions damage is calculated as the willingness to pay to avoid mortality attributable to particulate emissions."</i> (Sources: World Bank - World Development Indicators 1960-2012 (July 2013 Update) > Kiran D. Pandey and others' "The Human Costs of Air Pollution: New Estimates for Developing Countries" (2006). Historical data extends back circa 1990 (Most Countries & World) & includes World data but EXCLUDES HK data. (WB Ref. R6,655 Australia)

10.3 Appendix 3: City Structure Critical Indicator Matrix

- City Structure Critical Indicator Matrix

DOCTORAL THESIS:

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

MICHELLE LEONG GLASTRIS

City Structure Critical Indicator Matrix:					
Key Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP or City Population:	Source:
GOVERNANCE SECTOR INDICATORS:					
Claims on Central Government (% of GDP)	Definition: World Bank defines this: "Claims on central government include loans to central government institutions net of deposits". Scales: Country & World	Sector: GOVERNANCE Category: Governance – Modes of Governance and Meta-Governance Reason: Identifies to what extent a country's central government has claims/loans (which is net of deposits) & is indebted relative to its income/economic growth. It reflects how fiscally responsible the Government operates, how it impacts the sovereign debt credit rating and how the government debt impacts funding within the economy and the investment/business climate.	Other Sectors & Categories: Sector – GOVERNANCE - Fiscal Management Sector - ECONOMIC - Key Economic Drivers - Investment & Business Climate.	GDP: Indicator would be included as a Government Spending component in calculating GDP & unit expressed as a % of GDP. City Population: Impacts on the population's ability and cost to borrow and invest money and conduct business.	Source: World Bank – World Development Indicators
Health Expenditure, Total (% of GDP)	Definition: The World Bank defines this: "Total health expenditure is the sum of public and private health expenditure. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation." Scales: Country & World	Sector: GOVERNANCE Category: Governance - Leadership & Vision Reason: Identifies the leadership vision, measure of importance & financial support the Government gives to the provision of health associated services for the entire population – impacts on general health and well being and reflects access to health infrastructure & services by the country's workers, residents & visitors.	Other Sectors & Categories: Sector – GOVERNANCE - Fiscal Management Sector - ECONOMIC - Workforce - Investment & Business Climate. Sector - SOCIAL - Collective Values - Socio-Demographic Trends - Health & Education.	GDP: Indicator would be included as Government Spending, Gross Investment and Private Consumption components in calculating GDP & unit expressed as a % of GDP. City Population: Impacts on the population's overall health and access to health infrastructure and services.	Source: World Bank – World Development Indicators

DOCTORAL THESIS:

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

MICHELLE LEONG GLASTRIS

Key Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP or City Population:	Source:
GOVERNANCE SECTOR INDICATORS continued...					
Public Spending on Education, Total (% of GDP)	Definition: The World Bank defines this: "Public expenditure on education consists of current and capital public expenditure on education includes government spending on educational institutions (both public and private), education administration as well as subsidies for private entities (students/households and other private entities)." Scales: Country & World	Sector: GOVERNANCE Category: Governance - Leadership & Vision Reason: Identifies the leadership vision, measure of importance & financial support the Government gives to the provision of education and associated services for the entire population - impacts on the general education of the population and reflects the knowledge based capacity of the country's workers and residents.	Other Sectors & Categories: Sector – GOVERNANCE - Fiscal Management Sector - ECONOMIC - Economic Competitiveness - Workforce - Investment & Business Climate. Sector - SOCIAL - Collective Values - Socio-Demographic Trends - Health & Education.	GDP: Indicator would be included as a Government Spending component in calculating GDP & unit expressed as a % of GDP. City Population: Impact's on the country's general level of education as well as the productivity and capacity of the workforce.	Source: World Bank – World Development Indicators
Current Account Balance (% of GDP)	Definition: The World Bank defines this: "Current account balance is the sum of net exports of goods, services, net income, and net current transfers". Scales: Country & World	Sector: GOVERNANCE Category: Governance - Fiscal Management Reason: Measures the difference between national savings and investment and is a broad measure of the country's trade with the rest of the world. It reflects how well the Government & economy operates; the overall productivity of the economy; whether this produces a conducive investment/business climate & what comparative advantage the country has over others in competing for business.	Other Sectors & Categories: Sector – GOVERNANCE - Modes of Governance & Meta-Governance Sector - ECONOMIC - Key Economic Driver - Economic Competitiveness - Investment & Business Climate.	GDP: Indicator would be included as a (Exports - Imports) component in calculating GDP & unit expressed as a % of GDP. City Population: Impacts on the population's ability and cost to borrow and invest money and conduct business.	Source: World Bank – World Development Indicators & International Monetary Fund – World Economic Outlook

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

MICHELLE LEONG GLASTRIS

Key Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP or City Population:	Source:
GOVERNANCE SECTOR INDICATORS continued...					
5) Military Expenditure (% of GDP)	Definition: World Bank defines this: "Military expenditures data from SIPRI are derived from the NATO definition, which includes all current and capital expenditures on the armed forces, including peacekeeping forces; defense ministries and other government agencies engaged in defense projects; paramilitary forces, if these are judged to be trained and equipped for military operations; and military space activities. Such expenditures include military and civil personnel, including retirement pensions of military personnel and social services for personnel; operation and maintenance; procurement; military research and development; and military aid (in the military expenditures of the donor country)." Refer to Appendix A for full definition. Scales: Country & World	Sector: GOVERNANCE Category: Governance - Leadership & Vision Reason: Identifies the leadership vision, measure of importance & financial support the Government gives to the provision of military and defence associated services for the entire population - impacts on the country's political stability, government's fiscal management, investment/business climate and reflects country's collective values on peace keeping and defending the nation in relation to other key priorities and social trade-offs (i.e. military money that could be directed on health or education, etc).	Other Sectors & Categories: Sector – GOVERNANCE - Political Stability - Fiscal Management Sector - ECONOMIC - Investment & Business Climate. Sector - SOCIAL - Collective Values - Social Trade-Offs.	GDP: Indicator would be included as a Government Spending component in calculating GDP & unit expressed as a % of GDP. City Population: Impact's on the proportion of the population working in military and defence related industries.	Source: World Bank – World Development Indicators

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Key Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP or City Population:	Source:
GOVERNANCE SECTOR INDICATORS continued...					
6) Prison Population Rate (No. per 100,000 Inhabitants)	Definition: OECD defines this "Prison Population Rate based on the number per 100,000 inhabitants". Scales: Country & OECD Average used as a proxy for World for cross reference purposes	Sector: GOVERNANCE Category: Governance - Governance Trade-Offs Reason: In measuring the number of prisoners as a proportion of the total population – it is an indicator of crime and lawlessness. It reflects a Governance Trade-Off and a Social Trade-Off, leadership vision, the importance & financial support the Government gives to the provision of crime prevention and incarceration services for the entire population. It also reflects a country's collective values on crime and incarceration in relation to other key priorities and governance and social trade-offs (i.e. money spent on prisons that could otherwise be directed on health or education, etc).	Other Sectors & Categories: Sector – GOVERNANCE - Leadership & Vision - Modes of Governance & Meta-Governance - Fiscal Management Sector - SOCIAL - Collective Values - Socio-Demographic Trends - Social Trade-Offs.	GDP: Indicator would be included as a component of Government Expenditure when calculating GDP. City Population: Impacts a country's crime rate and lawlessness within the population.	Source: Organisation for Economic Co-operation and Development (OECD) - OECD Factbook 2010 - Crime> Prison Population

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Key Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP or City Population:	Source:
ECONOMIC SECTOR INDICATORS					
7) Inflation, Consumer Prices (Annual %)	Definition: World Bank defines this: "Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly". Scales: Country	Sector: ECONOMIC Category: - Key Economic Drivers Reason: Most popular measure of price inflation in retail goods & services as it determines how much consumers/households pay for goods & services. It affects the cost of living for households and also the cost of doing business, impacts on personal & corporate investments, influences the quality of life, rental/housing affordability and household wealth/disposable income. The inflation outlook affects labour contracts and government fiscal policy.	Other Sectors & Categories: Sector – GOVERNANCE - Regimes of Financial Capital Accumulation and Consumption > Liquidity - Modes of Governance & Meta-Governance > Capacity - Market Maturity - Fiscal Management - Regulatory Constructs > Regulatory Frameworks Sector - ECONOMIC - Investment & Business Climate. Sector - SOCIAL - Urban Concepts - Socio-Demographic Trends - Social Trade-Offs.	GDP: Indicator would be included as an Intermediate Consumption component in calculating GDP. City Population: Impacts the investment climate, general affluence and quality of life enjoyed by the country's population e.g. cost of living , household disposable income and rental/housing affordability, etc.	Source: World Bank – World Development Indicators

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ECONOMIC SECTOR INDICATORS continued...					
8) Total Investment (% GDP)	Definition: The IMF defines this: "Expressed as a ratio of total investment in current local currency and GDP in current local currency. Investment or gross capital formation is measured by the total value of the gross fixed capital formation and changes in inventories and acquisitions less disposals of valuables for a unit or sector." Scales: Country	Sector: ECONOMIC Category: - Investment & Business Climate Reason: Total Investments measures the extent of money invested in a country with respect to its economic growth. It impacts the productivity and capacity of the country, is a form of capital with multiplier effects (e.g. increased employment, increased consumption and investment, etc). It also reflects the attractiveness of the investment and business climate, market risks and returns, the maturity of the market, governance and regulatory environment.	Other Sectors & Categories: Sector – GOVERNANCE - Regimes of Financial Capital Accumulation and Consumption > Modes of Accumulation - Modes of Governance & Meta-Governance > Capacity - Market Maturity - Fiscal Management - Regulatory Constructs > Regulatory Frameworks Sector - ECONOMIC - Investment & Business Climate. - Economic Competitiveness - Forms of Capital	GDP: Indicator would be included as a Gross Investment component in calculating GDP & unit expressed as a % of GDP. City Population: Total Investment impacts the productive capacity of a country's economy and potentially raises the overall economic wealth of the population through various multiplier effects.	IMF – World Economic Outlook

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ECONOMIC SECTOR INDICATORS continued...					
9) Research and Development Expenditure (% of GDP)	Definition: The World Bank defines this: "Expenditures for research and development are current and capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture, and society, and the use of knowledge for new applications. R&D covers basic research, applied research, and experimental development". Scales: Country	Sector: ECONOMIC Category: - Economic Competitiveness Reason: Measure of how much is spent on Research and Development and therefore reflects the extent the government and private sector drives the development of intellectual capital, what sort of a leading edge does a country have in the provision creating/developing/improving future goods/services, what sort of a competitive advantage does this provide to a country's investment and business sectors and the impact it may have on educating knowledge workers.	Other Sectors & Categories: Sector – GOVERNANCE - Modes of Governance & Meta-Governance > Capacity - Market Maturity - Leadership & Vision - Fiscal Management Sector - ECONOMIC - Workforce - Technology Transfer - Investment & Business Climate. - Forms of Capital	GDP: Indicator would be included as a Gross Investment or Intermediate Consumption component in calculating GDP & unit expressed as a % of GDP. City Population: R & D expenditure impacts a country's intellectual capital and potentially raises the knowledge based productive capacity of the working population.	World Bank – World Development Indicators

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ECONOMIC SECTOR INDICATORS continued...					
10) Global Network Connectivity in the World City Network (GNC Connectivity Score or GNC Ranking)	Definition: Taylor et al define this as an "indirect measurement of flows; information and knowledge linking offices within a firm....the model can estimate potential working flows between all pairs of cities in a firm's office network. Aggregating all of these estimates for all firms provides an indirect measure of total flows between every pair of cities. Adding up an individual city's potential working flows with every other city provides an estimate of the network connectivity of that city. This is an indicator of the degree of integration of a given city into the world city network". Scales: City	Sector: ECONOMIC Category: - Investment & Business Climate Reason: Measures how well connected a city is within the world city network in terms of connectivity to "Advanced Producer Services". This reflects the development of intellectual capital, what sort of competitive advantages does this city provide to its investment and business sectors and the impact it may have on advancing the skills of a city's knowledge workers.	Other Sectors & Categories: Sector - ECONOMIC - Economic Competitiveness - Workforce - Technology Transfer - Investment & Business Climate. - Infrastructure Support - Forms of Capital	GDP: Indicator would be included as a Gross Value and Intermediate Consumption components in calculating GDP & unit expressed as a % of GDP. City Population: Provides a gauge of how well intellectual capital i.e. knowledge and information is being transferred/exchanged to its knowledge workers within a city's population.	Globalization and World Cities (GaWC) – GaWC Network Research and "Global Urban Analysis: A Survey of Cities in Globalization" (US Census Bureau 2011b)

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ECONOMIC SECTOR INDICATORS continued...					
11) Revenue Multiplier - CALCULATED (Sq ft / Person)	Definition: Leong Glastris defines this as: "The Revenue Multiplier is a measure of the economic productivity of a city relative to the city's office occupancy cost". It is calculated as: Revenue Multiplier (Sq ft / Person) = GDP per Capita (US\$ per Person pa) / Total Office Occupancy Costs (US\$ per Sq ft pa). Scales: City	Sector: ECONOMIC Category: - Investment & Business Climate Reason: The calculation was developed by Leong Glastris to identify the value in economic productivity relative to the office occupancy cost i.e. is it worthwhile locating an office executive in a particular city given the expected GDP output. It can be regarded as the cost of doing business globally. It reflects an economic and urban development premium, worker productivity as well as the investment/business attractiveness of the city, level of infrastructure support provided and the supply-demand dynamics of the office market. It also reflects social collective values and urban concepts regarding the desire for workers to relocate to a city with an attractive urban life style e.g. good access to cultural activities, affordable housing, schools, hospitals, etc.	Other Sectors & Categories: Sector - ECONOMIC - Economic Competitiveness - Workforce - Infrastructure Support - Forms of Capital Sector - SOCIAL - Collective Values - Urban Concepts	GDP: Indicator uses GDP per capita as a component in its calculation and also reflects the cost of doing business and would be included as a Intermediate Consumption component in calculating GDP City Population: Indicator uses GDP per capita as a component in its calculation & provides a gauge as to the economic productivity relative to the office occupancy cost for city workers.	Oxford Economics - 2013 Customised Data for M Glastris and CB Richard Ellis (CBRE) - Global Market View: Office Occupancy Costs and

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ECONOMIC SECTOR INDICATORS continued...					
12) Gross Domestic Product (\$USM, Constant 2005 Prices)	Definition: Oxford Economics defines this: "Gross domestic product (GDP) is an aggregate measure of production equal to the sum of the gross values added of all resident institutional units engaged in production (plus any taxes, and minus any subsidies, on products not included in the value of their outputs). It is also the sum of the final uses of goods and services (all uses except intermediate consumption) measured in purchasers' prices, less the value of imports of goods and services, or the sum of primary incomes distributed by resident producer units." Scales: City & Country	Sector: ECONOMIC Category: - Key Economic Drivers Reason: Measures total economic activity with respect to constant prices and is useful for tracking developments over time (Taylor et al. 2011). In this instance, the Production Approach is used to calculate GDP where intermediate consumption (e.g. cost of materials, supplies, services, etc used to produce final goods and services) is deducted from the Gross Value of domestic Output from various economic activities (Stutely 2003). It is regarded as a universal indicator with multiplier effects (e.g. increased employment, increased consumption and investment, etc). It reflects how slow/fast a country/city's economy is growing. Developing cities and countries have a relatively higher capacity for faster GDP growth than more developed/mature cities/countries (circa 3% real GDP growth pa) (Wikipedia 2013k).	Other Sectors & Categories: Sector – GOVERNANCE - Regimes of Financial Capital Accumulation and Consumption > Modes of Accumulation - Market Maturity - Fiscal Management Sector - ECONOMIC - Economic Competitiveness - Investment & Business Climate.	GDP: Indicator is a GDP measure and evaluates the economic activity with a city/country. City Population: Economic activity is achieved through its city/country population working at a various levels of productive capacity and implementing multiplier effects. It can be expressed as GDP per capita to evaluate general economic activity with respect to a city/country population.	Oxford Economics - 2013 Customised Data for M Glastris

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ECONOMIC SECTOR INDICATORS continued...					
13) Household Disposable Income (\$USM, Constant 2005 Prices)	Definition: Oxford Economics defines this: "Household disposable income is the amount of money that households have available for spending and saving after income taxes have been accounted for". Scales: City & Country	Sector: ECONOMIC Category: - Forms of Capital Reason: Measures how much a household has to spend in disposable net income and reflects the level of household disposable/discretionary wealth and to what extent household consumption (and household debt) will drive economic activity. It gauges the city/country's general level of household prosperity i.e. generally the higher the disposable income, the more developed and prosperous the household.	Other Sectors & Categories: Sector – GOVERNANCE - Regimes of Financial Capital Accumulation and Consumption > Modes of Accumulation - Market Maturity Sector - ECONOMIC - Key Economic Drivers - Investment & Business Climate. - Forms of Capital Sector - SOCIAL - Urban Concepts - Socio-Demographic Trends - Social Trade-Offs	GDP: Indicator would be included as a Private Consumption component in calculating GDP & unit expressed as a % of GDP. City Population: Assesses to what extent household disposable income within a city/country's population will drive economic activity and the general level of household prosperity.	Oxford Economics - 2013 Customised Data for M Glastris

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ECONOMIC SECTOR INDICATORS continued...					
14) Employment ('000s, People)	Definition: Oxford Economics defines this: "Employment usually identifies those employed according to the geographical location of their work, for example if a person is employed in London but commutes in from Essex, they would be counted in London's workplace employment. This is the most common measure of employment and is usually calculated from company surveys. For some countries however, this measure is not available and a residence-based measure is used instead, which is normally based on LFS surveys (e.g. Australia, Canada)". Scales: City & Country	Sector: ECONOMIC Category: - Workforce Reason: Measures how the employment level within a city/country and is a form of capital. It reflects government's policies to raise employment, the market maturity with respect to the proportion of workers employed in knowledge based jobs, the economic comparative advantage a city may have over others in terms of a skilled workforce and labour wages/salaries. It impacts on the levels of technology transfer and infrastructure support needed to support employment and on social aspects such as work-lifestyle balance and tertiary education attainment.	Other Sectors & Categories: Sector – GOVERNANCE - Modes of Governance & Meta-Governance > Capacity - Market Maturity - Leadership and Vision Sector - ECONOMIC - Key Economic Drivers - Economic Competitiveness - Investment & Business Climate. - Infrastructure Support - Forms of Capital Sector - SOCIAL - Urban Concepts - Education.	GDP: Employment generates economic activity through production, investment and consumption. It would be included as a Gross Value of Domestic Output and an Intermediate Consumption component in calculating GDP City Population: Indicates the employment level within a city/country's population.	Oxford Economics - 2013 Customised Data for M Glastris

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Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP and/or City Population:	Source:
SOCIAL SECTOR INDICATORS					
15) Urban Population or Urbanisation Rate (% of Total)	Definition: The World Bank defines this: "Urban population refers to people living in urban areas as defined by national statistical offices. It is calculated using World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects". Scales: Country	Sector: SOCIAL Category: - Socio-Demographic Trends Reason: Measures the number of people within the country who agglomerate around urban areas as a percentage of the total population. The indicator reflects government's ability to provide a supportive regulatory and fiscal policy framework for increased urbanisation, comparative productivity levels, skilled migrant labour, cultural & religious diversity, community & cultural identity, migration trends and social trade-offs/benefits. Increased urbanisation levels also impacts the built environment (e.g. more housing, schools, hospitals & infrastructure required), transport system, consumption of water and energy, pollution, etc.	Other Sectors & Categories: Sector – GOVERNANCE - Modes of Governance & Meta-Governance > Capacity - Leadership and Vision - Fiscal Management - Regulatory Constructs > Regulatory Frameworks Sector - ECONOMIC - Key Economic Drivers - Economic Competitiveness - Workforce - Investment & Business Climate. - Infrastructure Support Sector - SOCIAL - Collective Values - Urban Concepts - Socio Demographic Trends - Social Trade-Offs Sector - ENVIRONMENT - Urban Environment - Transportation - Water & Energy - Pollution - Environment Trade-Offs	GDP: Increased city population has the potential to raise economic activity through production, investment and consumption. City Population: Provides a gauge of what amount of the total country's population is settling in/around urban areas.	World Bank – World Development Indicators & United Nations – World Urbanization Prospects

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Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP and/or City Population:	Source:
SOCIAL SECTOR INDICATORS					
16) Population Density (People per sq. km of land area)	Definition: Demographia defines this: "Urban Population Density: This report provides average urban population density data. It is not possible to coordinate the dates of current population estimates with land area estimates. As a result, population densities (calculated using current estimates) are expressed in rounded numbers (to the nearest 100). Thus, the urban population densities should be considered reasonable approximation, rather than precise". Scales: City	Sector: SOCIAL Category: - Socio-Demographic Trends Reason: Measures urban population density with respect to urban land area - reflects government's ability to provide a supportive regulatory and fiscal policy framework for sustainable population densities. It impacts on overall city population capacity, workforce composition, cultural & religious diversity, community & cultural identity, health and education support and social trade-offs/benefits. Increased population density levels also impact on the built environment (higher density housing, schools & infrastructure required), living sustainably, transport system, consumption of water and energy, pollution, etc.	Other Sectors & Categories: Sector – GOVERNANCE - Modes of Governance & Meta-Governance > Capacity - Leadership and Vision - Fiscal Management - Regulatory Constructs > Regulatory Frameworks Sector - ECONOMIC - Key Economic Drivers - Workforce - Investment & Business Climate. - Forms of Capital Sector - SOCIAL - Collective Values - Urban Concepts - Socio Demographic Trends - Health & Education - Social Trade-Offs Sector - ENVIRONMENT - Urban Environment - Transportation - Water & Energy - Sustainability - Pollution - Environment Trade-Offs	GDP: Increased city density has the potential to raise economic activity through production, investment and consumption. City Population: Provides a gauge of how densely packed a city population is within the city and the premium people place on living in/close to the city.	Demographia - Demographia World Urban Areas (World Agglomerations)

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Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP and/or City Population:	Source:
SOCIAL SECTOR INDICATORS continued...					
17) Net Migration (No. of People)	Definition: The World Bank defines this: "Net migration is the net total of migrants during the period, that is, the total number of immigrants less the annual number of emigrants, including both citizens and noncitizens". Refer to Appendix A for full definition. Scales: Country	Sector: SOCIAL Category: - Urban Concepts Reason: Measures net migration - reflects government's ability to provide a supportive regulatory and fiscal policy framework for migration, comparative productivity levels, skilled migrant labour, cultural & religious diversity, community & cultural identity, migration trends and social trade-offs/benefits. Increased net migration levels also impact on the built environment (higher density housing, schools & infrastructure required), living sustainably, transport system, consumption of water and energy, pollution, etc.	Other Sectors & Categories: Sector – GOVERNANCE - Modes of Governance & Meta-Governance > Capacity - Leadership and Vision - Fiscal Management - Regulatory Constructs > Regulatory Frameworks Sector - ECONOMIC - Key Economic Drivers - Economic Competitiveness - Workforce - Investment & Business Climate. - Forms of Capital Sector - SOCIAL - Collective Values - Urban Concepts - Socio Demographic Trends - Social Trade-Offs Sector - ENVIRONMENT - Urban Environment - Transportation - Water & Energy - Sustainability - Pollution - Environment Trade-Offs	GDP: Increased net migration has the potential to raise economic activity through production, investment and consumption. City Population: Provides a gauge of what proportion of the total country's population comprises of migrants.	World Bank – World Development Indicators

Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP and/or City Population:	Source:
SOCIAL SECTOR INDICATORS continued...					
18) Total Dependency Ratio	Definition: The United Nations define this "Total dependency ratio (<20 & 65+)/ (20-64) by major area, region and country, 1950-2100 (ratio of population 0-19 and 65+ per 100 population)." Scales: Country	Sector: SOCIAL Category: - Socio-Demographic Trends Reason: Measures proportion of children and elderly dependents of the total population - reflects social burden on independent/working population which need to be supported. Reflects government's ability to provide a supportive regulatory and fiscal policy framework families with young &/or elderly dependents. Impacts on workforce participation, family's income earning capacity, the importance placed on caring for young/elderly dependents and the necessary infrastructure to support their needs (e.g. child care centres, schools, community centres, assisted living, retirement & nursing homes, etc) and living sustainably.	Other Sectors & Categories: Sector – GOVERNANCE - Modes of Governance & Meta-Governance > Capacity - Leadership and Vision - Regulatory Constructs > Regulatory Frameworks Sector - ECONOMIC - Workforce - Infrastructure Support - Economic Trade-Offs Sector - SOCIAL - Collective Values - Urban Concepts - Socio Demographic Trends - Social Trade-Offs Sector - ENVIRONMENT - Urban Environment - Sustainability	GDP: An increasing total dependency ratio has the potential to lower economic activity due to reduced workforce/labour participation. City Population: Provides a gauge of what proportion of the country's young and elderly segments are being supported by the country's working population.	United Nations – World Population Prospects

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SOCIAL SECTOR INDICATORS continued...					
19) Completed Tertiary Educational Attainment (% of Total Population)	Definition: World Bank defines as: "Percentage of population by educational attainment, 15+, total, completed tertiary is the percentage of people over age 15 who have completed tertiary education". Refer to Appendix A for full definition. Scales: Country	Sector: SOCIAL Category: - Health & Education Reason: Measures graduate/completion level for Tertiary Education - reflects extent government encourages tertiary education attainment, tertiarisation rates, provision of knowledge and services workers, competitive ability to tap into a local skilled workforce, growth in intellectual capital & value add services, the impact it may have on educating knowledge & service workers, higher education/training and income levels attained with increased expectations of a higher standard of living (e.g. access to housing, universities, better amenities and infrastructure).	Other Sectors & Categories: Sector – GOVERNANCE - Market Maturity - Leadership and Vision Sector - ECONOMIC - Economic Competitiveness - Workforce - Technology Transfer - Infrastructure Support - Forms of Capital Sector - SOCIAL - Socio Demographic Trends - Education Sector - ENVIRONMENT - Urban Environment	GDP: Increased completed tertiary education attainment has the potential to increase the general education and skills of the working population and the number of knowledge based workers. This in turn has the potential to raise economic activity through greater production, investment and consumption. City Population: Provides a gauge of what amount of the country's population have completed a tertiary education degree.	World Bank – World Development Indicators

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Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP and/or City Population:	Source:
SOCIAL SECTOR INDICATORS continued...					
20) City Structure Population (000's People) A) Total City Population ('000s, People) B) Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011 (000's, People)	Definition: a) Oxford Economics defines this: "Total population of the city consists of all persons falling within the scope of the census. In the broadest sense, the total may comprise either all usual residents of the city or all persons present in the city at the time of the census. The total of all usual residents is generally referred to as the de jure population and the total of all persons present as the de facto population". b) The United Nations defines this: "<i>Refers to the de facto population contained within the contours of a contiguous territory inhabited at urban density levels without regard to administrative boundaries. It usually incorporates the population in a city or town plus that in the sub-urban areas lying outside of but being adjacent to the city boundaries</i>". Scales: City	Sector: SOCIAL Category: - Socio-Demographic Trends Reason: Measures total city population (Oxford Economics) or the number of a country's people who agglomerate around urban centres/cities with over 750,000 inhabitants (United Nations). It reflects government's ability to provide a supportive policy and regulatory framework to encourage city population growth. This impacts on economic productivity and capacity levels, tertiarisation and education levels, workforce composition, cultural & religious diversity, community & cultural identity, health and education support and social trade-offs/benefits and the city's ability to attract residents, workers, visitors, etc.	Other Sectors & Categories: Sector – GOVERNANCE - Modes of Governance & Meta-Governance > Capacity - Leadership and Vision - Fiscal Management - Regulatory Constructs > Regulatory Frameworks Sector - ECONOMIC - Key Economic Drivers - Workforce - Investment & Business Climate. - Forms of Capital Sector - SOCIAL - Collective Values - Socio Demographic Trends - Health & Education - Social Trade-Offs Sector - ENVIRONMENT - Urban Environment - Transportation - Water & Energy - Sustainability - Pollution - Environment Trade-Offs	GDP: An increased city population level has the potential to raise economic activity through greater production, investment and consumption. City Population: Indicator provides a direct measure of a city's population.	Oxford Economics - 2013 Customised Data for M Glastris

Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP and/or City Population:	Source:
ENVIRONMENT SECTOR INDICATORS					
21) City Office Occupancy Costs (US\$/Sft per Annum)	Definition: CBRE define this: "Local office costs are reported in U.S. dollars on a per annum basis. This number reflects all occupancy costs, and therefore corresponds to "gross" rents for all markets. All occupancy cost figures are standardized to a net internal area basis of measurement". Scales: City	Sector: ENVIRONMENT Category: - Urban Environment Reason: Measures the cost of providing office accommodation within a city (cost of doing business). It reflects an economic and urban development premium as well as the investment/business attractiveness of the city and the supply-demand dynamics of the office market. This impacts on urban development, planning and transport policies, economic productivity and capacity levels, workforce composition, built environment (i.e. office buildings, share office facilities, etc), infrastructure support required and the city's ability to attract workers.	Other Sectors & Categories: Sector – GOVERNANCE - Modes of Governance & Meta-Governance > Capacity - Leadership and Vision - Regulatory Constructs > Regulatory Frameworks Sector - ECONOMIC - Economic Competitiveness - Workforce - Technology Transfer - Investment & Business Climate. - Infrastructure Support - Forms of Capital - Economic Trade-Offs Sector - SOCIAL - Collective Values - Socio Demographic Trends Sector - ENVIRONMENT - Urban Environment - Transportation	GDP: Indicator reflects the cost of doing business and would be included as an intermediate consumption in calculating GDP. City Population: Indicator provides a gauge to the cost of providing office accommodation to city workers within the city population.	CBRE - Global Market View: Office Occupancy Costs

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Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP and/or City Population:	Source:
ENVIRONMENT SECTOR INDICATORS					
22) Hospital Beds (per 1,000 People)	Definition: The World Bank defines this: "Hospital beds include inpatient beds available in public, private, general, and specialized hospitals and rehabilitation centres. In most cases beds for both acute and chronic care are included". Scales: Country	Sector: ENVIRONMENT Category: - Urban Environment Reason: Measures the number of hospital beds per 1,000 people. It reflects the ability and capacity to provide for those in need of hospital care as well as the needs of an ageing demographic segment as they require greater hospital care; population growth pressures & the capacity of social infrastructure/hospital support. It also reflects the Government's leadership and vision in planning for the future hospital needs of the population in their policies and public expenditure and the community's expectations to be able to access a hospital in a timely and efficient manner. Access to infrastructure such as hospitals and schools are also a consideration for young families and older/elderly couples when locating to cities.	Other Sectors & Categories: Sector – GOVERNANCE - Modes of Governance & Meta-Governance > Capacity - Leadership and Vision - Regulatory Constructs > Regulatory Frameworks Sector - ECONOMIC - Economic Competitiveness - Workforce - Investment & Business Climate. - Infrastructure Support Sector - SOCIAL - Socio Demographic Trends - Health - Social Trade-Offs Sector - ENVIRONMENT - Urban Environment	GDP: Indicator reflects the cost of providing hospital beds through either private or public expenditure. It would be included as Government Spending and Gross Investment components in calculating GDP. City Population: Indicates the number of beds as a proportion of the country's population.	World Bank – World Development Indicators

Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP and/or City Population:	Source:
ENVIRONMENT SECTOR INDICATORS continued...					
23) Motor Vehicles (per 1,000 people)	Definition: The World Bank defines this: "Motor vehicles include cars, buses, and freight vehicles but do not include two-wheelers. Population refers to midyear population in the year for which data are available". Scales: Country	Sector: ENVIRONMENT Category: - Transportation Reason: Reflects a country's reliance on motor vehicles, motor vehicle consumption and impacts journey to work/speed to markets and urban sprawl trends. It reflects the Government's leadership and vision in planning for future needs in Government urban development, planning, manufacturing/investment and transport policies, tax revenues and expenditures. It also impacts the efficiency of the public transport system, community and business values and expectations of transport efficiencies, living sustainably, and environment trade-offs e.g. traffic congestion, urban sprawl, pollution, etc.	Other Sectors & Categories: Sector – GOVERNANCE - Modes of Governance & Meta-Governance > Capacity - Leadership and Vision - Fiscal Management - Regulatory Constructs > Regulatory Frameworks Sector - ECONOMIC - Economic Competitiveness - Workforce - Investment & Business Climate. - Infrastructure Support - Economic Trade-Offs Sector - SOCIAL - Collective Values - Urban Concepts Sector - ENVIRONMENT - Urban Environment - Sustainability - Pollution - Environment Trade-Offs	GDP: An increased level of motor vehicles has the potential to raise economic activity through greater production, investment and consumption and also to devalue with the cost of offsetting/rectifying economic and environment trade-offs. City Population: Gives an indication of the number of motor vehicles as a proportion of the country's population.	World Bank – World Development Indicators

Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP and/or City Population:	Source:
ENVIRONMENT SECTOR INDICATORS continued...					
24) Energy Use (kg of oil equivalent per capita)	Definition: The World Bank defines this: "Energy use refers to use of primary energy before transformation to other end-use fuels, which is equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport". Scales: Country	Sector: ENVIRONMENT Category: - Water and Energy Reason: Reflects energy consumption and provides a broad level indication of energy consumption intensive countries, accessibility to energy, energy efficiency and sustainability measures that may be employed as well as quality of living and globalisation trends. It reflects the Government's leadership and vision in planning for future energy needs in urban development, planning, energy and environmental policies and expenditures. It also reflects community and business values and expectations of energy consumption and efficiencies, living sustainably, and environment trade-offs e.g. pollution, green house gas emissions, etc.	Other Sectors & Categories: Sector – GOVERNANCE - Modes of Governance & Meta-Governance > Capacity - Leadership and Vision - Fiscal Management - Regulatory Constructs > Regulatory Frameworks Sector - ECONOMIC - Economic Competitiveness - Workforce - Investment & Business Climate. - Infrastructure Support - Economic Trade-Offs Sector - SOCIAL - Collective Values - Urban Concepts Sector - ENVIRONMENT - Urban Environment - Sustainability - Pollution - Environment Trade-Offs	GDP: An increased level of energy use has the potential to raise economic activity through greater production, investment and consumption and also to devalue with the cost of offsetting/rectifying economic and environment trade-offs. City Population: Provides a gauge of the country's amount of energy consumed per capita.	World Bank – World Development Indicators

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Indicator Name:	Definition & Scale of Significance:	Key Sector and Category Represented & Reason for Selection:	Other Sector and Category Application:	Connection/Relevance to GDP and/or City Population:	Source:
ENVIRONMENT SECTOR INDICATORS continued...					
25) Carbon Dioxide (CO₂) Emissions , (metric tons of CO ₂ per capita)	Definition: The World Bank defines this: "Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring". Scales: Country	Sector: ENVIRONMENT Category: - Pollution Reason: Measures one of the main Greenhouse gases carbon dioxide emissions and reflects global warming/Greenhouse Effect, pollution, adverse health side effects & quality of living trends. It reflects the Government's leadership and vision in planning for protecting the environment in urban development, planning, energy and environmental policies and expenditures. It also reflects community and business values and expectations of reducing green house gas emissions, living sustainably, and environment trade-offs e.g. global warming.	Other Sectors & Categories: Sector – GOVERNANCE - Modes of Governance & Meta-Governance > Capacity - Leadership and Vision - Fiscal Management - Regulatory Constructs > Regulatory Frameworks Sector - ECONOMIC - Workforce - Investment & Business Climate. - Economic Trade-Offs Sector - SOCIAL - Collective Values - Urban Concepts Sector - ENVIRONMENT - Urban Environment - Sustainability - Pollution - Environment Trade-Offs	GDP: Increased levels of CO₂ emissions has the potential to lower economic activity due to the significant costs associated with offsetting/rectifying the economic and environment trade-offs. City Population: Provides a gauge of the country's amount of CO₂ emissions per capita.	World Bank – World Development Indicators

10.4 Appendix 4: Tables of Correlation Analyses for Six Key Cities – Critical Indicators

- Sydney, Australia
- New York and Detroit, USA
- Guangzhou and Shanghai, China
- Bangalore, India

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Correlation Analyses Table – Critical Indicators: Sydney, Australia (Note: Correlations of +/- 0.70 are strongly correlated)

Sector & Category:	Governance - Modes of Governance & Meta-Governance > Capacity	Governance - Leadership & Vision	Governance - Leadership & Vision	Governance - Leadership & Vision	Governance - Governance Trade-Offs	Governance - Fiscal Management	Economic - Key Economic Drivers	Economic - Forms of Capital	Economic - Workforce	Economic - Key Economic Drivers	Economic - Economic Competitiveness	Economic - Investment & Business Climate	Economic - Investment & Business Climate	Economic - Investment & Business Climate
Scale:	Country	Country	Country	Country	Country	Country	City - SYDNEY	City - SYDNEY	City - SYDNEY	Country	Country	City - SYDNEY	Country	City - SYDNEY
Source:	World Bank (WDI)	United Nations (WHS) & World Bank (WDI)	UNESCO (Institute of Statistics) & World Bank (WDI)	World Bank (WDI)	OECD (Factbook Crime)	World Bank (WDI) & IMF (WEO)	Oxford Economics	Oxford Economics	Oxford Economics	World Bank (WDI) & IMF (WEO)	World Bank (WDI)	Oxford Economics & CBRE	IMF (WEO)	Globalisation and World Cities
1950-2013	Claims on Central Government, etc (% of GDP)	Health Expenditure, Total (% of GDP)	Public Spending on Education, Total (% of GDP)	Military Expenditure (% of GDP)	Prison Population Rate (No. per 100,000)	Current Account Balance (% GDP)	SYDNEY GDP (million \$2005)	SYDNEY Household disposable income (million \$2005)	SYDNEY Employment	Inflation - CPI Prices (Annual %)	Research & Development Expenditure (% GDP)	Sydney Revenue Multiplier (GDP per Capita / Total Office Occupancy Costs)	Total Investment (% GDP)	Global Network Connectivity (GNC Proportionate Connectivity, 1.00=London) SYD
Syd GDP Correl	-0.83	0.98	-0.68	-0.64	1.00	-0.21	1.00	0.99	0.99	0.03	0.80	-0.90	0.79	0.70
Syd Pop Correl (OE)	-0.78	0.99	-0.63	-0.60	0.99	-0.15	0.99	0.99	1.00	0.03	0.85	-0.89	0.78	0.67
Syd Pop Correl (UN)	-0.96	0.98	-0.67	-0.85	0.99	-0.27	0.98	0.98	0.99	-0.25	0.89	-0.92	0.29	0.69

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Correlation Analyses Table – Critical Indicators: Sydney, Australia (Note: Correlations of +/- 0.70 are strongly correlated) continued...

Sector & Category:	Social - Urban Concepts	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Health & Education	Environment - Urban Environment	Environment - Urban Environment	Environment - Transportation	Environment - Water & Energy	Environment - Pollution
Scale:	Country	City - SYDNEY	Country - Urban	City - SYDNEY	City - SYDNEY	Country	Country	Country	City - SYDNEY (Core)	Country	Country	Country
Source:	World Bank (WDI)	Demographia	World Bank (WDI) & United Nations (WUP)	Oxford Economics	United Nations (WUP)	United Nations (World Population Prospects)	World Bank (WDI)	World Bank (WDI)	CBRE (GMV OOC)	World Bank (WDI)	World Bank (WDI)	World Bank (WDI)
1950-2013	Net Migration (Number of People)	Population Density (People per sq. km) SYD	Urban Population i.e Rate of Urbanisation (% of Total Population)	City Pop SYD	Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011 (Number of People) SYD	Total Dependency Ratio	Completed Tertiary Educational Attainment, 15+ years (% Total Population)	Hospital Beds (per 1,000 people)	Total Office Occupancy Costs (Current US\$ per Sqft pa) SYD	Motor Vehicles (per 1,000 people)	Energy Use (KG of Oil Equivalent per Capita)	CO2 Emissions (Metric Tons per Capita)
Syd GDP Correl	0.88	-0.78	0.99	0.99	0.98	-0.97	0.96	-0.88	0.94	0.99	0.64	0.33
Syd Pop Correl (OE)	0.93	-0.79	0.99	1.00	1.00	-0.99	0.98	-0.89	0.91	0.97	0.56	0.35
Syd Pop Correl (UN)	0.51	-0.78	0.92	1.00	1.00	-0.72	0.99	-0.83	0.95	0.99	0.98	0.98

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Correlation Analyses Table – Critical Indicators: New York and Detroit, USA (Note: Correlations of +/- 0.70 are strongly correlated)

Sector & Category:	Governance - Modes of Governance & Meta-Governance > Capacity	Governance - Leadership & Vision	Governance - Leadership & Vision	Governance - Leadership & Vision	Governance - Trade-Offs	Governance - Fiscal Management	Economic - Key Economic Drivers	Economic - Forms of Capital	Economic - Workforce	Economic - Key Economic Drivers	Economic - Forms of Capital	Economic - Workforce	Economic - Key Economic Drivers	Economic - Economic Competitiveness	Economic - Investment & Business Climate	Economic - Investment & Business Climate	Economic - Investment & Business Climate	Economic - Investment & Business Climate	Economic - Investment & Business Climate
Scale:	Country	Country	Country	Country	Country	Country	City - NEW YORK	City - NEW YORK	City - NEW YORK	City - DETROIT	City - DETROIT	City - DETROIT	Country	Country	City - NEW YORK	City - DETROIT	Country	City - NEW YORK	City - DETROIT
Source:	World Bank (WDI)	United Nations (WHS) & World Bank (WDI)	UNESCO (Institute of Statistics) & World Bank (WDI)	World Bank (WDI)	OECD (Factbook - Crime)	World Bank (WDI) & IMF (WEO)	Oxford Economics	Oxford Economics	Oxford Economics	Oxford Economics	Oxford Economics	Oxford Economics	World Bank (WDI)	World Bank (WDI)	Oxford Economics & CBRE	Oxford Economics & CBRE	IMF (WEO)	Globalisation and World Cities	Globalisation and World Cities
1950-2013	Claims on Central Government, etc (% of GDP)	Health Expenditure, Total (% of GDP)	Public Spending on Education, Total (% of GDP)	Military Expenditure (% of GDP)	Prison Population Rate (No. per 100,000)	Current Account Balance (% GDP)	NY GDP (million \$2005)	NY Household disposable income (million \$2005)	NY Employment	DETROIT GDP (million \$2005)	DETROIT Household disposable income (million \$2005)	DETROIT Employment	Inflation - CPI Prices (Annual %)	Research & Development Expenditure (% GDP)	NY Revenue Multiplier (GDP per Capita / Total Office Occupancy Costs)	Detroit Revenue Multiplier (GDP per Capita / Total Office Occupancy Costs)	Total Investment (% GDP)	Global Network Connectivity (GNC Proportionate Connectivity, 1.00=London) NY	Global Network Connectivity (GNC Proportionate Connectivity, 1.00=London) DET
NY GDP Correl	-0.27	0.78	-0.39	0.79	0.90	0.41	1.00	0.95	0.71	-0.63	-0.65	-0.80	0.03	0.50	-0.72	0.92	-0.50	1.00	-1.00
NY Pop Correl (OE)	-0.83	0.85	0.71	-0.10	0.99	-0.74	0.89	0.96	0.95	-0.62	0.85	-0.21	-0.36	0.54	-0.59	0.94	-0.12	0.91	-1.00
NY Pop Correl (UN)	-0.06	0.97	0.81	-0.20	0.93	-0.63	0.94	0.98	0.86	-0.75	0.63	-0.52	-0.33	0.66	-0.55	0.96	-0.59	0.99	-0.99
DET GDP Correl	0.61	-0.83	0.16	-0.83	-0.84	-0.73	-0.63	-0.72	-0.15	1.00	0.98	0.92	0.46	-0.91	-0.86	0.57	0.88	-1.00	1.00
DET Pop Correl (OE)	0.51	-0.89	0.27	-0.91	-0.93	-0.62	-0.81	-0.89	-0.32	0.93	0.90	0.96	0.32	-0.81	-0.74	0.22	0.85	-0.97	0.83
DET Pop Correl (UN)	-0.37	0.97	0.75	-0.05	0.87	-0.50	0.93	0.93	0.79	-0.74	0.51	-0.62	-0.18	0.71	-0.57	0.96	-0.60	1.00	-0.97

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Correlation Analyses Table – Critical Indicators: New York and Detroit, USA (Note: Correlations of +/- 0.70 are strongly correlated) continued...

Sector & Category:	Social - Urban Concepts	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Health & Education	Environment - Urban Environment	Environment - Urban Environment	Environment - Urban Environment	Environment - Transportation	Environment - Water & Energy	Environment - Pollution
Scale:	Country	City - DETROIT	City - NEW YORK	Country - Urban	City - NEW YORK	City - DETROIT	City - NEW YORK	City - DETROIT	Country	Country	Country	City - NEW YORK (Downtown)	City - DETROIT	Country	Country	Country	
Source:	World Bank (WDI)	Demographia	Demographia	World Bank (WDI) & United Nations (WUP)	Oxford Economics	Oxford Economics	United Nations (WUP)	United Nations (WUP)	United Nations (World Population Prospects)	World Bank (WDI)	World Bank (WDI)	CBRE (GMV OOC)	CBRE (GMV OOC)	World Bank (WDI)	World Bank (WDI)	World Bank (WDI)	
1950-2013	Net Migration (Number of People)	Population Density (People per sq. km) DET	Population Density (People per sq. km) NY	Urban Population i.e Rate of Urbanisation (% of Total Population)	City Pop New York	City Pop Detroit	Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011 (Number of People) NY	Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011 (Number of People) DET	Total Dependency Ratio	Completed Tertiary Educational Attainment, 15+ years (% Total Population)	Hospital Beds (per 1,000 people)	Total Office Occupancy Costs (Current US\$ per Sqft pa) NY	Total Office Occupancy Costs (Current US\$ per Sqft pa) DET	Motor Vehicles (per 1,000 people)	Energy Use (KG of Oil Equivalent per Capita)	CO2 Emissions (Metric Tons per Capita)	
NY GDP Correl	-1.00	-0.77	-0.50	0.95	0.89	-0.81	0.94	0.93	-1.00	0.47	-0.88	0.83	0.31	0.37	-0.67	-0.49	
NY Pop Correl (OE)	0.27	-0.81	-0.35	0.97	1.00	-0.80	0.94	0.88	-0.94	0.94	-0.99	0.71	0.50	-0.31	-0.31	-0.24	
NY Pop Correl (UN)	0.71	-0.72	-0.54	0.98	0.94	-0.90	1.00	0.92	-0.52	0.79	-0.84	0.67	0.65	-0.13	0.36	0.19	
DET GDP Correl	1.00	-0.01	0.66	-0.75	-0.62	0.93	-0.75	-0.74	1.00	-0.62	0.71	0.90	-0.65	0.33	0.96	0.97	
DET Pop Correl (OE)	0.85	0.13	0.74	-0.90	-0.80	1.00	-0.90	-0.89	0.72	-0.42	0.88	0.78	-0.84	0.23	0.94	0.90	
DET Pop Correl (UN)	0.42	-0.74	-0.52	0.91	0.88	-0.89	0.92	1.00	-0.20	0.46	-0.51	0.69	0.63	-0.19	0.28	0.31	

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Correlation Analysis Table – Critical Indicators: Guangzhou and Shanghai, China (Note: Correlations of +/- 0.70 are strongly correlated)

	Governance - Modes of Governance & Meta-Governance > Governance - Leadership & Vision						Economic - Key Economic Drivers												
Sector & Category:	Governance - Leadership & Vision	Governance - Leadership & Vision	Governance - Leadership & Vision	Governance - Leadership & Vision	Governance - Leadership & Vision	Governance - Fiscal Management	Economic - Key Economic Drivers	Economic - Forms of Capital	Economic - Workforce	Economic - Key Economic Drivers	Economic - Forms of Capital	Economic - Workforce	Economic - Key Economic Drivers	Economic - Economic Competitiveness	Economic - Investment & Business Climate	Economic - Investment & Business Climate	Economic - Investment & Business Climate	Economic - Investment & Business Climate	
Scale:	Country	Country	Country	Country	Country	Country	City - SHANGHAI	City - SHANGHAI	City - SHANGHAI	City - GUANGZHOU	City - GUANGZHOU	City - GUANGZHOU	Country	Country	City - SHANGHAI	City - GUANGZHOU	Country	City - SHANGHAI	City - GUANGZHOU
Source:	World Bank (WDI)	United Nations (WHS) & World Bank (WDI)	UNESCO (Institute of Statistics) & World Bank (WDI)	World Bank (WDI)	OECD (Factbook Crime)	World Bank (WDI) & IMF (WEO)	Oxford Economics	Oxford Economics	Oxford Economics	Oxford Economics	Oxford Economics	Oxford Economics	IMF (WEO)	World Bank (WDI)	Oxford Economics & CBRE	Oxford Economics & CBRE	IMF (WEO)	Globalisation and World Cities	Globalisation and World Cities
1950-2013	Claims on Central Government, etc (% of GDP)	Health Expenditure, Total (% of GDP)	Public Spending on Education, Total (% of GDP)	Military Expenditure (% of GDP)	Prison Population Rate (No. per 100,000)	Current Account Balance (% GDP)	SHANGHAI GDP (million \$2005)	SHANGHAI Household disposable income (million \$2005)	SHANGHAI Employment	GUANGZHOU GDP (million \$2005)	GUANGZHOU Household disposable income (million \$2005)	GUANGZHOU Employment	Inflation - CPI Prices (Annual %)	Research & Development Expenditure (% GDP)	Shanghai Revenue Multiplier (GDP per Capita / Total Office Occupancy Costs)	Guangzhou Revenue Multiplier (GDP per Capita / Total Office Occupancy Costs)	Total Investment (% GDP)	Global Network Connectivity (GNC Proportionate Connectivity, 1.00=London) SHA	Global Network Connectivity (GNC Proportionate Connectivity, 1.00=London) GUA
GUAGDP Correl	0.58	0.72	0.75	0.56	0.71	0.27	1.00	1.00	0.89	1.00	0.99	0.98	-0.06	0.97	-0.63	-0.83	0.86	0.96	0.93
GUAPop Correl (OE)	0.49	0.70	0.67	0.46	0.64	0.16	0.99	0.98	0.88	0.99	0.99	0.97	0.25	0.92	-0.36	-0.65	0.89	0.99	0.98
GUAPop Correl (UN)	0.83	0.85	0.07	-0.30	0.85	0.63	0.94	1.00	0.78	0.95	0.97	0.99	-0.55	0.99	-0.65	-0.83	0.38	0.91	0.88
SHAGDP Correl	0.82	0.72	-0.40	-0.15	0.73	0.57	1.00	1.00	0.90	1.00	0.98	0.99	-0.40	0.97	-0.63	-0.82	0.50	0.95	0.93
SHAPop Correl (OE)	0.87	0.74	-0.47	-0.14	0.77	0.62	0.99	0.99	0.90	0.98	0.96	1.00	-0.44	0.98	-0.57	-0.78	0.46	0.92	0.89
SHAPop Correl (UN)	0.82	0.83	0.06	-0.29	0.83	0.63	0.96	1.00	0.81	0.97	0.98	0.99	-0.52	0.99	-0.65	-0.83	0.40	0.92	0.89

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Correlation Analysis Table – Critical Indicators: Guangzhou and Shanghai, China (Note: Correlations of +/- 0.70 are strongly correlated) continued...

Sector & Category:	Social - Urban Concepts	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Health & Education	Environment - Urban Environment	Environment - Urban Environment	Environment - Urban Environment	Environment - Transportation	Environment - Water & Energy	Environment - Pollution
Scale:	Country	City - GUANGZHOU	City - SHANGHAI	Country - Urban	City - SHANGHAI	City - GUANGZHOU	City - SHANGHAI	City - GUANGZHOU, Guangdong	Country	Country	Country	City - SHANGHAI (Pudong)	City - GUANGZHOU	Country	Country	Country
Source:	World Bank (WDI)	Demographia	Demographia	World Bank (WDI) & United Nations (WUP)	Oxford Economics	Oxford Economics	United Nations (WUP)	United Nations (WUP)	United Nations (World Population Prospects)	World Bank (WDI)	World Bank (WDI)	CBRE (GMV OOC)	CBRE (GMV OOC)	World Bank (WDI)	World Bank (WDI)	World Bank (WDI)
1950-2013	Net Migration (Number of People)	Population Density (People per sq. km) GUA	Population Density (People per sq. km) SHA	Urban Population i.e Rate of Urbanisation (% of Total Population)	City Pop SHA	City Pop GUA	Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011 (Number of People) SHA	Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011 (Number of People) GUA	Total Dependency Ratio	Completed Tertiary Educational Attainment, 15+ years (% Total Population)	Hospital Beds (per 1,000 people)	Total Office Occupancy Costs (Current US\$ per Sqft pa) SHA	Total Office Occupancy Costs (Current US\$ per Sqft pa) GUA	Motor Vehicles (per 1,000 people)	Energy Use (KG of Oil Equivalent per Capita)	CO2 Emissions (Metric Tons per Capita)
GUA GDP Correl	-0.71	-0.48	-0.55	0.98	0.98	0.99	0.97	0.95	-0.99	1.00	0.79	0.85	0.89	0.99	0.99	0.97
GUA Pop Correl (OE)	-0.42	-0.53	-0.60	0.96	0.97	1.00	0.95	0.94	-0.97	0.98	0.84	0.64	0.74	0.99	0.95	0.93
GUA Pop Correl (UN)	-0.76	-0.50	-0.57	0.99	0.97	0.94	0.99	1.00	-0.90	0.99	0.75	0.87	0.89	0.98	0.95	0.94
SHA GDP Correl	-0.86	-0.53	-0.60	0.96	0.99	0.99	0.96	0.94	-0.87	0.99	0.76	0.85	0.88	0.98	0.99	0.98
SHA Pop Correl (OE)	-0.88	-0.55	-0.62	0.99	1.00	0.97	0.98	0.97	-0.92	1.00	0.72	0.81	0.86	0.98	0.99	0.98
SHA Pop Correl (UN)	-0.75	-0.50	-0.57	0.98	0.98	0.95	1.00	0.99	-0.87	0.99	0.74	0.86	0.89	0.98	0.96	0.93

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Correlation Analyses Table – Critical Indicators: Bangalore, India (Note: Correlations of +/- 0.70 are strongly correlated)

Sector & Category:	Governance - Modes of Governance & Meta-Governance > Capacity	Governance - Leadership & Vision	Governance - Leadership & Vision	Governance - Leadership & Vision	Governance - Leadership & Vision	Governance - Fiscal Management	Economic - Key Drivers	Economic - Forms of Capital City - BANGALORE	Economic - Workforce City - BANGALORE	Economic - Key Drivers	Economic - Competitiveness	Economic - Investment & Business Climate City - BANGALORE	Economic - Investment & Business Climate	Economic - Investment & Business Climate City - BANGALORE
Scale:	Country	Country	Country	Country	Country	Country	Country	Country	Country	Country	Country	Country	Country	Country
Source:	World Bank (WDI)	United Nations (WHS) & World Bank (WDI)	UNESCO (Institute of Statistics) & World Bank (WDI)	World Bank (WDI)	OECD (Factbook - Crime)	World Bank (WDI) & IMF (WEO)	Oxford Economics	Oxford Economics	Oxford Economics	World Bank (WDI) & IMF (WEO)	World Bank (WDI)	Oxford Economics & CBRE	IMF (WEO)	Globalisation and World Cities
1950-2013	Claims on Central Government, etc (% of GDP)	Health Expenditure, Total (% of GDP)	Public Spending on Education, Total (% of GDP)	Military Expenditure (% of GDP)	Prison Population Rate (No. per 100,000)	Current Account Balance (% GDP)	BANGALORE (STATE OF KARNATAKA) GDP (million \$2005)	BANGALORE (STATE OF KARNATAKA) Household disposable income (million \$2005)	BANGALORE (STATE OF KARNATAKA) Employment	Inflation - CPI Prices (Annual %)	Research & Development Expenditure (% GDP)	Bangalore Revenue Multiplier (GDP per Capita / Total Office Occupancy Costs)	Total Investment (% GDP)	Global Network Connectivity (GNC Proportionate Connectivity, 1.00=London) BAN
BANG GDP Correl	-0.04	-0.91	-0.58	-0.55	0.98	-0.91	1.00	1.00	0.82	0.91	0.66	0.74	0.79	0.97
BANG Pop Correl (OE)	0.10	-0.39	-0.35	-0.12	0.96	-0.55	0.99	0.98	0.89	0.12	0.85	0.83	0.84	0.85
BANG Pop Correl (UN)	0.73	-0.47	-0.37	-0.53	0.97	-0.25	0.99	0.99	0.84	0.04	0.82	0.80	0.90	0.88

DOCTORAL THESIS:

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

MICHELLE LEONG GLASTRIS

Correlation Analyses Table – Critical Indicators: Bangalore, India (Note: Correlations of +/- 0.70 are strongly correlated) continued...

Sector & Category:		Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Socio-Demographic Trends	Social - Health & Education	Environment - Urban Environment	Environment - Urban Environment	Environment - Transportation	Environment - Water & Energy	Environment - Pollution
Scale:	Country	City - BANGALORE	Country - Urban	City - BANGALORE	City - BANGALORE	Country	Country	Country	City - BANGALORE	Country	Country	Country
Source:	World Bank (WDI)	Demographia	World Bank (WDI) & United Nations (WUP)	Oxford Economics	United Nations (WUP) Population of Urban Agglomerations with 750,000 Inhabitants or More in 2011 (Number of People) BAN	United Nations (World Population Prospects)	World Bank (WDI)	World Bank (WDI)	CBRE (GMV OOC)	World Bank (WDI)	World Bank (WDI)	World Bank (WDI)
1950-2013	Net Migration (Number of People)	Population Density (People per sq. km) BAN	Urban Population i.e Rate of Urbanisation (% of Total Population)	City Pop Bangalore (State of Karnataka)		Total Dependency Ratio	Completed Tertiary Educational Attainment, 15+ years (% Total Population)	Hospital Beds (per 1,000 people)	Total Office Occupancy Costs (Current US\$ per Sqft pa) BAN	Motor Vehicles (per 1,000 people)	Energy Use (KG of Oil Equivalent per Capita)	CO2 Emissions (Metric Tons per Capita)
BANG GDP Correl	-0.97	0.37	0.76	0.99	0.99	-0.99	0.88	0.62	0.10	0.99	0.99	0.96
BANG Pop Correl (OE)	-0.98	0.35	0.78	1.00	0.99	-1.00	0.83	0.75	-0.06	1.00	0.96	0.94
BANG Pop Correl (UN)	-0.76	0.41	0.97	0.99	1.00	-0.84	0.96	0.78	-0.01	1.00	0.99	0.99

10.5 Appendix 5: Key Cities Overview

- Bangalore
- Guangzhou
- Shanghai
- Sydney
- Detroit
- New York

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

MICHELLE LEONG GLASTRIS

City Structure Overview: Bangalore (Bengaluru)	
Indicative Development Stage: Early Emerging	
Location: Capital city of the state of Karnataka, India Coordinates: 12°58'N, 77°35'E	
Key Highlights:	Comments:
Key Factors Contributing to City Structure Development Trends:	- Established in 1537 (Approximate age 476 years) – Chieftain Kempe Gowda I built a mud fort and established it as a province of the Vijayanagara Empire. - Bangalore fort captured by British armies in 1791 during the Third Anglo-Mysore War. The British moved their cantonment to Bangalore (1809) where a town grew around the cantonment absorbing several villages and administered municipal and administrative functions. - Two importance developments contributed to the rapid growth of the city – introduction of telegraph connections to all major Indian cities in 1853 and a rail connection to Madras in 1864. - Previously known as the “Garden City” in 1927 where civic improvements were implemented e.g. construction of parks, public buildings and hospitals. - Became an investment location for large scale manufacturing and industry firms in the early 20th century. - In order to support these industries, the infrastructure and a strong labour pool of skilled engineers was developed to ultimately form the genesis for the IT sector in the 1970s. Widely considered as the “Silicon Valley of India” with a strong export-oriented IT sector. 1941-1951 and 1971-1981 recorded rapid population growth where many of the immigrant influx came from northern Karnataka. 1980s and 1990s experienced a real estate boom resulting from investors redeveloping Bangalore's large plots and colonial bungalows into multi-storied apartments. 1986 – Bangalore Metropolitan Region Development Authority established to co-ordinate development of the entire region.
Major Macro Events and City Specific Events post 1950 (Earliest commencement of datasets):	1947 India's Independence 1958 Worldwide Economic Recession 1962 Indo China War 1947, 1965, 1971 and 1999 – Indo Pakistani War 1973-74, 1979 and 2003-08 - Oil Crises 1990-1991 Gulf War and 2003-2011 Iraq War 1997-1998 Asian Financial Crisis 2001-Present Global War on Terrorism 2007-2009 Global Financial Crisis (GFC) 2008, 2010 and 2013 – Bangalore terrorist attacks.

City Structure Overview: **Bangalore (Bengaluru)** continued...

Key Highlights:	Comments:
Impact of Recent Government Planning and Investment/Economic Policies & Decisions:	• Provided a range of proactive neo-liberal national and local policies and initiatives to enable Bangalore to develop as a globally competitive IT cluster e.g. financial incentives for firms; targeted education and training used build a skilled labour market tailored to the needs of Bangalore firms; provision of land, buildings and infrastructure for potential investors; investment in research and development programmes; and actively encouraging linkages between firms within the sector. • Karnataka state pioneered a comprehensive IT policy, worked cooperatively with city planners and the private sector to develop several industrial parks serviced by high tech infrastructure & actively promoted Bangalore to attract foreign investment (Saxenian 2006).
Primary Industry Clusters:	• Considered a “<i>paradigmatic cluster: ‘a system of interconnected firms and institutions whose whole is more than the sum of its parts’ (Porter 2000: 21)” (Beall & Fox 2009: 81).</i> • IT and Software – IBM, Texas Instruments (first multinational firm to locate a base in Bangalore in 1985), Infosys Technologies, Wipro, Tata Consultancy Services. Bangalore’s IT industry divided into three main clusters – Software Technology Parks of India; International Tech Park Bangalore; and Electronics City. • Aeronautical and Aerospace – National Aerospace Laboratories, Indian Space Research Organisation. • Biotechnology - Biocon • Electrical and Electronics – Bharat Electronics Limited, Bharat Heavy Electricals. • Manufacturing – United Breweries Group, Motor Industries Company, Bharat Earth Movers, HMT (formerly Hindustan Machine Tools). • Research and Development Centres – ABB, Airbus, Bosch, Boeing, General Electric, General Motors, Google, Microsoft, Mercedes-Benz, Nokia, Oracle, Philips, Shell, Toyota, etc. • Customer Assistance Centres- General Electric and British Airways. • Financial Research and Data Operations – Reuters (processes financial data and produces corporate earnings reports and broker research). • Tertiary Education – Includes Bangalore University(1886); University of Visvesvaraya College of Engineering (1917) and associated private engineering colleges affiliated with Visvesvaraya Technological University; Indian Institute of Science (1909); national Centre for Biological Sciences; University of Agricultural Sciences Bangalore; Institute of Bio-informatics and Applied Biotechnology, National Institute of Design, National Law School of India University, Indian Institute of Management Bangalore, India National Institute of Mental Health and Neuro Sciences; St John’s Medical College; Bangalore Medical College and M.P. Birla Institute of Fundamental Research. • Hospitals – There are around 5 teaching hospitals and 167 private hospitals in Bangalore. The top 10 private hospitals are Fortis Hospital, Manipal Hospitals, Nimhans, Narayana Hrudayalaya, Hosmat Hospital, Columbia Asia, Sagar Hospitals, Vikram Hospital, Greenview Medical Centre, Bangalore Hospital and Mallya Hospital.

City Structure Overview: Bangalore (Bengaluru) continued...

Key Highlights:	Comments:
Network Interactions:	• Significant relationships and synergies have developed between industry and the educational institutions with regard to providing the requisite education and skills training and research initiatives often funded by local offices of transnational firms e.g. Texas Instruments. • Consequently “<i>these proactive policies, effective coordination and cooperative linkages between firms and educational institutes</i>” have further reinforced Bangalore’s top IT sector ranking within India (Beall & Fox 2009: 81).
Other Considerations:	• GaWC classify Bangalore as a <i>Beta+</i> city with a <i>Global Network Proportionate Connectivity Score</i> of 0.36 (1.00=London) and the World Economic Forum classify India as a <i>Stage 1 Factor Driven Economy</i>. • Bangalore has successfully developed a conducive investment climate – entrepreneurial spirit, deep and highly skilled, comparatively low wage labour markets and government flexibility to attract venture capital investment. • Bangalore is able to capitalise on the 12.5 hour time difference between Silicon Valley when bidding for outsourcing contracts which enable offshore maintenance and re-engineering to occur once American customers finish work for the day. • Significant wealth inequality/disparity between Bangalore’s circa 8M computer engineers versus the rest of the city’s inhabitants living without basic services (e.g. electricity, roads and water) – it is estimated more than 40% of Bangalore’s population live in slums (Kim & Short 2008). • Key issue with lagging transportation system and other public infrastructure which is not keeping up with private investment and Bangalore’s population growth – whilst Bangalore is building the Namma Metro, a rapid transit system to improve transportability, there have been extensive project delays and additional budget costs (Wikipedia 2013r). There is still expected to be a shortfall in providing sufficient transport accessibility and this potentially compromises Bangalore’s competitive ability to attract new or maintain existing international firms compared to more attractive, better serviced emerging IT centres across India. • Potential to capitalise on Indian engineers who leave India to work for American firms in Silicon Valley and later return to Bangalore to establish IT service businesses and networks, transfer their knowledge on leading edge technologies, acting as business conduits and developing transnational networks between Bangalore and Silicon Valley. If the Indian government can prudently incentivise these professionals to return and channel their knowledge as policy advisors, investors, entrepreneurs and managers, this would enable Bangalore to transition to the next stage of evolution.

Sources: (Bangalorebest.com 2013; Beall & Fox 2009a; Brunn, Williams & Zeigler 2003; CEIC Data Manager 2012b; Dupont 2007; Ghose 2011; Globalization and World Cities (GaWC) Research Network 2010; Kim & Short 2008; Saxenian 2006; Shome 2012; Singhal, McGreal & Berry 2012; Taylor et al. 2011; Wikipedia 2013b, 2013r, 2013}; World Economic Forum 2013)

City Structure Overview: Guangzhou (formerly Canton)	
Indicative Development Stage: Emerging	
Location: Capital city of Guangdong province, China Coordinates: 23°7'N, 113°15'E	
Key Highlights:	Comments:
Key Factors Contributing to City Structure Development Trends:	• General Note: In China, the 1790s was regarded as an “age of prosperity” for the Qing Dynasty (1644-1911AD). However in the 19th century, efforts were focussed on redressing national ignominy after the Chinese were defeated in the Opium Wars (1840-42 and 1856-58) and tried to restore China’s wealth, strength and respect. By the 20th century, it was recognised that more far-reaching, radical approaches were required i.e. questioning the traditional culture s based on Confucian values. The New Culture Movement represented a “<i>cultural and intellectual uprising...calling for a wholesale repudiation of China’s past and a new regime of even more extensive borrowing</i>” which led to experimenting and borrowing ideas and systems from the West (Schell & Delury 2013: 8). This resulted in a piecemeal or fragmented policy approach and in adopting foreign models and their inherent problems and China oscillated between an attraction and a repulsion for its culture. This detracted from China’s ability to develop its national identity and its unique cultural traditions. Ultimately whilst Mao Zedong destroyed the “<i>old core of Chinese identity</i>”, it may have also paved the way for a “<i>spectacular new kind of economic growth under his successor, Deng Xiaoping</i>” (Schell & Delury 2013: 9). This was particularly the case for Deng’s economic reform “<i>Reform and Opening Up</i>” which was implemented in December 1978 and constituted a strategic transformation where China’s economy has grown rapidly over the past three decades. • Established as Panyu and operated as a city from 206BC (Approximate age 2,219 years) when it became the capital of the Nanyue Kingdom during the Qin Dynasty (211-206BC). • During the Qing Dynasty (1644-1911AD), Guangzhou was regarded as one of the four metropolises and was the China’s primary exporting port. When foreign trade reopened in 1683AD, Guangzhou & Shanghai were two of the four designated ports and in 1757-1842 AD in the single port of Guangzhou there was significant trading activity with Europe which made it one of the world’s great trading ports. • When the Communist forces took over the city in 1949, there was a mass exodus of Guangzhou inhabitants to Hong Kong and Macau and Guangzhou’s ranking as an international city fell. • Economic reforms introduced by Deng Xiaoping led to increasing economic growth due to Guangzhou’s location to nearby Hong Kong and the Pearl River. • With increasing labour costs in Hong Kong, manufacturers began to open plants in Guangzhou. • With a significant increase in foreign investment, Guangzhou is the key manufacturing hub on Pearl River Delta where 34 out of China’s total 40 industrial manufacturing sectors are located in Guangzhou.

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

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City Structure Overview: Guangzhou (formerly Canton) continued...

Key Highlights:	Comments:
Major Macro Events and City Specific Events post 1950 (Earliest commencement of datasets):	• 1949 Mao Zedong proclaims founding of People's Republic of China • 1966-1976 Cultural Revolution • 1978 Deng Xiaoping becomes leader and his economic reforms result in significant economic growth. • 1958 Worldwide Economic Recession • 1962 Indo China War • 1973-74, 1979 and 2003-08 - Oil Crises • 1990-1991 Gulf War and 2003-2011 Iraq War • 1997-1998 Asian Financial Crisis • 1989 Democracy movement suppressed in Tiananmen Square • 2000 Huadu and Panyu districts merged into Guangzhou and Conghua and Zengcheng became county level cities of Guangzhou. • 2001-Present Global War on Terrorism • 2007-2009 Global Financial Crisis (GFC) • 2010 – Guangzhou hosts Asian Games.
Impact of Recent Government Planning and Investment/Economic Policies & Decisions:	• Twelfth Five Year Plan (2011-2015) identifies future urban development will be built around five “national central cities” (Guangzhou, Shanghai, Beijing, Tianjin and Chongqing) and six “regional central cities” (Shenzhen, Nanjing, Wuhan, Shenyang, Chengdu and Xi'an). Twenty designated centres were also identified for future urban development. The aim is to generate clusters of cities around megacities in order to maximise labour market and infrastructure efficiencies: “<i>The idea is to form networks within each cluster, thereby creating a larger labour pool and preventing duplication of infrastructure</i>” (Miller 2012: 98). • Twelfth Five Year Plan (2011-2015) also identifies seven priority industries: 1) New Energy (nuclear, wind and solar power); 2) Energy Conservation and Environmental Protection (energy reduction targets); 3) Biotechnology (pharmaceuticals and medical devices); 4) New materials (rare earths and high-end semiconductors); 5) New IT (broadband networks, internet security infrastructure, network convergence); 6) High-end Equipment Manufacturing (aerospace and telecom equipment); 7) Clean Energy Vehicles (KPMG 2011). This has implications for Guangzhou which has industrial zones which specialise in some of these areas. • Land Reform post 1998 “<i>emphasised tightening land supply and building a transparent market for land use right transfers</i>” (Hu 2013). However the Property Law passed in 2007 intended to cover “<i>the creation, transfer and ownership of property</i>” has generated market and investment uncertainty – in particular where land parcels are held leasehold and have limited tenure “<i>seventy years for residential use; fifty years for industrial, educational, science and technology, cultural, public health, or mixed use; forty years for commercial, tourism and entertainment use</i>” (Hu 2013). Currently the Property Law regarding renewal of leasehold arrangements for land used for non-residential purposes lacks regulatory transparency, this in turn undermines the confidence of building owners and their tenants, developers and investors. One example of this lack of confidence - it was recently reported in Bloomberg News that over a dozen Chinese developers/investors were seeking greater investment certainty (in spite of lower returns) by investing billions overseas in more mature, stable markets such as Brooklyn, New York, Los Angeles, Sydney and the UK (Brandt, Carmiel & Levy 2013). • Wong and Zhao (1999) make the distinction between the “<i>formal</i>” process of land transfer, which begins with an application by a prospective land users and requires three levels of approval and the “<i>informal</i>” process, which is what happens in a majority of cases” (Friedmann 2005: 106). The concern lies with developers, investors and

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

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Key Highlights:	Comments:
Impact of Recent Government Planning and Investment/Economic Policies & Decisions:	speculators purchasing land use rights to either trade in the secondary market or to enable them to quickly build a development to make a fast/speculative profit. Both potentially artificially bids up the market value of the land without due regard to delivering new supply in line with market demand and net absorption levels. • In January 2009, the National People's Congress approved a development plan for the Pearl River Delta Region and in March 2009, Guangzhou Municipal Government and Foshan Municipal Government agreed to establish a framework to merge the two cities.
Primary Industry Clusters:	• Guangzhou is divided into four separate state level industrial development zones based on industrial and economic activity under a single administrative committee: 1) Guangzhou High Tech Industrial Development Zone; 2) Guangzhou Export Processing Zone (2005); 3) Guangzhou Economic and Technological Development Zone (2005); 4) Guangzhou Free Trade Zone (1992). • Guangzhou Software Development Park (1999) specialises in software development and system integration. It houses over 629 enterprises and over 16,000 employees. • Guangzhou tends to specialise in the automotive, banking and finance and manufacturing sectors which include electronics and electrical equipment; IT; petrochemical; transportation and logistics; biomedicine; pharmaceuticals; textiles and fabrics. • Petrochemicals – Exxon Mobil, BHP, BP and Royal Dutch/Shell Group. • Automotive and Auto Parts– Toyota Motor, Mitsubishi Motors, Volkswagen, Honda Motor, Nissan Motor, Delphi Automotive Systems, Peugeot, Yamaha, Isuzu Motors, Allied Signal and Bridgestone. • IT , Software, Communications & Navigation – Unisys & Guangzhou Haige Communications Group. • Aeronautical and Aerospace – United Technologies, Air France Group and Allied Signal. • Electrical and Electronics – Siemens, Matsushita Electric Industrial, Mitsubishi Electric, BASF, Royal Philips Electronics, LG, L.M. Ericsson, Motorola, Sumitomo Electric Industries, NEC, Toshiba, Samsung, Solectron Corporation, Sanyo Electric, Xerox, Eastman Kodak, Casio and Sony. • Pharmaceuticals, Chemicals and related Consumer Products – Glaxo Smith Kline, Bayer, Proctor Gamble, Dow Chemical, Mitsubishi Chemical, ICI, Colgate, Kimberly-Clark, Avon, Owens Corning, Philip Morris, Air Products and Reckitt Colman. • Food and Beverage Manufacturing – Coca-Cola, PepsiCo, McDonalds, Carrefour, Kelloggs, Nestle, Suntory, Group Danone, Quaker and Guangzhou Tech-Long Packaging Machinery Co. • Banking, Finance & Insurance– AXA, Deutsche Bank, BNP Paribas, Mitsui, Sumitomo Bank, Societe Generale, American International Group, Bank of America, HSBC Holdings, . • Tertiary Education – There are around 20 universities and colleges in Guangzhou. Some of these universities and their specialities include: South China University of Technology (Engineering); Sun Yat-Sen University (1924: IT, Chemical and Pharmaceuticals, Political Science and Law, Economics and Business Management); Guangdong University of Technology (IT); Guangdong University of Foreign Studies (Foreign Languages); Southern Medical University (1951: Medicine); Guangdong Pharmaceutical University (Pharmaceuticals) and Guangzhou University of Chinese Medicine (Chinese Medicine). • Hospitals – There are around 5 teaching hospitals (The First Affiliated Hospital, Guangzhou University Hospital, Nanfang Hospital, Zhongshan Ophthalmic Hospital and Guangdong Provincial Hospital) and 20 international hospitals and clinics in Guangzhou.

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

MICHELLE LEONG GLASTRIS

City Structure Overview: Guangzhou (formerly Canton) continued...

Key Highlights:	Comments:
Network Interactions:	- Given the incredibly diverse range of industry clusters and the housing of a large number of multinational/Fortune 500 companies, significant relationships, innovation and production synergies have developed both within and between different cluster groups. Given some of these clusters have a sizeable critical mass, the scales of production/economies of scale provides significant momentum in the manufacturing and professional services arena. - There are also considerable synergies between the private sector and the universities and colleges which provide a stream of highly educated graduates as the new recruits in the labour market.
Other Considerations:	GaWC classify Guangzhou as a <i>Beta city</i> with a <i>Global Network Proportionate Connectivity Score</i> of 0.32 (1.00=London) and the World Economic Forum classify China as a <i>Stage 2 Efficiency Driven Economy</i>. - Guangzhou has successfully established itself as a one of mainland China's leading commercial and manufacturing regions. - Fortunately Guangzhou is well placed as China moves towards creating higher value-added products and services especially given the competitive, innovative and entrepreneurial nature of many of these multinational/Fortune 500 companies. - However in trying to redress the wealth inequality as set out in the Twelfth Five Year Plan, it is expected that rising income growth will spur an increase in minimum wages particularly in coastal locations. This is estimated by some to rise by more than 13% pa (KPMG 2011). This will place upward pressure operating costs for manufacturers and professional service firms and impact profit margins. This could potentially force some companies to either consolidate operations or re-locate to another city (either to China's inland regions or to another country) that offers lower wages/operating costs, better investment certainty and incentives and improved regulatory transparency. - There are also environmental trade-offs associated with Guangzhou's high level of manufacturing activity. Key concern over Guangzhou's air pollution levels where it was reported by the World Health Organisation that whilst Beijing had four times the concentration of sulphur dioxide as London, Guangzhou in fact had seventeen times the amount of sulphur dioxide as London (Beall & Fox 2009a). This extraordinarily high level of air pollution manifests itself in the city being frequently so thickly immersed in smog that air flights have been cancelled/re-scheduled and also in a wide range of major health problems (e.g. respiratory ailments, cancers) and increased mortality rates. It is anticipated that in line with the Twelfth Five Year Plan, that the 3.5% reduction in carbon dioxide emissions and the 3.5% reduction in energy use will be swiftly realised in Guangzhou and other industrial manufacturing intensive cities/regions (KPMG 2011).

Sources: (Beall & Fox 2009a; Brandt, Carmiel & Levy 2013; Brunn, Williams & Zeigler 2003; CEIC Data Manager 2012a; China Briefing 2012; Douglass 2000, 2001; Excel Guangzhou 2013; Friedmann 2005; Fung & Peng 2011; Globalization and World Cities (GaWC) Research Network 2010; Hu 2013; Invest Guangzhou 2013; Jiang & Shen 2010; KPMG 2011; Lin 2002; Miller 2012; Schell & Delury 2013; Sit 2010; Taylor et al. 2011; Thompson & Lane 2010; Wikipedia 2012b, 2013c, 2013i, 2013l; World Bank 2013c; Xu & Yeh 2003; Yeung 2011; Zhao, Chan & Sit 2003).

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

MICHELLE LEONG GLASTRIS

City Structure Overview: **Shanghai**

Indicative Development Stage: Obsolescence – Re-Growth

Location: Capital city of provincial level municipality Shanghai, China

Coordinates: 31°13'N, 121°28'E

Key Highlights:	Comments:
Key Factors Contributing to City Structure Development Trends:	• General Note: In China, the 1790s was regarded as an “age of prosperity” for the Qing Dynasty (1644-1911AD). However in the 19th century, efforts were focussed on redressing national ignominy after the Chinese were defeated in the Opium Wars (1840-42 and 1856-58) and tried to restore China’s wealth, strength and respect. By the 20th century, it was recognised that more far-reaching, radical approaches were required i.e. questioning the traditional culture s based on Confucian values. The New Culture Movement represented a “<i>cultural and intellectual uprising...calling for a wholesale repudiation of China’s past and a new regime of even more extensive borrowing</i>” which led to experimenting and borrowing ideas and systems from the West (Schell & Delury 2013: 8). This resulted in a piecemeal or fragmented policy approach and in adopting foreign models and their inherent problems and China oscillated between an attraction and a repulsion for its culture. This detracted from China’s ability to develop its national identity and its unique cultural traditions. Ultimately whilst Mao Zedong destroyed the “<i>old core of Chinese identity</i>”, it may have also paved the way for a “<i>spectacular new kind of economic growth under his successor, Deng Xiaoping</i>” (Schell & Delury 2013: 9). This was particularly the case for Deng’s economic reform “<i>Reform and Opening Up</i>” which was implemented in December 1978 and constituted a strategic transformation where China’s economy has grown rapidly over the past three decades. • Shanghai began operating as a city from 1074AD (Approximate age 939 years) but was only politically recognised as a City in 1927. • During the Qing Dynasty (1644-1911AD), when foreign trade reopened in 1683AD, Guangzhou & Shanghai were two of the four designated ports. By 1735, Shanghai became the major trade port for the lower Yangtze River area and grew in international status when the British occupied the city after the First opium War and through the 1842 Treaty of Nanjing was included as a treaty port for international trade. By 1857, when foreign powers obtained navigation right on the Yangtze, Shanghai overtook Guangzhou as China’s leading port for foreign trade. • British, French and American envoys carved out concession in order to establish visitation and trading rights. In 1854 in order to manage the foreign settlements, the Shanghai Municipal Council was formed. To the present day these sections are still known as the French Concession and the International Settlement which housed the British and American Concessions. As Shanghai opened up to international trade and financial activity and emerging modern industries, the trading networks and exchange of information allowed Chinese merchants to quickly adopt Western business practices and transfer the knowledge across other parts of the city. • After the First Sino-Japanese War (1894-1895), the Treaty of Shimonoseki allowed Japan to build the first factories in Shanghai which sparked other foreign industrial construction. In the Second Sino-Japanese War (1937-1945), after the battle of Shanghai, the Japanese occupied parts of Shanghai until Japan’s surrender at the conclusion of World War II. • After the Communist forces took over the city (1949), many foreign firms relocated to Hong Kong as part of a foreign divestment in response to Communist control. During the 1950s and 1960s, Shanghai’s key economic focus was as an industrial centre. • Economic reforms introduced by Deng Xiaoping and implemented by Premier Zhu Rongji, then the Mayor of Shanghai. In order to transform Shanghai Zhu “<i>adopted the bold, visionary thinking of a venture capitalist who looked on Shanghai as a giant start-up opportunity</i>” and in order to attract Foreign Direct Investment (FDI)

City Structure Overview: **Shanghai continued...**

Key Highlights:	Comments:
Key Factors Contributing to City Structure Development Trends continued...	established the Shanghai Foreign Investment Commission “<i>with unprecedented authority to streamline the approval process for foreign investment</i>” and therefore bypassed long processing times and the need to bribe officials/bureaucrats (Schell & Delury 2013: 329-330). • With a significant increase in FDI, new market reforms and an open approach to improving Shanghai’s economic wealth, Zhu was able to successfully position Shanghai for China’s remarkable economic growth over the ensuing decades. • It was reported that over “<i>half of the world’s top 500 transnational corporations and 57 of the largest industrial enterprises in the world have set up shop in Shanghai, contributing to an annual regional growth rate of over 20 per cent – more than twice the national average</i>” (Beall & Fox 2009: 90).
Major Macro Events and City Specific Events post 1950 (Earliest commencement of datasets):	• 1949 Mao Zedong proclaims founding of People’s Republic of China and foreign divestment ensues in Shanghai. • 1966-1976 Cultural Revolution • 1978 Deng Xiaoping becomes leader and his economic reforms result in significant economic growth. • 1958 Worldwide Economic Recession • 1962 Indo China War • 1973-74, 1979 and 2003-08 - Oil Crises • 1988 Zhu Rongji is appointed as Mayor of Shanghai and implements a series of new market reforms for the city including the attraction of Foreign Direct Investment. • 1990-1991 Gulf War and 2003-2011 Iraq War • 1997-1998 Asian Financial Crisis • 1989 Democracy movement suppressed in Tiananmen Square • 2001-Present Global War on Terrorism • 2007-2009 Global Financial Crisis (GFC) • 2010 – Shanghai hosts 2010 World Expo.

City Structure Overview: **Shanghai continued...**

Key Highlights:	Comments:
Impact of Recent Government Planning and Investment/Economic Policies & Decisions:	• Twelfth Five Year Plan (2011-2015) identifies future urban development will be built around five “national central cities” (Guangzhou, Shanghai, Beijing, Tianjin and Chongqing) and six “regional central cities” (Shenzhen, Nanjing, Wuhan, Shenyang, Chengdu and Xi'an). Twenty designated centres were also identified for future urban development. The aim is to generate clusters of cities around megacities in order to maximise labour market and infrastructure efficiencies: “<i>The idea is to form networks within each cluster, thereby creating a larger labour pool and preventing duplication of infrastructure</i>” (Miller 2012: 98). • Twelfth Five Year Plan (2011-2015) also identifies seven priority industries: 1) New Energy (nuclear, wind and solar power); 2) Energy Conservation and Environmental Protection (energy reduction targets); 3) Biotechnology (pharmaceuticals and medical devices); 4) New materials (rare earths and high-end semiconductors); 5) New IT (broadband networks, internet security infrastructure, network convergence); 6) High-end Equipment Manufacturing (aerospace and telecom equipment); 7) Clean Energy Vehicles (KPMG 2011). This has implications for Guangzhou which has industrial zones which specialise in some of these areas. • Land Reform post 1998 “<i>emphasised tightening land supply and building a transparent market for land use right transfers</i>” (Hu 2013). However the Property Law passed in 2007 intended to cover “<i>the creation, transfer and ownership of property</i>” has generated market and investment uncertainty – in particular where land parcels are held leasehold and have limited tenure “<i>seventy years for residential use; fifty years for industrial, educational, science and technology, cultural, public health, or mixed use; forty years for commercial, tourism and entertainment use</i>” (Hu 2013). Currently the Property Law regarding renewal of leasehold arrangements for land used for non-residential purposes lacks regulatory transparency, this in turn undermines the confidence of building owners and their tenants, developers and investors. One example of this lack of confidence - it was recently reported in Bloomberg News that over a dozen Chinese developers/investors were seeking greater investment certainty (in spite of lower returns) by investing billions overseas in more mature, stable markets such as Brooklyn, New York, Los Angeles, Sydney and the UK (Brandt, Carmiel & Levy 2013). • Wong and Zhao (1999) make the distinction between the “<i>formal</i>” <i>process of land transfer, which begins with an application by a prospective land users and requires three levels of approval and the “informal” process, which is what happens in a majority of cases</i>” (Friedmann 2005: 106). The concern lies with developers, investors and speculators purchasing land use rights to either trade in the secondary market or to enable them to quickly build a development to make a fast/speculative profit. Both potentially artificially bids up the market value of the land without due regard to delivering new supply in line with market demand and net absorption levels. • In terms of economic and investment stimulus in 1989, Zhu had attracted over \$400M in FDI and also negotiated a \$3B loan from the World Bank for expanding Shanghai's housing and transport infrastructure. By 1993, Shanghai's FDI had soared to US\$3B and to US\$15B in 2010 (Schell & Delury 2013). • This paved the way for Shanghai's rapid re-development in the 1990s, the transformative market economic reforms and land management practices propelled Shanghai as a world city and has become mainland China's leading financial centre and a major manufacturing and logistics hub. The Shanghai Stock Exchange was established in 1990.

City Structure Overview: Shanghai continued...

Key Highlights:	Comments:
Primary Industry Clusters:	- Shanghai has 41 development zones. Fifteen of these are state-level development zones which include 4 state-level economic and technological development zones (see below), 8 customs surveillance development zones, 1 high tech industrial zone, 1 financial and trade zone and 1 national tourist resort. - The four state-level economic and technological development zones are: 1) Shanghai Hongqiao Economic and Technological Development Zone; 2) Jinqiao Export Economic Processing Zone; 3) Minhang Economic and Technological Development Zone; 4) Shanghai Caohejing High Tech Development Zone. - One other development zone is the Shanghai Comprehensive Industrial Development Zone – one of nine municipal-level industrial zones; major industries include mechanical equipment, electronics, bio-engineering, pharmaceuticals, food and beverage. - Shanghai also has a large number of industrial, development and research parks which include: 1) Shanghai Chemical Industrial Park – Expected to be one of the four key industrial bases in Shanghai it has major multinational corporations which include Bayer, BASF and British Petroleum. 2) Shanghai Software Development Park (1999) – Comprises three subsidiary parks (Pudong Software Park, Fudan Software Park and SJTU Caohejing Software Park). The Government has provided financial support to the value of US\$484.5M. 3) Shanghai Jiaotong University Science Park (1999) – comprises of four subsidiary zones (Withub Zone, Zhangjiang Zone, Mingu Zone and Xinhua Zone). - Shanghai tends to specialise in the automotive, banking and finance, IT, trading and manufacturing sectors which include biotechnology, chemical and pharmaceutical, electronics and electrical equipment; industrial machinery and parts, IT; manufacturing, metals; petrochemicals, transportation and logistics. Petrochemicals – Exxon Mobil and BP. Steel Manufacturing – Areclor Mittal, Baoshan Iron and Steel Works, Baotou Iron and Steel and Shanghai Yingji. Automotive and Auto Parts- Ford, General Motors, Shanghai Volkswagen, SAIC Motors and Hyundai. IT and Software – IBM, Inventec, Canonical, Computer Supported Collaborative Learning and ST Microelectronics. Aeronautical and Aerospace – United Technologies, Shanghai Sikorsky, Shanghai Aircraft manufacturing Factory, Shanghai aviation Industrial Corporation, Kawasaki Heavy Industries Machinery Trading Company. Electrical and Electronics – General Electric, Sony, Kyocera, SE Electronics and Siemens. Pharmaceuticals, Chemicals and Bio-Tech – BASF, Novartis, Bayer, Aventis, Eli Lilly, Glaxo Smith Kline, Merck, ICI, Zensun (Shanghai) Sci & Tech Co., ICI/Astra Zeneca, GSK, Roche, Novo Nordisk, Novartis, Shanghai Schering-Plough, Boehringer Ingelheim, Bristol-Myers Squibb and Johnson and Johnson. Banking, Finance & Insurance– AXA, General Electric, Deutsche bank, BNP Paribas, Mitsui, Sumitomo Bank, Societe Generale, American International Group, Bank of America, HSBC Holdings. Research and Development Centres – Novartis, Rhodia, GE Global Research, DuPont Central Research, General Motors, SAIC Motors and Amoi Research Centre.

City Structure Overview: Shanghai continued...

Key Highlights:	Comments:
Primary Industry Clusters continued...	• Tertiary Education – Shanghai has over 30 universities and colleges, some of these universities and their specialities include: Shanghai Jiao Tong University (Engineering, Chemical & Pharmaceuticals), East China University (Engineering), Shanghai University of Finance & Economics (Banking and Finance), Fudan University (Banking and Finance, IT, Chemical & Pharmaceuticals, Foreign Languages, Political Science & Law, Economics & Business Management), Shanghai University (IT), Shanghai International Studies University (Foreign Languages), East China University of Political Science & Law (Political Science & Law), School of Economics at Fudan University (Economics & Business Management), Shanghai University of Finance & Economics (Economics & Business Management), School of Economics & Management at Tongji University (Economics & Business Management) and Shanghai Institute of Foreign Trade (Economics & Business Management). • Hospitals – As at 2004, there were around 400 state owned hospitals, 79 private hospitals and 20 overseas-invested hospitals and clinics in Shanghai. There are also 14 medical research institutions and 75 health organisations (Shanghai Municipal Health Bureau 2004).
Network Interactions:	• Given the incredibly diverse range of industry clusters and the housing of a large number of multinational/Fortune 500 companies, significant relationships, innovation and production synergies have developed both within and between different cluster groups. Given some of these clusters have a sizeable critical mass, the scales of production/economies of scale provides significant momentum in the manufacturing; aeronautical and aerospace; pharmaceuticals, chemicals and bio-tech; banking and finance; research and development arenas. • One example of this is SAIC Motor which is one of the largest automotive corporations in China based in Shanghai – it has strategic partnerships with Volkswagen and General Motors. • There are also considerable synergies between the private sector and the universities and colleges which provide a stream of highly educated graduates as the new recruits in the labour market. • Multinational corporations are using Shanghai as an strategic location in their global supply chain due to Shanghai's access to a deep manufacturing market, distribution channels, premier world financial and business status, major logistics hub and its developing research and development sector.

City Structure Overview: **Shanghai continued...**

Key Highlights:	Comments:
Other Considerations:	• GaWC classify Shanghai as an <i>Alpha+ city</i> with a <i>Global Network Proportionate Connectivity Score</i> of 0.69 (1.00=London) and the World Economic Forum classify China as a <i>Stage 2 Efficiency Driven Economy</i>. • Shanghai has positioned itself as the premier manufacturing and logistics hub and the leading financial and business centre for mainland China. It has the largest population and generates the highest GDP compared to other Chinese cities. • Fortunately like Guangzhou, it is also well placed as China moves towards creating higher value-added products and services especially given the competitive, innovative and entrepreneurial nature of many of these multinational/Fortune 500 companies. • However in transitioning to the next stage of development, it will need to address a number of concerns which include: <i>“inadequate port facilities, unwise location of the new international airport, excess supply of real estate in Pudong, serious traffic congestion, air and water pollutions and the lack of bottom-up development based on rural enterprises in the counties...Perhaps most important of all, Shanghai still lacks the “software” required to make good use of its hardware, that is a well-enforced legal system and protection of intellectual property rights”</i> (Brunn, Williams and Zeigler 2003: 435-6). • An illustration of this is the reported instances of some Chinese car manufacturers copying designs from other car manufacturers e.g. BYD cars looking similar to the Toyota Lexus, General Motors suing Chery for copying the first generation Daewoo Matiz and Mercedes Benz taking legal action against Shuanghuan Noble for its similarities with the Smart Fortwo (Shanghai Municipal Health Bureau 2004). • Even more ominous is the Chinese Government automotive policy which effectively places uncompetitive pressure on foreign carmakers to reveal electric vehicle technology commercial in confidence information before they are allowed to sell the vehicles to the Chinese market. Furthermore they must enter a joint venture with the Chinese manufacturer owning 51% of the joint venture (Wikipedia 2012a).

Sources: (Beall & Fox 2009a; Brandt, Carmiel & Levy 2013; Brunn, Williams & Zeigler 2003; Buijs, Tan & Tunas 2010; CEIC Data Manager 2012a; China Briefing 2012; Douglass 2000, 2001; Friedmann 2005; Globalization and World Cities (GaWC) Research Network 2010; Hu 2013; Invest Shanghai 2011; Jiang & Shen 2010; KPMG 2011; Lehman, Lee & Xu 2013; Lin 2002; Miller 2012; Mulligan & Crampton 2005; Schell & Delury 2013; Shanghai Municipal Health Bureau 2004; Sit 2010; Sorensen & Okata 2010; Taylor et al. 2011; Thompson & Lane 2010; Wikipedia 2012a, 2012b, 2013c, 2013m, 2013y; World Economic Forum 2013; Yeung 2011; Zhao, Chan & Sit 2003)

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

MICHELLE LEONG GLASTRIS

City Structure Overview: Sydney	
Indicative Development Stage: Maturing (Established)	
Location: Capital city in the state of New South Wales, Australia	
Coordinates: 33°52'S, 151°12'E	
Key Highlights:	Comments:
Key Factors Contributing to City Structure Development Trends:	- The first British penal colony was established in Sydney Cove in 1788. By 1822, reasonable progress where banks, roads, bridges and buildings and other public infrastructure were established. In 1842 the Municipal Council of Sydney was incorporated and Sydney became Australia's first city. - With the rise of industrialisation in the last quarter of the 19th century, suburban development accelerated with the introduction of steam powered tramways and railways reducing commuting times to work and the city. In the 20th century, the level of decentralisation continued where public transport and cars were able to place further distance between city business, industry and manufacturing and residing in the suburbs. The population and job dispersal into the suburbs continued circa 1980 and particularly in the 21st century when a structural change in the employment sector occurred where jobs moved not only from manufacturing to professional and information services but also towards more "<i>knowledge-intensive activity in all sectors of the economy</i>" (Kelly & Mares 2013). In terms of city structure development, this not only impacted the workforce composition and increased the demand for higher education, but is also created a desire for white collar professionals to conveniently locate close to the city and prompted a return to centralisation and urban renewal planning policies. - According to the latest 2011 Census data for the Sydney Local Government Area (LGA), whilst the levels of clerical and administrative workers declined to 13.1% of the total number of people employed in the Sydney LGA or 12,666 people (compared to 14.0% in the 2006 Census), the number of managers increased to 16.5% or 16,006 people (compared to 16.2% in 2006) and the number of professionals rose to 38.8% or 37,598 people (compared to 36.8% in 2006) (City of Sydney 2013). In comparison, Greater Metropolitan Sydney recorded similar trends where clerical and administrative workers also declined to 16.2% or 10,859 people (from 16.7% in 2006), an increase in managers to 13.3% or 12,576 (from 13.2% in 2006) and an increase in professionals to 25.5% or 28,492 people (from 23.8% in 2006). When compared to Greater Metropolitan Sydney, the Sydney LGA captures a larger employment of managers and professionals which collectively totals 53,604 people or accounts for around 55.3% of the total number of people employed in the Sydney LGA (City of Sydney 2013). In line with the growth in knowledge intensive workers, educational qualifications for those employed in the Sydney LGA notably rose from 31.3 % (2006 Census) to 40.2% (2011 Census) (City of Sydney 2013). - With the increased demand in white collar employment in the 1980s came a development boom in office, retail, industrial and residential building construction in the Sydney CBD and established major suburban markets (North Sydney, Crows Nest/St Leonards, Chatswood, Parramatta and North Ryde/Macquarie Park). However as this level of development activity quickly picked up pace, it became unfettered as developers and investors increasingly undertook speculative development which was largely left unchecked by lending institutions and state and local governments. Consequently had the adverse effect of increasing the volatility of the market dynamics and uncertainty in investment returns i.e. where large quantum of new development projects were delivered to the market regardless of market demand and/or the markets' capacity to absorb both existing vacant stock and the new building stock. This created an excessive supply surplus with high vacancies, falling asset values and an inability to sell new developments which in turn created major financial difficulties for many developers and investors who ultimately defaulted on their loans and the lending institutions inadvertently held increasing property portfolios. When the property eventually burst in the late 1980s-early 1990s, both the lending institutions and

City Structure Overview: **Sydney continued...**

Key Highlights:	Comments:
Key Factors Contributing to City Structure Development Trends continued...	developers/investors learnt their lessons where the banks imposed tighter lending controls e.g. higher asset value to loan ratios, development covenants, minimum pre-commitment/sales levels prior to commencement of construction, etc. This had the marker transformative effect of keeping the market supply and demand dynamics in sync which kept supply and pricing (rents, investment yields, land and capital values) volatilities in relative check. As at July 2012, total office stock in Sydney CBD stands at 4.9M sqm and constitutes 62% of the 7.9M sqm in all CBD and Sydney Metropolitan stock (includes North Sydney, North Ryde/Macquarie Park, Parramatta, Crows Nest/St Leonards, Chatswood office markets but includes Newcastle, Wollongong and other Sydney suburban office markets) (Property Council of Australia (PCA) 2012, 2013) . North Sydney and North Ryde/Macquarie park provided the next largest tier of office stock at respectively 861,200 sqm (10.9%) and 820,400 sqm (10.4%) (Property Council of Australia (PCA) 2012, 2013) .
Major Macro Events and City Specific Events post 1950 (Earliest commencement of datasets):	1901-1966 Immigration Restriction Act (i.e. White Australia Policy) restricted immigrants from non Anglo Saxon countries. The policies emanating from the Act were progressively removed in 1949-1973 culminating in the Racial Discrimination Act being passed in 1975. 1958 Worldwide Economic Recession 1973-74, 1979 and 2003-08 - Oil Crises 1980s Structural change in the employment sector as Sydney shifts from manufacturing to professional and information service based jobs. 1983 Floating of the Australian currency 1997-1998 Asian Financial Crisis 2000 Sydney hosts the Summer Olympic Games 2001- Present Global War on Terrorism 2007-2009 Global Financial Crisis (GFC)
Impact of Recent Government Planning and Investment/Economic Policies & Decisions:	- In line with Australia's general trend of rising migration levels, net migration has contributed to Sydney's population growth and created a greater demand for employment, housing, retail, transport and social infrastructure (schools, universities, hospitals, cultural, leisure and community facilities, public open spaces, etc). <i>City of Sydney Strategic Plan</i> for Sydney was released by the City of Sydney council in 1971 and provided three yearly reviews to the Plan until 1983. The Plan was intended to provide "<i>the principal planning document meant to guide Sydney's urban morphology for almost the following 20 years</i>" (Hu 2012). <i>Central Sydney Strategy</i> was released in 1988 and was a collaborative effort between the NSW State Government and the City of Sydney. It emphasised the increasing importance of Sydney as a key player in the wider international economic, business and financial stage. To ensure the city attained its "Global Sydney" vision, the NSW Government established the Central Sydney Planning Committee in 1988. As part of the Committee's remit, it acted "<i>as a development control committee for major projects of a construction value of over \$50 million in central Sydney</i>" (Hu 2012).

City Structure Overview: Sydney continued...

Key Highlights:	Comments:
Impact of Recent Government Planning and Investment/Economic Policies & Decisions continued...	• <i>Metropolitan Strategy for Sydney</i> was first released by the NSW Department of Planning and Infrastructure in 2005 with subsequent reviews until the current 2013 draft. The 2013 draft sets some ambitious employment, dwelling and population targets for key sub-regions and various centres. Whilst it is commendable to have these targets to work towards, it also places considerable onus on local councils and communities to translate these outcomes at a local scale. It also brings into question if these targets are realistic to achieve in light of economic imperatives; current capacity levels (workforce, population, land availability, residential and non-residential building stock, etc); future market supply and demand dynamics; the state's provision of critical infrastructure to support these growth targets; how industry clusters and industries with high growth potential can be commercially nurtured and developed; and how innovation can be more effectively employed in their economic and planning strategies to maximise productivity and global competitiveness in Sydney's growing knowledge intensive activities across all employment sectors. • The <i>Central Sydney Strategy</i> and <i>Metropolitan Strategy for Sydney</i> planning documents highlight the increasing conflicts between State and Local Government where the "<i>root reason for this inter-governmental conflict over planning is that urban governance power in Australia ultimately rests with the state government constitutionally. Local governments' powers and planning resources are very limited</i>" (Hu 2012). Whilst Local Government is entrusted to provide Local Environmental Plans (LEPs) under the Local Government Act 1993 to implement the State Government's planning objectives and targets, the State Government exercises overall control over planning processes and has the authority to legislatively override any planning decisions Local Government may make/implement. This conflict is further exacerbated by the fact that a majority of the 41 Sydney metropolitan councils have limited revenue streams, limited land supply for development which places upward pressure on property pricing, increasingly ageing infrastructure that needs to be regularly maintained or replaced, possess limited resources and are increasingly facing amalgamation with other councils which they are reluctant to undergo for political reasons. However it should also be acknowledged that in recent years there has been greater cooperation and policy alignment between the three tiers of federal, state and local government. For example the City of Sydney liaises with Federal and State Government, other neighbouring Local Councils as well as a range of industry associations and local business and residential communities on a number of economic, planning, transport, cultural and environmental policy and strategy initiatives.

City Structure Overview: Sydney continued...

Key Highlights:	Comments:
Primary Industry Clusters:	• According to the 2011 Census data within the Sydney LGA the six largest industry sectors for employment are Professional, Scientific and Technical Services (16.8% of the total employment population within Sydney LGA); Financial and Insurance Services (10.1%); Accommodation and Food Services (10.0%); Health Care and Social Assistance (7.9%); Retail Trade (7.6%); Education and Training (7.3%) – collectively they represent 57,677 workers or 59.7% of the Sydney LGA's working population (City of Sydney 2013). • Sydney tends to specialise in business and professional services; banking, finance and insurance; ICT and software development, creative industries and media; medical and science research; education, information and communications technology; defence and aerospace and advanced manufacturing. • Business and Professional Services – Includes Deloitte Touche Tohmatsu, Ernest and Young, KPMG, PricewaterhouseCoopers, Accenture, Siemens, Sinclair Knight Mertz, Ove Arup, Cardno, Computershare, Bluelink, Datacom, Thomson Reuters, Sony, Brother, Toshiba and Fuji Xerox. • Banking, Finance & Insurance– Includes American Express, AMP Group, AXA, BT Financial, Blackrock Investments, Schroder Investment Management, Macquarie Bank, General Electric, Deutsche Bank, BNP Paribas, Citigroup, UBS, Credit Suisse, ING, Morgan Stanley, Mizuho Corporate Bank, Mitsui, Sumitomo Bank, Societe Generale, American International Group, Bank of America, HSBC Holdings, Royal Bank of Scotland, Standard and Poors and Moody's. • Retail – Includes Coca Cola Amatil, PepsiCo/Smith's Snackfood, Nestle, Woolworths, Metcash and Aldi. • Petrochemicals – Includes Chevron Australia / Caltex Australia. • Creative Industries and Media- Includes Fairfax Media, ABC, SBS Network, Seven Network, Nine Network, Network Ten, Animal Logic, Omnilab, KMM, FremantleMedia (Australia) and Jets Digital Group. • ICT, Computer and Software Development –Includes Apple, IBM, Microsoft and Google. • Defence and Aerospace – Includes Thales, GHD, Aerospace & Defence Products, BAE Systems, Raytheon, Schenker Australia and ThyssenKrupp Aerospace. • Bio-Tech and Advanced Manufacturing – Includes Cochlear, Bluescope Steel, SilexSolar and Silanna. • Pharmaceuticals, Chemicals, Bio-Tech & Diagnostic/Pathology Laboratories– Includes Novartis, Bayer, Eli Lilly, Merck Serono Australia, Astra Zeneca, Roche, Novartis, Boehringer Ingelheim, Du Pont, Lavery Health, Douglass Hanley Moir and Johnson and Johnson. • Science, Innovation and Research and Development Centres – Include CSIRO, University of Sydney; University of Technology Sydney (UTS); The ARC Centre for Autonomous Systems; University of NSW (UNSW); National ICT Australia (NICTA); Defence Science & Technology Organisation, Warren Centre for Advanced Engineering, Australian National Fabrication Facility, Advanced Manufacturing Cooperative Research Centre, Australian Nuclear Science and Technology Organisation, Defence Materials Technology Centre & Australian Technology Park. • Tertiary Education – Sydney six major universities are Sydney University, University of NSW, University of Technology, Macquarie University, Australian Catholic University and the University of Western Sydney. There are also secondary campuses for the University of Notre Dame Australia, University of Wollongong and Curtin University of Technology. • Hospitals – There are around 43 public hospitals and 78 private hospitals in Sydney which also include 14 teaching hospitals (e.g. Royal North Shore Hospital, Royal Prince Alfred Hospital, Prince of Wales Hospital, St. Vincent's Hospital, Childrens Hospital at Westmead, Macquarie University Hospital), etc.

City Structure Overview: Sydney continued...

Key Highlights:	Comments:
Primary Industry Clusters continued...	• Medical Research Institutions- There are over 16 medical research institutions and include the Garvan Institute of Medical Research, Victor Chang Cardiac Research, St. Vincent's Centre for Applied Medical Research, Children's Medical Research Institute, Children's Cancer Institute of Australia for Medical Research, Melanoma and Skin Cancer Research, Kolling Institute of Medical Research, Bosch Institute – University of Sydney, Ophthalmic Research Institute of Australia, Neuroscience Research Australia, Schizophrenia Research Institute, ANZAC Research Institute, Ingham Institute of Applied Medical Research, Glaxo Smith Kline Medicines Research Unit, Woolcock Institute of Medical Research and Westmead Millennium Institute.
Network Interactions:	• Given the incredibly diverse range of industry clusters and the housing of a large number of multinational/Fortune 500 companies, significant relationships, innovation and production synergies have developed both within and between different cluster groups. Given some of these clusters have a sizeable critical mass, the scales of production/economies of scale provides significant momentum in the business and professional services; banking, insurance and finance; ICT and software, defence and aerospace; pharmaceuticals, chemicals and bio-tech; mining; creative industries and media arenas. • There are also considerable synergies between the private sector and the universities and colleges which provide a stream of highly educated graduates as the new recruits in the labour market. • There are also a number of business incubators, innovation centres and start up networks to provide entrepreneurial advice, introductions to venture capitalists and angel investors as well as government funding and assistance.
Other Considerations:	• GaWC classify Sydney as an <i>Alpha+ city</i> with a <i>Global Network Proportionate Connectivity Score</i> of 0.71 (1.00=London) and the World Economic Forum classify Australia as a <i>Stage 3 Innovation Driven Economy</i>. • The Sydney City to Airport Corridor is a microcosm of Sydney. It is located within a 10km radius of the Sydney CBD and extends from the Sydney CBD through to the Sydney's Domestic and International Airports and Port Botany. It hosts a diverse range of functional activities of global and domestic significance and houses key commercial and infrastructure hubs critical to Australia's economic and commercial development. A report (Leong Willimott 2004c) on the Corridor found: 1) Key to the Corridor's attractiveness are its major linkages (proximity to other CBD and major suburban centres, extensive transport networks, major transport and logistics hubs; 2) The Gap Analysis highlighted large spatial imbalances particularly for the office and industrial markets where there were lengthy supply turnover and construction lag times and the need to preserve industrial zoned lands for high end industrial uses that support servicing the airports and Port Botany; 3) The need to raise Sydney's global competitiveness by improving efficient access to international channels of distribution, key commercial and transport hubs and the specialised knowledge intensive employment base; 4) Further examine office, retail and industrial land consolidation; large site consolidation and re-zoning and development capacities; land use and sensitivity modelling.

City Structure Overview: Sydney continued...

Key Highlights:	Comments:
Other Considerations continued...	• In spite of its achievements, Sydney does need to make some significant improvements if it is to build on its productivity, innovative capacity, resilience and enhance its global presence and international networks. It has been advocated that whilst Sydney and Melbourne “<i>demonstrate strength in...Liveability and Attractiveness, Environmental Sustainability and Creativity and Diversity</i>”, both cities need to improve on the areas of “<i>Governance, Connectivity and Enterprise Hub</i>” (Hu, Blakely & Zhou 2013). • Furthermore, it has also been advocated that if Sydney is to increase its global competitiveness, raise its status and input into within foreign multinational firms’ strategies, it needs to undertake the following: 1) “<i>Sydney operations of the foreign multinationals will have to become embedded into both local networks and the multinational firm networks if they are to make a greater contribution to the knowledge deployed in the multinationals, and presumably generate more value for Sydney in the process</i>”; 2) “<i>there is room to enhance the interactions of the foreign multinationals with local partners, suppliers and public research institutes and universities. Presumably improving such linkages, as well as the skills and the capabilities available in Sydney, would be important steps...</i>”; 3) “<i>Of particular importance will be improvements to customer service and support and strategic thinking. The presence of foreign multinationals provides a unique opportunity to piggyback into global markets. Impressing the Sydney operations of multinationals may be a much easier way to internationalise than having to set up foreign marketing and distributions</i>”; 4) “<i>The fact that Sydney has become more important to multinational companies in almost all activities in the last ten years is an indication that the Asia Pacific as a whole is more important to these companies and that Sydney has been improving as a location for these companies. The implication is that Sydney has a more significant place in the strategies of multinational companies</i>” (Enright, Petty & Cuganesan 2009).

Sources: (Brunn, Williams & Zeigler 2003; City of Sydney 2013; Day & Reibstein 1997; Enright, Petty & Cuganesan 2009; Globalization and World Cities (GaWC) Research Network 2010; Hu 2012; Hu, Blakely & Zhou 2013; Kelly & Mares 2013; Leong Willimott 2004c, 2006b; NSW Trade and Investment 2013; Pritchard & Searle 2009; Property Council of Australia (PCA) 2012, 2013; Ross 2010; Searle & Pritchard 2005; Taylor et al. 2011; Whipple 2006; Wikipedia 2013a, 2013b, 2013c; World Bank 2013c)

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

MICHELLE LEONG GLASTRIS

City Structure Overview: Detroit	
Indicative Development Stage: Obsolescence - Decline	
Location: A key city in the state of Michigan, USA Coordinates: 42°19'N, 83°2'W	
Key Highlights:	Comments:
Key Factors Contributing to City Structure Development Trends:	• Originally founded as a French settlement in 1701, Detroit (i.e. “the Strait” in French) was subsequently transferred from the British to the USA under the Jay Treaty in 1796. After the Siege of Detroit, Detroit was recaptured from the British by the USA in 1813 and was incorporated as a city in 1815. • Due to its strategic location along the four Great Lakes (Michigan, Superior, Huron and Erie), in the 1830s Detroit evolved into a major transportation hub with its shipping trade and manufacturing industries (shipbuilding, railroad equipment, cars and bicycles). However industrial growth was given a significant boost in 1896 when Henry Ford started manufacturing automobiles in downtown Detroit and it became known as “Motor City”. The rise in industrialisation continued into the first half of the 20th century where the America’s automobile industry was retooled to produce transport vehicles and equipment during World War II and increased Detroit’s population. • With the advent of automobile manufacturer mergers; de-industrialisation; the construction of America’s extensive freeway system post 1950s, there was a significant push towards decentralisation. At the 1950 peak of Detroit City’s population boom, the city housed around 1.8M people and dramatically shrank by 60.3% to 713,777 people as at the April 2010 Census (US Census Bureau 2011a; Wikipedia 2013e). However it has been advocated by Charles Waldheim that Detroit’s decentralisation began in the 1920s when Henry Ford relocated his manufacturing facilities outside downtown Detroit in order to lower production costs (Robbins & El-Khoury 2004) and other car manufacturers such as General Motors and Chrysler later followed suit. • There were also significant racial tensions arising from racial conflict and discrimination which started with the persecution of African-Americans by the Ku Klux Klan in the 1920s and the Detroit Race Riot in 1943. As the African-American Civil Rights Movement gained support across America in the 1950s and 1960s, this heightened conflict in cities such as Detroit. Detroit’s Twelfth Street Riot in 1967 resulted in “43 dead, 46 injured, over 7,200 arrests, and more than 2,000 buildings destroyed. Thousands of small businesses closed permanently to relocated to safer neighbourhoods, and the affected district lay in ruins for decades” (Wikipedia 2013e). In the 1971 Milliken versus Bradley trial and subsequent appeal, the National Association for the Advancement of Colored People (NAACP) advocated Michigan state officials and Governor Milliken had allowed policies that enabled “unfair housing practices (such as redlining) and educational segregation”. The unfortunate, unnecessary and long term consequences of the State of Michigan refusing to confront and deal with these racially segregated housing patterns was that it further exacerbated racial tensions and discrimination, increased wealth and social inequalities and subsequently gave rise to a further population mass exodus to the suburbs: “John Mogk, a professor of law and an expert in urban planning at Wayne State University in Detroit, says, “Everybody thinks that it was the riots [in 1967] that caused the white families to leave. Some people were leaving at that time but, really, it was after Milliken that you saw mass flight to the suburbs. If the case had gone the other way, it is likely that Detroit would not have experienced the steep decline in its tax base that has occurred since then”(Wikipedia 2013e).

City Structure Overview: Detroit continued...

Key Highlights:	Comments:
Key Factors Contributing to City Structure Development Trends continued...	• The 1970s hit the Detroit economy badly where the “city reeled from high unemployment, racial transition, collapsing housing markets, and the unintended effects of well-meaning federal housing policies dating from Lyndon Johnson’s presidency” (Ryan 2012:85) and coupled with the Oil Crises in 1973 and 1979 where foreign car makers manufacturing more fuel efficient, smaller cars eroded the US auto industry market. • In the 1980s and 1990s, the global shift in manufacturing towards more flexible production and specialisation resulted in “shorter production runs, more automation and less skilled workers. While this makes industry much more sensitive to changing consumer preferences, it has reduced the number and skill levels of manufacturing workers. This in turn has led to a decrease in labour’s bargaining power with resultant effects on wages. And the more jobs are deskilled, the more easily they can be shipped offshore to unskilled labour pools” (Kim and Short 2008:41-42). This was indeed the case as Detroit became more de-industrialised and employment in the car manufacturing industry continued to decline as plant closures and/or more manufacturing being increasingly outsourced overseas or elsewhere. This period also signalled the rise of the knowledge worker and significant employment growth in the professional and information service sector exemplified in areas such as Silicon Valley and Route 128 but also on the rise in downtown Detroit with its business and finance core. • Between 1970—1990, the urban decline in parts of Detroit were significant. For example the Jefferson-Chalmers neighbourhood which lies in Detroit’s far east on the Detroit River “declined catastrophically, losing 55 percent of its population and over 40 percent of its housing”. Whilst vacant buildings and land were cleared for new development and urban renewal projects, most of this has recently occurred in the Downtown Detroit, Midtown and New Centre precincts in the form of office buildings, high end residential apartments to cater for the young professionals locating to jobs in the Downtown precinct, sports stadiums, casinos and hotels. • However with the significant decline in the Detroit’s population base and high unemployment level, the City of Detroit’s tax revenue was severely eroded as an over 50% delinquency on 2011 tax bills resulted in a revenue loss of \$246M where around half of the money would have been reinvested in Detroit public services and infrastructure. The city’s financial situation deteriorated and a financial emergency was declared in March 2013 and the State of Michigan took administrative control of the city. In July 2013, the City of Detroit filed for Chapter 9 Municipal Bankruptcy Protection and was declared bankrupt as a result of its \$18.5B debt that it was unable to honour with its thousands of creditors. There were reports of the City being so under resourced it is unable to provide basic street lighting and rubbish removal services and the police and fire services having a very long or no response time to emergencies (Carlisle 2013; Davey 2013).
Major Macro Events and City Specific Events post 1950 (Earliest commencement of datasets):	• 1950 Peak of Detroit City’s population at 1.8M people. • 1950s and 1960s African-American Civil Rights Movement gained support across America. • 1958 Worldwide Economic Recession • 1967 Detroit’s Twelfth Street Riot • 1973-74, 1979 and 2003-08 - Oil Crises • 1980s and 1990s Structural change in the employment sector as Detroit continues to de-industrialise and shift towards professional and information service based jobs. • 2001- Present Global War on Terrorism • 2006 Detroit hosted sports events (2006 Super Bowl XL; 2006 and 2012 World Series and 2009 NCAA Final Four) as well as entertainment and performing arts festivals (Detroit International Jazz Festival) – these events generated urban improvements and boosted economic activity.

City Structure Overview: **Detroit continued...**

Key Highlights:	Comments:
Major Macro Events and City Specific Events post 1950 (Earliest commencement of datasets): continued...	• 2007-2009 Global Financial Crisis (GFC) • March 2013 a Financial Emergency was declared and the State of Michigan took administrative control of the City of Detroit. • July 2013 the City of Detroit had accumulated \$18.5B in debt, filed for Chapter 9 Municipal Bankruptcy Protection and was declared bankrupt.
Impact of Recent Government Planning and Investment/Economic Policies & Decisions:	• <i>1951 City of Detroit Master Plan</i> – Redevelopment plans focussed on Lafayette Park and Jefferson-Chalmers neighbourhood was still regarded as a prosperous suburb. • <i>City of Detroit's Community Renewal Program</i> (circa 1966) identified Jefferson-Chalmers neighbourhood as "conservation area". • The federal 1968 Housing Act sought to "<i>redress past wrongs like redlining backfired badly</i>" and Section 235 Program which "<i>subsidized any housing costs, including home purchase, for low-income families in excess of 20 percent of household income. Homes purchased under Section 235 were also insured by the Federal Housing Authority (FHA)</i>" and resulted in the Housing and Urban Development (HUD) taking ownership of a property if the owner foreclosed on his/her mortgage (Ryan 2012). This precipitated a rapid decline of Detroit neighbourhoods such as Jefferson-Chalmers when the housing subsidies buoyed market prices and valuations and low income earners who had purchased a home for more than its actual market value were unable to make maintenance repairs, repay their mortgages and subsequently defaulted on their loans further "<i>saddling HUD with a large mortgage on a low-value house</i>" and was quantified: "<i>The disaster began to unfold in 1970. At the beginning of the year, HUD owned 900 homes in the city, but by the end of 1970, it owned 2,300, and by the end of 1971 it owned 5,000 vacant Detroit houses...By 1976 HUD owned 8,400 houses and 1,800 vacant lots in the city, more than three times as many as it did in either New York or Philadelphia</i>" (Ryan 2012). Further exacerbating the situation were corrupt speculators who would "<i>purchase a home at a low price, conduct spurious "repairs" on the house, and resell it at a higher price to an FHA-insured buyer</i>" (Ryan 2012). Not surprisingly Section 235 was later suspended by the Nixon administration (1973) and subsequently cancelled. The incident has notable parallels and eerily foretells the catastrophic housing debacle that would unfold into the GFC decades later. • Noticeable lack of strategic and integrated planning, design and vision in Detroit during the 1960s, 1970s and 1980s which allowed fragmented and ad hoc development to occur based on market driven development, steadily decreasing density/decentralisation and urban abandonment (Robbins and El-Khoury – Waldheim, Ch. 6:77-79; Ryan 2012). • <i>1990 Detroit Vacant Land Survey</i> report was released by the City of Detroit's Planning Commission which "<i>documented a process of depopulation and disinvestment that had been underway in Detroit since the 1950s</i>", recommended the most derelict parts of the city be closed down, residents be relocated to more vitalised areas where they would be more efficiently and better serviced and showed "<i>unsentimental and surprisingly clear-sighted acknowledgement of a process of post-industrial de-densification that continues to this day in cities produced by modern industrialization</i>" (Robbins and El-Khoury – Waldheim, Ch. 6:77-79). Unfortunately the recommendations were dismissed and the irony is that many of these recommendations have been advocated more recently as solutions to a wider recovery program.

City Structure Overview: **Detroit continued...**

Key Highlights:	Comments:
Impact of Recent Government Planning and Investment/Economic Policies & Decisions continued...	• <i>City of Detroit Master Plan Draft (2004); Strategic Master Plan (2009) and City of Detroit Master Plan of Policies Revision (2009)</i> identifies development trends and priorities, areas of urban development and economic revitalisation – in particular the ten clusters of neighbourhoods areas and commercial districts (City of Detroit 2009). • As an older city, Detroit has found its urban decayed tracts more difficult to revitalise given the housing stock tends to be old/obsolete, poorly maintained with low capital and land values that do not warrant large injections of capital expenditure. Also the sheer quantum of vacant stock is significant – as at the 2010 Census there were around 79,725 vacant homes which represented 22.8% of the total housing stock in Detroit City (US Census Bureau 2011a). It has also been advocated that the “<i>abandonment of vast tracts of housing in...Detroit...was the result of malicious intent or bad public policies...</i>” (Bruegmann 2005: 47) • The neighbourhood of Jefferson-Chalmers was adversely impacted by long term population decline – in 1950 the population was 24,327 and by 2000, the population had decreased to 8,188 people where African Americans represented around 7.9% of the total 1950 population and increased to 86.3% of the total 2000 population. From the 1950s the economic base was reduced through a series of automobile plant closures or retrenchments and inhabitants choosing to relocate out of the neighbourhood. Parts of the neighbourhood were gradually rebuilt – the most notable being Jefferson Square (catered for low-moderate income rental families) and more significantly Victoria Park (catered for the emerging African American middle class families). • The 78 acre (32 ha) Lafayette Park was built in 1956 by developer Herbert Greenwald and architect Mies van der Rohe and comprises a number of townhouses and high rise residential apartments (built 1958-1965) located on the Detroit lower east side. With a total construction budget of US\$35M, it has been lauded as a successful urban renewal project: “<i>Originally planned as a mixed-income and mixed-race development, Lafayette Park continues to this day to enjoy multiple original family residents, high relative market value, and greater racial, ethnic, and class diversity than both the city and suburbs that surround it</i>” (Robbins and El-Khoury – Waldheim, Ch. 6:89). • Recent development projects have helped the city to try and “<i>reinvent itself through waterfront investment, the creation of commercial districts and tourism despite persistent poverty and racial segregation</i>” (Burdett & Sudjic 2007). These projects include One Detroit Centre (1993); Detroit Tigers Stadium (2000); Detroit Lions Stadium (2002); GM \$500M HQ redevelopment of the Renaissance Centre (2003); staged redevelopment the Detroit International Riverfront precinct worth \$559M (includes \$135M from GM and \$50M from Kresge Foundation); MGM Grand Detroit, Motor City Casino and Greektown Casino (2007-8). • It should also be noted that since the 1970s, there have been a range of federal programs that have provided funding to cities for urban development improvement programs (e.g. Model Cities funding, Community Development Block Grants, Urban Development Action Grants and Detroit's Empowerment Zone). This has been supplemented by State and City resources to attract development projects and incentivise developers and major corporations to locate to the city (e.g. waiving/lifting state and local taxes, reducing land use restrictions, relaxing zoning, planning and environmental regulations, etc). When Detroit successfully won “Empowerment Zone” status and \$100M in Federal funding, it raised a subsequent \$2B in commitments and pledges predominantly from the automotive industry and banks and monies were allocated towards Empowerment Zone projects (11 of these projects were based around automotive and related manufacturing and 6 were based in general industry) (Savitch & Kantor 2002).

City Structure Overview: **Detroit continued...**

Key Highlights:	Comments:
Impact of Recent Government Planning and Investment/Economic Policies & Decisions continued...	• Kantor and Savitch (2002) make reference to the “solution set” deals brokered between Mayor Coleman Young and General Motors for the General Motors Detroit/Hamtramck Assembly Plant located in the Central Industrial Park (CIP) in Poletown (1981) and later with Chrysler for the Chrysler Jefferson Avenue Plant (1992) and question whether the anticipated longer term benefits did eventually outweigh the sacrifices made by the City and its residents. In the case of GM’s Poletown Plant, Mayor Young invoked Michigan’s “quick take” law to overcome land acquisition and financing difficulties and committed the City of Detroit to “at least \$200 million in direct expenditures and a dozen years of tax abatements...Cost overruns, balloon payments, and increased payments for land acquisitions continue to be borne by the city. A reluctant city council has continued to grant tax abatements for new plant equipment, and new bonds have been issued for the tax increment financing district. So committed was Detroit to this market endeavour that the city followed through on its plans despite revenue shortfalls. While the subsidies poured into CIP, Detroit did curb allocational spending by laying off police. By most accounts CIP has fallen far short of expectations, but it is now touted as a symbolic achievement – a “loss-leader” that is supposed to yield other benefits” (Savitch & Kantor: 2002:130). There were also associated social costs where the City exercised “eminent domain” to demolish part of a neighbourhood and to “relocate the 4,200 people who lived in the area, along with their 1,300 homes, 140 businesses, six churches and one hospital” (Wikipedia 2013v). In the case of Chrysler’s Jefferson Avenue Plant, the level of financial support and incentives outweighed the economic benefits and financial and social costs: “The “solution set” that Young used for Poletown was now applied to Jefferson Avenue. The support...consisted of tax abatements, loans, revenues from bond sales, job training, and land write downs. The city acquired 400 acres of land, relocated about 2,000 residents, cleared over 800 houses, and supplied the infrastructure. The property was then sold to Chrysler for \$5 million, estimated at half its market value. At the time public assistance amounted to \$200 million, though cost overruns now put the figure at \$264 million...In 1992 the new Chrysler plant opened with less than a quarter of that work force, and the anticipated spinoffs of new industry have yet to materialize” (Savitch & Kantor: 2002:130-1). In hindsight, in light of the considerable public debt the City of Detroit was racking up in heavily subsidising these and similar development projects, it does raise the question to what extent these projects contributed to the City’s eventual 2013 Bankruptcy and could it have been avoided. Furthermore, whether these were prudent financial decisions, whether there was a sufficient economic return for the city and community and whether the social costs (displacement, job losses and wage cuts as well as a reduction in the provision of community services e.g. police layoffs and subsequent rise in crime, inability to provide street lighting and rubbish removal services across the city, under resourced police and fire emergency services, etc) collectively outweighed the economic benefits realised. It is also advocated that Detroit’s “tabula rasa” or “blank slate” redevelopment approach has removed much of the city’s historic significance and built heritage that could have otherwise provided the city with more locational distinctiveness and unique character: “As city officials erased the city, they also removed one of the city’s principal competitive advantages in an increasingly generic world: its own built environment...By the 1990s, Detroit’s redevelopment practice often behaved as if the existing city did not matter at all” (Ryan 2012:74-75).

City Structure Overview: **Detroit continued...**

Key Highlights:	Comments:
Impact of Recent Government Planning and Investment/Economic Policies & Decisions continued...	• <i>2008 Stimulus Plan</i> to boost employment and revitalise neighbourhoods (including 7-Mile/Livernois, Brightmoor, East English Village, Grand River/Greenfield, North End and Osborn) was announced by the City of Detroit and was to be funded by public funding through city bonds and private investment (Wikipedia 2013e, 2013u).
Primary Industry Clusters:	• According to September 2013 employment statistics for the Detroit-Warren-Livonia Metropolitan Statistical Area (US Department of Labor: Bureau of Labor Statistics 2013b), there are over 1.85M people employed and the top five employment industry sectors were: 1) Professional and Business Services (353,200 workers or 19.1% of Total Nonfarm workers); 2) Trade, Transportation and Utilities (344,700 workers or 18.6%); 3) Education and Health Services (294,700 workers or 15.9%); 4) Manufacturing (228,800 workers or 12.4%); and 5) Government (192,700 workers or 10.4%). In the year to October 2013, both professional and business services and the manufacturing sectors recorded employment increases of respectively 11,300 and 8,600 workers respectively. • Detroit specialises in automobile manufacturing, business and professional services; emerging technologies research and development; banking, finance and insurance; ICT, computer and software development, advertising; medical services, medical, biomedical and science research and education. • Automobile Manufacturing – Includes General Motors Corporation, Ford Motor Company, Daimler Chrysler and Volkswagen of America as well as auto parts manufacturers American Axle and Manufacturing, Delphi and Guardian Industries. • Business and Professional Services – Includes Deloitte Touche Tohmatsu; Ernest and Young; KPMG; PricewaterhouseCoopers; Miller, Canfield, Paddock & Stone; Lowe, Campbell Ewald; BBDO and McCann-Erikson • Banking, Finance & Insurance– Includes Bank of America, JP Morgan, ABN Amro, BT, Merrill Lynch, Comerica Bank, Federal Reserve Bank of Chicago – Detroit Branch and Quicken Loans. • Retail – Includes Kmart and Whole Foods Market. • ICT, Computer and Software Development – Includes Compuware, OnStar, Blue Cross Blue Shield and HP Enterprise Services. • Emerging Technologies Research & Development (biotechnology, nanotechnology and hydrogen fuel cell development) – Includes 1) biotech firms Ash Stevens, Caraco Pharmaceutical laboratories, Mitostem and StemGent; 2) nanotechnology firms RHK Technology and Oerlikon; 3) hydrogen fuel cells R & D firms GM, Honda and US Army Tank Automotive Research & Engineering Centre (TARDEC). • Hospitals, Medical Services, Medical, Biomedical and Science Research – There are over 12 major hospitals which include the Detroit Medical Hospital (a regional Level 1 trauma centre which includes a number of smaller hospitals, medical research centres and institutes); Henry Ford Health System; St. John Health System and the John D. Dinell VA Medical Centre and a \$500M biomedical research centre is planned as part of the expansion of the Henry Ford Health System (Wikipedia 2013e). There are also a number of medical research institutes and centres which include the Karmanos Cancer Institute and the Kresge Eye Institute. • Entertainment, Performing Arts and Leisure: Motown Motion Picture Studios, Fox Theatre, Music Hall, Masonic Temple Theatre, Detroit Opera House, Orchestra Hall, Comerica Park, Ford Field, Joe Louis Arena, MGM Grand Detroit, MotorCity Casino and Greektown Casino.

City Structure Overview: **Detroit continued...**

Key Highlights:	Comments:
Primary Industry Clusters continued...	• Tertiary Education – There are two major universities in Detroit - the Wayne State University (a national research university with medical and law schools in the Midtown area) and the University of Detroit Mercy (business, dentistry, law, engineering, architecture, nursing and allied health professions) whilst the University of Michigan has a satellite campus for Osteopathic Medicine based in the Detroit Medical Centre (Wikipedia 2013e).
Network Interactions:	• Given the incredibly diverse range of industry clusters and the housing of a large number of multinational/Fortune 500 companies, significant relationships, innovation and production synergies have developed both within and between different cluster groups. Given some of these clusters have a sizeable critical mass, the scales of production/economies of scale provides significant momentum in the automotive car manufacturing; banking, insurance and finance; ICT, computer and software, emerging industries, medical and science research arenas. • For example, it was announced in July 2013 that GM and Honda have agreed to jointly develop hydrogen fuel cell vehicles by 2020 where <i>“GM and Honda will build on each other’s technology and share suppliers to lower the cost of fuel-cell vehicles”</i> (Lichterman & Seetharaman 2013). In addition GM is also jointly developing hydrogen fuel cell technology with the US Army Tank Automotive Research, Development & Engineering Centre (TARDEC) where their respective fuel cell labs are <i>“20 miles apart, which greatly promotes daily collaboration, and GM and TARDEC engineers are developing extensive plans to share physical material and data between the two locations”</i> (Wayland 2013). • There are also considerable synergies between the private sector and the universities and colleges which provide a stream of highly educated graduates as the new recruits in the labour market. For example Detroit Medical Centre is staffed by doctors from the Wayne State University School of Medicine and has a strong teaching affiliation and Michigan State University College of Osteopathic Medicine has a satellite campus located at the DMC. • There are also a number of business incubators, innovation centres and start up networks that provide entrepreneurial advice, introductions to venture capitalists and angel investors as well as government funding and assistance. For example TechTown is a business incubator affiliated with Wayne State University which has assisted biotech startups MitoStem and Asterand. Also the Great Lakes Stem Cell Innovation Centre (GLSCIC) together with the TechTown campus provide lab and equipment assistance where Astrerand company founder Dr James Eliason explains <i>“Detroit has a low cost structure. Balancing the high costs of equipment rental and lab space is a major hurdle for new biotech companies, so GLSCC offers shared office space with a generically quipped lab. Members rent a small space on the TechTown campus, and they also get access to entrepreneurial training, stem cell expertise and the opportunity to use more specialised equipment through Wayne State”</i> (Sands 2013).

City Structure Overview: **Detroit continued...**

Key Highlights:	Comments:
Other Considerations:	• GaWC classify Detroit as an <i>Beta -- city</i> with a <i>Global Network Proportionate Connectivity Score</i> of 0.22 (1.00=London) and the World Economic Forum classify the USA as a <i>Stage 3 Innovation Driven Economy</i>. • Instigating Detroit's long term recovery represents a mammoth task "<i>many factors have brought Detroit to this point, including a shrinking tax base that still had a 360-square-kilometre city to maintain; overwhelming health-care and pension costs; and city services crippled by aged computer systems, poor record-keeping and widespread dysfunction</i>" (Davey 2013) and requires substantial funding to redress the under resourced city services, administration, ageing infrastructure and high levels of unemployment and crime. • However some of the network structures and intelligent environments being developed and cited as examples in the network interactions above, demonstrate that these collective capabilities and synergies can be successfully developed through these joint ventures and support networks to enhance innovation capacities and speed to market production efficiencies.

Sources: (Bruegmann 2005; Brunn, Williams & Zeigler 2003; Burdett & Sudjic 2007; City-Data 2009a; City of Detroit 2009; Fainstein 1990; Ghose 2004; Globalization and World Cities (GaWC) Research Network 2010; Hart 1995; Kim & Short 2008; Lichterman & Seetharaman 2013; Morrill 2012; New Geography 2013a; Robbins & El-Khoury 2004; Ryan 2012; Sands 2013; Savitch & Kantor 2002; Taylor et al. 2011; US Census Bureau 2011a; US Department of Labor: Bureau of Labor Statistics 2013a; Vlasic 2013; Wayland 2013; Wikipedia 2013d, 2013e, 2013p, 2013q, 2013v; World Economic Forum 2013).

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

MICHELLE LEONG GLASTRIS

City Structure Overview: New York	
Indicative Development Stage: Mature	
Location: New York City located in the state of New York, USA Coordinates: 40°42'N, 74°0'W	
Key Highlights:	Comments:
Key Factors Contributing to City Structure Development Trends:	• In 1624, “New Netherland” was originally founded as a Dutch fur trading settlement on the site currently known as Lower Manhattan and was later called “New Amsterdam”. The city was ceded by the Dutch to the British who renamed the city “New York” in 1664. • New York grew as a trading port in the early 1700s and as “<i>slavery became integrally tied to New York’s economy through the labour of slaves throughout the port, and the banks and shipping tied to the South</i>” (Wikipedia 2013t). • New York was the last capital of the USA under the Articles of Confederation and the first capital under the Constitution of the United States (1787). With the “<i>Gradual Abolition Law of 1799</i>”, slavery was completely abolished in New York State by 1827 but discrimination was still prevalent. • Throughout the 19th century, development in New York flourished through its trade and commerce activities and with increased European immigration. The Commissioners’ Plan of 1811 was adopted to expand the “<i>city street grid to encompass all of Manhattan</i>” and the 1819 opening of the Erie Canal through New York was instrumental in connecting the port to its inland source of “<i>agricultural markets and commodities via the Hudson River and the Great Lakes</i>” (Wikipedia 2013t). In 1898 parts of the surrounding County and Brooklyn were consolidated with the city to form the City of New York which comprises five boroughs – the Bronx, Brooklyn, Manhattan, Queens and Staten Island. • During the first half of 20th century, the introduction of the subway (1904) connected the city; New York continued to gain world status as a city for industry and commerce; during the 1920s the city attracted “<i>African Americans during the Great Migration from the American South</i>” and its population exceeded 10M in the early 1930s; development in New York was further buoyed by the post World War II economic and construction boom (Wikipedia 2013t). • In the 1960s, de-industrialisation caused declines in employment in the manufacturing and industrial sector and the New York economy was adversely impacted by the Oil crises (1973-74, 1979 and 2003-08) and increasing levels of crime which continued into the early 1990s. • In the 1980s and 1990s, the global shift towards the service sector caused further stratification of and inequality in New York’s employment market where there were high paying jobs for knowledge-based professionals at one end and minimum-wage jobs at the other end of the employment spectrum. The income distribution implications of shifting from a manufacturing base to a service based economy were significant: “A strong manufacturing base allowed low-skilled workers to obtain relatively good wages. The service economy, in contrast, provides high-paying jobs for those with marketable skills, but more limited opportunities for low-skilled workers. For those lacking high educational attainment, opportunities exist only in the low-waged service sector” (Kim & Short 2008). The poor employment and income prospects for low-skilled workers were further exacerbated by outsourcing these low skilled jobs to other parts of the North American continent and overseas to take advantage of lower labour and manufacturing costs.

City Structure Overview: New York continued...

Key Highlights:	Comments:
Key Factors Contributing to City Structure Development Trends continued...	• By the 1990s, a series of factors further culminated in New York's development trajectory – these factors include a decline in crime rates through “<i>revised police strategies, improving economic opportunities, gentrification, and new residents, both American transplants and new immigrants from Asia and Latin America. Important new sectors, such as Silicon Alley, emerged in the city's economy. New York's population reached all-time highs in the 2000 Census and then again in the 2010 Census</i>” (Wikipedia 2013j). • The 2001 September 11 terrorist attacks on New York City resulted in a devastating loss of human life, city infrastructure and disruptions to economic/commercial and administrative activity (refer to syb section 7.3.2 Key Assumptions regarding the 2001 September Terrorist attacks for further details) and a decline in GDP of \$27.3B in the last three months of 2001 and during 2002. One World Trade Center, a 9/11 memorial and museum and the PATH station are completed and the three other office towers and the World Trade Center Transportation Hub are currently under construction (Wikipedia 2013x). • The Global Financial Crisis (GFC) occurred in 2007-2009 and its aftermath which is still be felt globally, had an enormous impact on its epicentre New York as a significant number of global investment banks, other financial institutions, investment markets and unsuspecting home owners and investors were caught in the global financial maelstrom and its systemic effects (refer to Appendix 6: Macro Event – Global Financial Crisis and its Impacts for further details). • In the early 21st century, New York has continued to gain prominence as a world/global city along with London and Tokyo and is attributed in large part to its high concentration of corporate headquarters, international business services firms and knowledge-based jobs and Wall Street as a one of the leading financial markets. • Top 4 Location Quotients (measures employment concentration where $LQ > 1.00$ denotes “<i>Industry is producing more than it consumed locally i.e. exporting</i>”) for New York City in 2011: 1) Fashion, Apparel and Textiles $LQ=3.12$; 2) Financial Services $LQ=2.32$; 3) Communications, Software & Media Services $LQ=2.08$; 4) Front Office & Producer Services $LQ=1.59$ (New York State Department of Labor: Bureau of Labor Market Information 2012). • As of the latest 2010 Census, New York City's Housing Market is comparatively tight with only 262,278 vacant dwellings or 7.8% vacancy. The housing market is also tightly held where out of the vacant dwellings, only 28,587 vacant dwellings or 10.9% of the vacant stock or 0.9% of the total dwelling stock is available for sale (US Census Bureau 2011a).
Major Macro Events and City Specific Events post 1950 (Earliest commencement of datasets):	• Post World War II economic and construction boom. • 1950s and 1960s African-American Civil Rights Movement gained support across America which raised awareness of discrimination and inequality and advocated the rights for African-Americans. This also raised the issue of segregation in areas such as Harlem, central Brooklyn and areas in the Bronx and Queens. • 1958 Worldwide Economic Recession • 1973-74, 1979 and 2003-08 - Oil Crises • 1980s and 1990s Structural change in the employment sector as New York continues to de-industrialise and shift towards professional and information service based jobs. • 2001- September 11 Terrorist Attacks on New and the present Global War on Terrorism • 2007-2009 Global Financial Crisis (GFC) and its aftermath.

City Structure Overview: **New York continued...**

Key Highlights:	Comments:
Impact of Recent Government Planning and Investment/Economic Policies & Decisions:	• 1916 Zoning Resolution prescribed building setbacks and building area to lot size percentages to ensure sunlight was able to reach street level. • <i>Federal Housing Acts of 1949 and 1954 prescribed redevelopment comply with a “comprehensive community plan” and “neighbourhood analysis” findings; urban renewal plans adopted a Modernist approach (Ryan 2012).</i> • The federal 1968 Housing Act sought to “<i>redress past wrongs like redlining backfired badly</i>” and Section 235 Program which “<i>subsidized any housing costs, including home purchase, for low-income families in excess of 20 percent of household income. Homes purchased under Section 235 were also insured by the Federal Housing Authority (FHA)</i>” and resulted in the Housing and Urban Development (HUD) taking ownership of a property if the owner foreclosed on his/her mortgage (Ryan 2012). Further exacerbating the situation were corrupt speculators who would “<i>purchase a home at a low price, conduct spurious “repairs” on the house, and resell it at a higher price to an FHA-insured buyer</i>” (Ryan 2012). Not surprisingly Section 235 was later suspended by the Nixon administration (1973) and subsequently cancelled. The incident has notable parallels and eerily foretells the catastrophic housing debacle that would unfold into the GFC decades later. • It has been advocated that structural trends such as Globalism tend to generate a “roller coaster economy” which in turn make it difficult to formulate public policy e.g. mid 1970s fiscal crisis coupled with increasing government expenditures and debts, post 1981 boom years, October 1987 stock market crash and ensuing rising unemployment and reduced operating costs, 1990s resurgence in the stock market which generated budget surpluses followed by the macro shock of 2001 September 11 (Savitch & Kantor 2002). However what this roller coaster ride does is build and strengthens a city’s resilience (as discussed in Chapter 6 with regards to the analysis of Economic, Household Disposable Income and Employment Resiliencies for New York). • Federal funding to New York has notably declined from close to 21% in the late 1970s to around 9% (circa 2002) as a result of cutbacks in or eliminations of programs e.g. Urban Development Action Grant program and the Community Development Block Grant. In 1993 New York City was designated one of the Empowerment Zones which enabled it to qualify for multimillion dollar funding to assist the area between Harlem to the Bronx however it has been noted that “<i>this program has yet to actually receive and spend most of the promised monies and it has attracted little business interest</i>” (Savitch & Kantor 2002:124). Consequently the State of New York supplements some of the city’s financing from the state’s tax revenues where a significant amount is generated from New York City. • The City Planning Commission and its planners have been criticised for not strongly enforcing integrated planning policies and directing land use activity, in contrast the mayoral agency the Economic Development Corporation (EDC), has been accused of being “<i>unconcerned with the environmental or aesthetic impacts of property investment. The EDC’s efforts resulted in a patchwork of major mixed-use projects in Manhattan and Brooklyn. These included Battery Park City in downtown Manhattan and MetroTech in central Brooklyn, both constructed during the 1980s; the renewal of Times Square in the Manhattan core, completed in the 1990s; and Columbus Circle, a huge structure also in midtown Manhattan, which opened in the 2000s</i>” (Burdett & Sudjic 2007 - Susan Fainstein’s chapter “Behind the Boom”:85).

City Structure Overview: **New York continued...**

Key Highlights:	Comments:
Impact of Recent Government Planning and Investment/Economic Policies & Decisions continued...	• Kantor and Savitch (2002) make reference to “growth promotion” in New York where important public programs e.g. <i>“zoning, tax, business incentive, infrastructure, housing and transportation...are designed in ways that facilitate the leveraging of private sector investment. New York is a high-tax city, but taxes are routinely reduced through abatement programs, land write downs, and other exemption techniques”</i> (Savitch & Kantor 2002:125). • In order to attract and retain jobs in New York and in particular Manhattan, a series of business incentive programs have been launched since the 1970s to attract large corporate employers, provide tax breaks to developers and commercial property owners, encourage business expansions or major developments by providing substantial tax breaks, loans and other benefits (Savitch & Kantor 2002:125). These “supply-side” packages are usually brokered by the mayoral agency, the Public Development Corporation. • One example of this is the deal brokered between Mayor Edward Koch and the National Broadcasting Company (NBC) in 1987. After 35 years of residing in the Rockefeller Center, NBC threatened to relocate its 4,000 workers to a site in New Jersey claiming the existing premises were obsolete and there were cheaper sites outside the city. Concerned that NBC’s exodus might initiate other major tenant relocations, the city persuaded NBC to stay by providing them with <i>“a package of assistance that included a tax break worth \$72 million in real estate taxes over a thirty-year period and \$800 million in bonds that were exempt from taxes. In addition, the deal also provided NBC with a freeze on future property taxes, while forgiving part of its commercial rent tax and freeing it from paying city sales taxes on at least \$1.1 billion on the purchase of new equipment. All told, keeping NBC cost city taxpayers nearly \$100 million in lost potential revenues. Similar and even larger packages of benefits have been dealt out to financial companies, entertainment enterprises, office-building developers, credit card firms, banks and sundry other businesses”</i> (Savitch & Kantor 2002:126). Whilst it is understandable to want to persuade major corporations to locate and stay in a global city like New York, it does beg the questions whether it is commercially viable and equitable for municipalities to be offering such a large quantum of supply side incentives and how this impacts property market dynamics. • Bonus Zoning and the trading of Air Rights were frequently used in the 1980s to bolster commercial densities and building heights. Zoning regulations have also been amended to allow for greater luxury residential conversions. Market driven forces rather than public policy have tended to dictate the redevelopment of strategically located areas as a result of strong competition for jobs, decentralisation of back office operations to lower cost suburbs and a high demand for luxury apartments. • In spite of such strong market driven forces, there has also been some attempt to protect and provide for those less fortunate. Examples include the provision of free health services within the city’s hospital system, free university education for city residents at some of the city’s public colleges, access to subsidised and/or inexpensive public transport system and the provision of a large shelter system for the homeless and some attempt at a check and balance system that enables local community boards to protect the interests of long-standing tenants; review and challenge proposed redevelopments and negotiate concessions for the public (Savitch & Kantor 2002). Overall, however these attempts still fall short of redressing the growing inequality gap between the poor and the working class and the wealthy. • Under the recent Bloomberg administration, there has been more of a concerted effort to examine land use planning and provide affordable housing yet the latter will be difficult to achieve given the high land acquisition costs and low profit margins on low end housing – further exacerbating the situation is older/obsolete affordable housing stock that is being permanently withdrawn for high end housing redevelopment.

City Structure Overview: **New York continued...**

Key Highlights:	Comments:
Primary Industry Clusters:	• According to September 2013 employment statistics for the New York-Northern New Jersey-Long Island Metropolitan Statistical Area (US Department of Labor: Bureau of Labor Statistics 2013c), there are over 8.71M people employed and the top five employment industry sectors were: 1) Education and Health Services (1,633,400 workers or 18.7% of Total Nonfarm workers); 2) Trade, Transportation and Utilities (1,614,900 workers or 18.5%); 3) Professional and Business Services (1,375,400 workers or 15.8%); 4) Government (1,205,800 workers or 13.8%); and 5) Leisure and Hospitality (797,700 workers or 9.2%). • New York predominantly specialises in banking, finance and insurance; business and professional services; health care, biomedical and science research; real estate; ICT and information technology; entertainment, media, film and publishing; and manufacturing. • Banking, Finance & Insurance– Includes Federal Reserve Bank of New York; JP Morgan, Citigroup; Goldman Sachs; American Express; Morgan Stanley; Bank of New York Mellon; Kohlberg Kravis Roberts; BlackRock; American International Group; MetLife; New York Life Insurance; TIAA-CREF; Travelers Companies; Loews and Guardian Life Insurance. • Business and Professional Services – Includes Deloitte Touche Tohmatsu; Ernest and Young; KPMG; PricewaterhouseCoopers; Omnicom Group; Interpublic Group of Companies; Miller, Canfield, Paddock & Stone; Lowe, Campbell Ewald; and McCann-Erikson • Commercial Real Estate Services – Includes CBRE Group; Jones Lang LaSalle; Knight Frank; Colliers International and Tishman Speyer. • ICT and Information Technology – Includes Google, Verizon Communications and Time Warner Cable. • Entertainment, Media, Film and Publishing – Includes Sony Music Entertainment; Warner Music Group, Universal Music Group; Wall Street Journal; New York Times; ABC; NBC; News Corporation; Time Warner; CBS; Fox; Viacom; Thomson Reuters and McGraw-Hill. • Performing Arts and Leisure: MOMA, Guggenheim Museum, Carnegie Hall, Broadway, Lincoln Centre, Metropolitan Opera, New York City Opera, New York Philharmonic and New York City Ballet, Juilliard School, Jazz and Lincoln Center, Lee Strasberg Theatre. • Manufacturing, Household & Personal Products and Apparel– Includes Colgate-Palmolive; Avon Products; Estee Lauder; Ralph Lauren; Footlocker; Leucadia National and Tri-State Biodiesel. • Healthcare, Biomedical and Science Research – Includes Bristol Myers Squibb; ImClone Systems; OSI Pharmaceuticals; Cura Gen; Alexion Pharmaceuticals and Pfizer. • Hospitals, Medical and Science Research – There are over 62 hospitals in New York which include Lincoln Medical Center; Albert Einstein College Hospital; Brooklyn Hospital Center; New York Community hospital; Bellevue Hospital Center; Mount Sinai Hospital; New York-Presbyterian/Weill-Cornell Medical Center; Flushing Hospital Medical Center; Mount Sinai Hospital Queens; Richmond University Medical Center and Staten Island University Hospital. Major biomedical research institutions include Memorial Sloan-Kettering Cancer Center, Rockefeller University, SUNY Downstate Medical Center, Albert Einstein College of Medicine, Mount Sinai School of Medicine and Weill Cornell Medical College. • Tertiary Education – There are at least nine major universities in New York – Barnard College, Columbia University, City University of New York, Cooper Union, Fordham University, New York University, New York Institute of Technology, Pace University and Yeshiva University. There are also numerous private colleges, religious and special purpose institutions which include St. John's University, the Juilliard School, Manhattan

City Structure Overview: **New York continued...**

Key Highlights:	Comments:
Primary Industry Clusters continued...	College, The School of Visual Arts and Wagner College.
Network Interactions:	- Given the incredibly diverse range of industry clusters and the housing of a large number of multinational/Fortune 500 companies, significant relationships, innovation and production synergies have developed both within and between different cluster groups. Given some of these clusters have a sizeable critical mass, the scales of production/economies of scale provides significant momentum in the sectors of banking, finance and insurance; business and professional services; health care, biomedical and science research; real estate; ICT and information technology; entertainment, media, film and publishing; and manufacturing. - For example “Silicon Alley” is host to a number of high tech and media industry clusters located along the Flatiron District down to SoHo and TriBeCa. Popular networking functions such as “First Tuesday” provided a regular opportunity for welcoming “500 to 1000 venture capitalists and entrepreneurs” in Silicon Alley and was an initiative of “law firm Sonnenschein and the Kellogg School of Management, as well as other corporate founders, including Accenture (then Andersen Consulting), AlleyCat News and Merrill Lynch” (Wikipedia 2013z). Silicon Alley has been gaining increasing prominence as a startup leader and is making significant investment inroads compared to Silicon Valley and Route 128 in Boston: “According to the National Venture Capital Association, 247 venture capital deals worth \$1.4 billion closed in New York in 2009, despite the recession and rocky market. New York still ranks third behind Silicon Valley and Boston in the number of deals and overall investment rates, but New York is holding its own against the other big hubs and possibly beginning to increase its share” (Wikipedia 2013z). - There are also considerable synergies between the private sector, hospitals and the universities and colleges which provide a stream of highly educated graduates as the new recruits in the labour market. There are strong industry ties and joint ventures between the biomedical research institutions, hospitals and universities.
Other Considerations:	GaWC classify New York as an <i>Alpha++ city</i> with a <i>Global Network Proportionate Connectivity Score</i> of 1.00 (1.00=London) and the World Economic Forum classify the USA as a <i>Stage 3 Innovation Driven Economy</i>. - New York has developed an extensive network structure and a range of intelligent environments that cultivate a high degree of explicit and tacit knowledge exchange and innovative capacity. Some of the examples cited above demonstrate these collective capabilities and synergies can be successfully developed through these joint ventures and support networks to enhance innovation capacities and speed to market production efficiencies. - In 2007, the former Mayor Bloomberg had announced in 2030 plans for the city to provide 265,000 new residential dwellings by allowing re-zoning to increase densities and making an allocation for affordable housing, use of subsidies to lower housing costs and significant investment in the mass transit system to improve access for people living outside the Manhattan core (Burdett & Sudjic 2007 - Susan Fainstein’s chapter “Behind the Boom”). The success of those plans is contingent on gaining support and approval from various levels of government, obtaining financing support and whether the newly appointed Mayor Bill de Blasio and successive administrations will continue to honour those commitments.

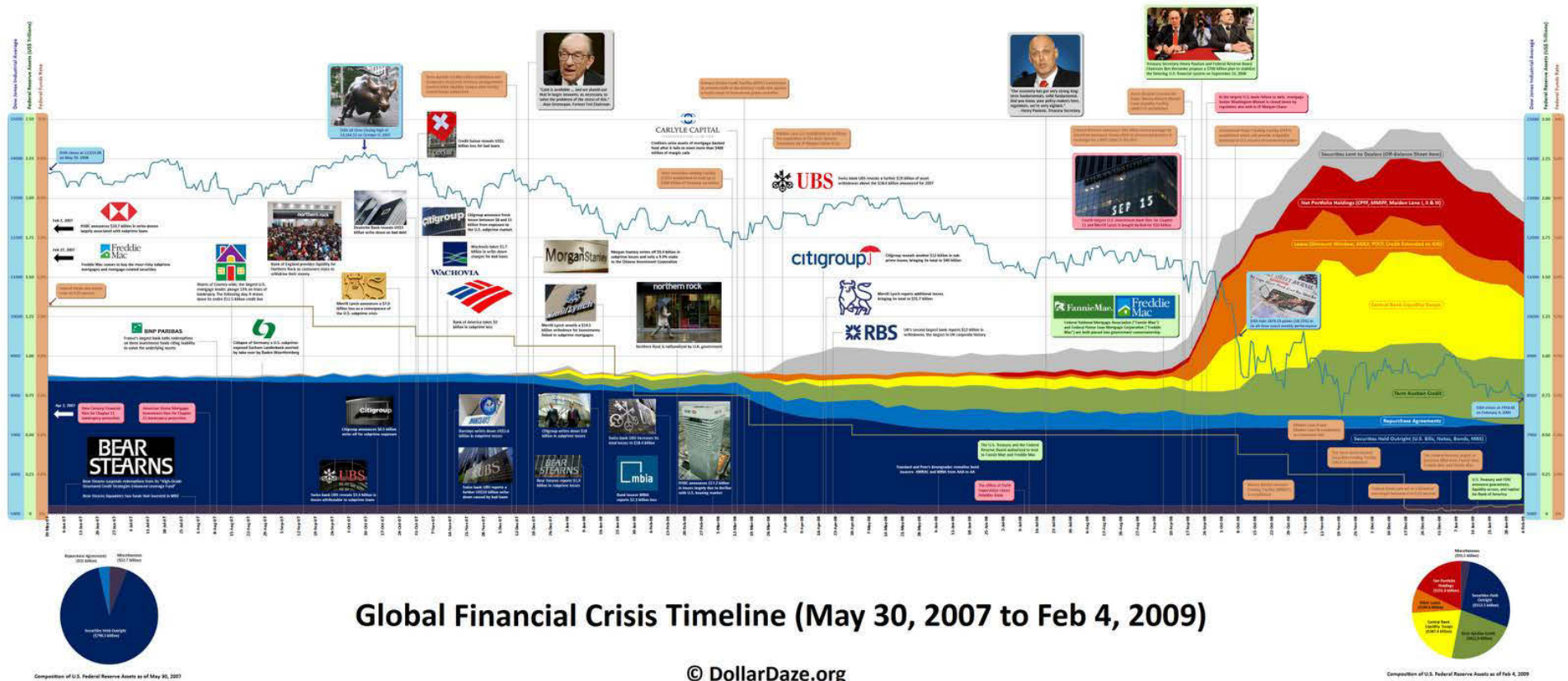
Sources: (Brunn, Williams & Zeigler 2003; Burdett & Sudjic 2007; City-Data 2009b; Day & Reibstein 1997; Fainstein 1990; Ghose 2004; Globalization and World Cities (GaWC) Research Network 2010; Kim & Short 2008; Morrill 2012; Mulligan & Crampton 2005; New Geography 2013b; New York State Department of Labor: Bureau of Labor Market Information 2012; Porter 1995; Ryan 2012; Savitch 2010; Savitch & Kantor 2002; Schneider & Woodcock 2008; Sorensen & Okata 2010; Taylor et al. 2011; US Census Bureau 2011b; US Department of Labor: Bureau of Labor Statistics 2013b; Watson 2012; Wikipedia 2013f, 2013s, 2013t, 2013z; World Economic Forum 2013).

10.6 Appendix 6: Macro Event – Global Financial Crisis and its Impacts

- Global Financial Crisis (GFC) Timeline
- Preliminary Analysis - City Structure Information System: Impact of GFC

EVALUATION OF KEY DRIVERS IN THE DEVELOPMENT PERFORMANCE OF CITY STRUCTURES

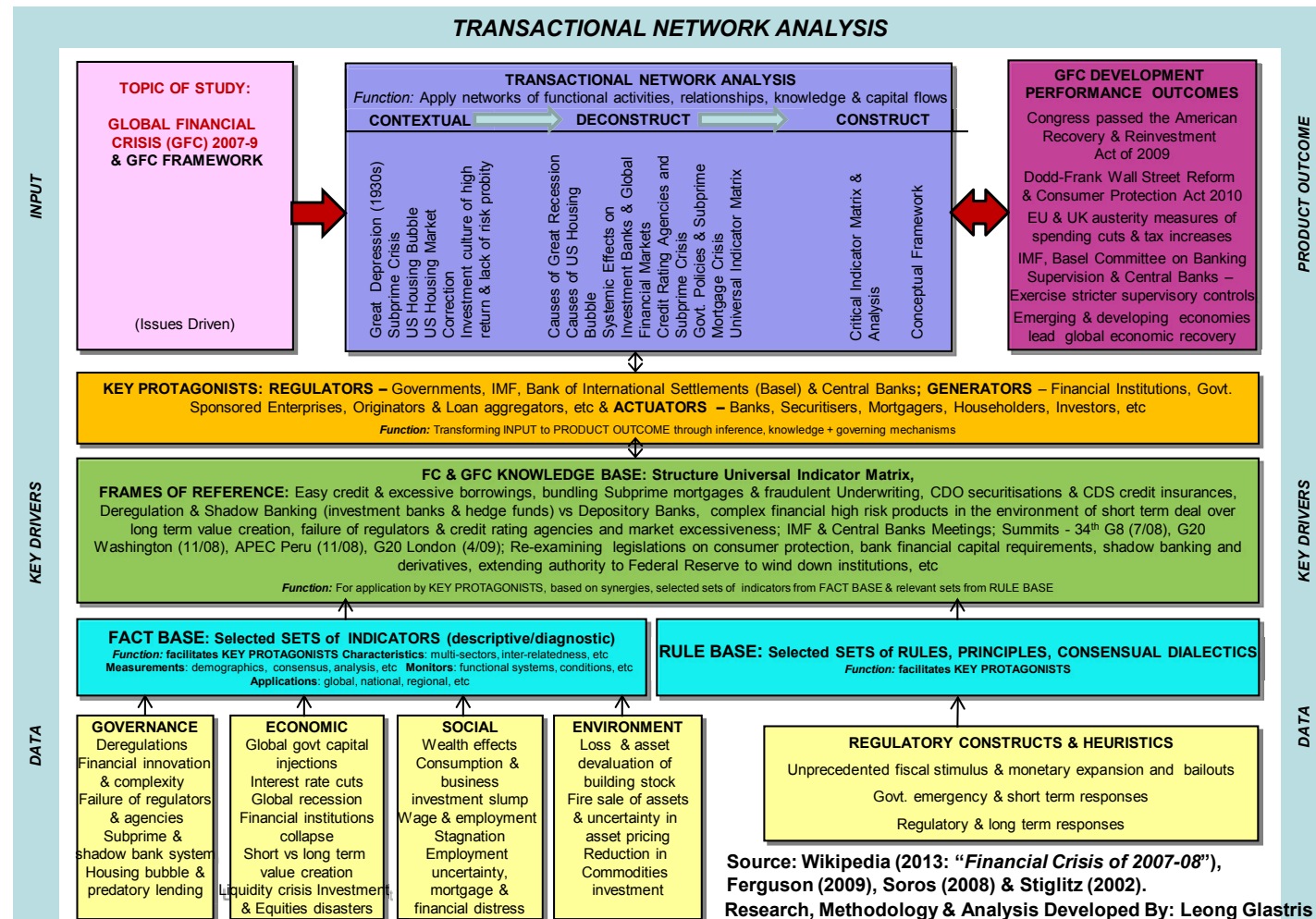
MICHELLE LEONG GLASTRIS



Source: University of New Haven Economics Department Faculty Blog, <http://unheconomics.blogspot.com.au/2012/09/trade-matters-john-rosen.html>

Global Financial Crisis (GFC) Timeline:

City Structure Information System: Impact of GFC



Source: (Ferguson 2009; Soros 2008; Stiglitz 2002; Wikipedia 2013h)

Preliminary Analysis - City Structure Information System: Impact of GFC

10.7 Appendix 7: Metrics for Intelligent Cities

- Table 7A: Metric for Intelligent Cities
- Table 7B: Indicator Comparison

Appendix 7A: Metrics for Intelligent Cities

Metrics for Intelligent Cities:

<i>Education and skills of the population</i>	<i>Knowledge and innovation institutions</i>	<i>Digital infrastructure and e-services</i>	<i>Innovation performance</i>
1 Population with tertiary-level education (per cent of 25–64 years age class)	1 Number of university students (per cent of total population)	1 City area covered by cable networks (per cent of total area)	1 EPO patent applications (per million of population)
2 Participation in life-long learning (per cent of 25–64 years age class)	2 Number of university staff (per million of population area)	2 City area covered by Wi-Fi networks (per cent of total area)	2 New trade marks (per million of population)
3 New S&E graduates (per cent of population aged 20–9)	3 Total R&D expenditure (per cent of GDP area)	3 City area covered by xDSL networks (per cent of total manufacturing enterprises)	3 Innovative enterprises-manufacturing (per cent of all)
4 Researchers in industry and services (per cent of total workforce)	4 Public R&D expenditure (GERD as per cent of GDP)	4 Computers (per million of population enterprises)	4 Innovative enterprises-services (per cent of all services)
5 Employment of tertiary-level graduates as per cent of total employment	5 Business R&D expenditure (BERD as per cent of GDP)	5 Internet connections (per million of population) of all enterprises)	5 Enterprises having internal R&D department (per cent)
6 Employment in medium and high-tech manufacturing (per cent of total workforce)	6 Business spending for licensing (per cent of turnover)	6 Broadband connections (per million of population)	6 Sales of new-to-market products (per cent of turnover)
7 Employment in high-tech services (per cent of total workforce)	7 Number of incubators (per million of population)	7 Users of e-gov services (per million of population) of turnover)	7 Sales of new-to-firm not new-to-market products (per cent)
	8 Number of S&T Parks (per million of population enterprises)	8 City enterprises owning a website (per cent of total)	8 New companies creation (per cent of total enterprises)
	9 Number of Technology Transfer and Innovation Centres (per million of population)	9 City enterprises involved in B2B or B2C (per cent of total enterprises)	9 Exports high-tech products (per cent of total exports)
	10 Exports high-tech services (per cent total exports)		

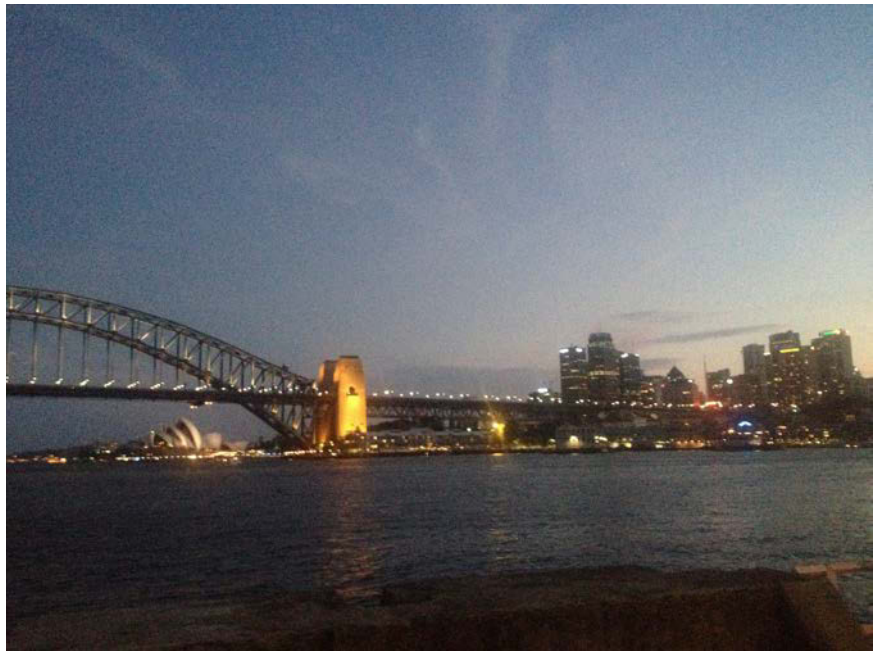
Source: Nicos Komninos (2008: 133)

Appendix 7B: Indicator Comparison

Comparison of Komninos' Metrics of Intelligent Cities and Leong Glastris' City Structure Universal Indicator Matrix	
1) Education and skills of the population	
Komninos' Indicator:	Leong Glastris Indicator:
1) Population with tertiary level education (% of 25-64 years age class)	59) Critical Indicator: SOCIAL - Health and Education > Completed Tertiary Educational Attainment (% of Total Population)
7) Employment in high-tech services (% of total workforce)	30) Universal Indicator: ECONOMIC - Workforce > Employment in Services (% of Total Employment)
2) Knowledge and Innovation Institutions	
Komninos' Indicator:	Leong Glastris Indicator:
3) Total R & D expenditure (% of GDP)	19) Critical Indicator: ECONOMIC - Economic Competitiveness > Research and Development Expenditure (% of GDP)
10) Export high-tech services (% of total exports)	39) Universal Indicator: ECONOMIC - Infrastructure Support > ICT Service Exports (% of Service Exports, BoP)
3) Digital Infrastructure and E-Services	
Komninos' Indicator:	Leong Glastris Indicator:
5) Internet Connections (per million of population)	32) Universal Indicator: ECONOMIC - Technology Transfer > Internet Users (per 100 people)
4) Innovation Performance	
Komninos' Indicator:	Leong Glastris Indicator:
1) EPO patent applications (per million of population)	43) Universal Indicator: ECONOMIC - Forms of Capital > Patent Applications, Residents (Number of Patents)
9) Exports high-tech products (% of total exports)	23) Universal Indicator: ECONOMIC - Infrastructure Support > High Technology Exports (% of Manufactured Exports)
<i>Source: Komninos (2008:133) & Leong Glastris</i>	

Notes: Numbers correspond to either indicators on Komninos' Table in Appendix 7A or indicators in Leong Glastris' City Structure Universal Indicator Matrix Table in Appendix 2. Yellow highlighted box denotes a Critical Indicator.

Chapter 11 References



Sydney CBD from Blues Point Reserve

Source: Kyle Willimott

*"We live on an island surrounded by a sea of ignorance.
As our island of knowledge grows, so does the shore of our
ignorance"*

(John Archibald Wheeler, American theoretical physicist (1911-2008))

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TOTAL DEPENDENCY RATIO:
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POPULATION DENSITY: <http://data.un.org/Data.aspx?d=PopDiv&f=variableID%3a14>

LIFE EXPECTANCY AT BIRTH, BOTH SEXES:
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Chapter 12

Contact Details



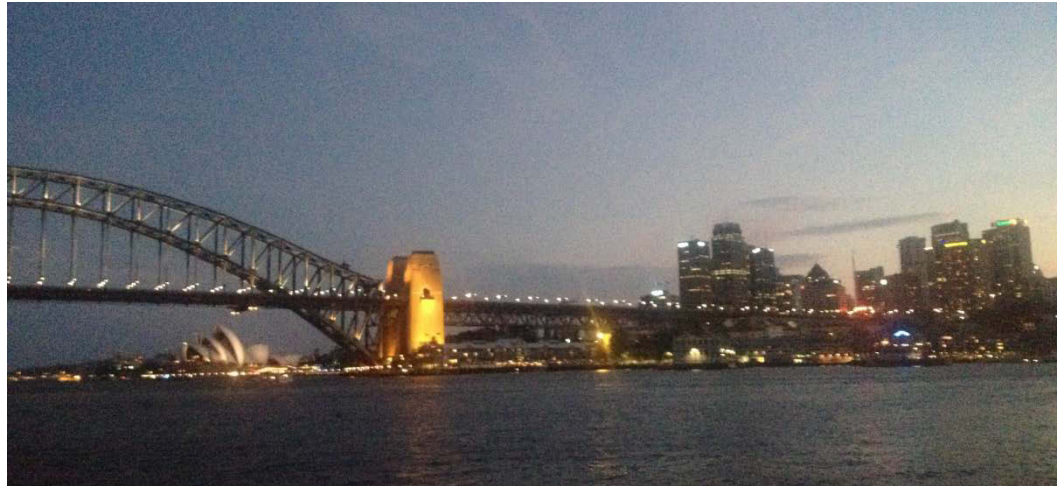
Sydney CBD – Hyde Park

Source: Leong Glastris

"What strange phenomena we find in a great city, all we need do is stroll about with our eyes open. Life swarms with innocent monsters."

(Charles Baudelaire, French poet (1821-1867), "Miss Scalpel")

12 Contact Details



**Sydney Harbour Bridge, Sydney Opera House and Sydney CBD
Skyline from Blues Point Reserve, New South Wales, Australia**

Source: Kyle Willimott

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Evaluation of Key Drivers in the Development Performance of City Structures



**City of Rockland on Penobscot Bay viewed from
Dodge Mountain, Rockland Maine, USA**

Source: Leong Glastris

"The city is our most remarkable invention. In this dynamic, cosmopolitan space lies the wellspring of our creativity as a species...And yet to be successful a city has to be open to continuous development, free to evolve and grow with the demands of new times...The greatest cities nurture and stimulate ideas in science and the arts that are at the very heart of human civilisation. For this reason, sustainable, humane and well-governed cities are our best hope for the future."

(Smith 2012: "City: A Guidebook for the Urban Age": 339)