The history and future of projects as a transition innovation: towards a sustainable project management framework

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1   Introduction

In a paper presented at the 33rd EGOS Colloquium titled '*Sustainability transitions; Exploring the emerging research fields and their contribution to management studies*', Jochen Markard traced the emerging field of sustainability transitions where he brought together ideas from scholars from various disciplines. Among others, Markard (2017, p. 4) compared the problem characteristics, scope, and solutions of historical project endeavours, like 'fly to the moon' with the contemporary complex challenges like climate change. Using this comparison, we propose that project management, which originated from aiding scientific and technological endeavours (such as building massive structures and lunar travel) should now also endeavour to deliver on complex issues facing our society such as global sustainability and climate change. How the project management discipline would meet these expectations is, however, still somewhat of a mystery.

The aim of the paper is therefore to review the history of projects and project management as a transition innovation and propose a sustainable project management framework that could point to how project management can transition further to meet the expectations of global sustainability. To fulfill this aim, we will first outline and analyze the historical trajectory of projects and project management. Our analysis will be based on a multi-level perspective on transitions (see e.g., Rip & Kemp, 1998; Geels, 2002; Smith et al., 2010), which we will use to illustrate how and why project management transitioned in the past to meet with the changes in societal demand. We will then present the challenges project management faces today to transition to meet the challenges of sustainable development and suggest a way forward. We are using a pathway suggested by systems scholars (Ackoff et al., 2006; Weisbord & Janoff, 1996) to present our argument by studying where we came from (our history), where we are heading (the future), and how to get there from where we are now (the transition).

The article is structured as follows. We start with a review of the perspectives on sustainable transitions and explain why we chose the multi-level perspective for our analysis. Thereafter we outline the method we have used to explain the development of project management using three levels of analysis (landscape, sociotechnical regimes, and technological niches). We then provide a history of projects from prehistoric times until project management was recognized as a profession (referred to as premodern projects), followed by the history of modern project management. After analyzing the history during these two periods, we will visually present how project management evolved due to the changes at the landscape level by developing niches that were supported by sociotechnical regimes to respond to societal changes. We will then discuss the challenges project management is facing in transitioning from its current state to meet the changes of sustainable development and encapsulate these challenges in a framework that can help us to carry out further research to transition to meet the new challenge. We conclude that by using this model as a starting point project management researchers and practitioners could move forward to lead project management's transition towards sustainable project management.

2   Background
The background consists of two parts. First, we will outline perspectives on sustainable transitions, and then present three levels of technological transition that will be used as the analytical framework to reflect on the historical trajectory of project management.

2.1   Perspectives on sustainable transitions
Although there are multiple perspectives on sustainable transitions, Markard (2017) suggests that, in general, they include:
1. The role of technology and technological innovation that transform sectors or industries (e.g., Building Information Models in construction)
2. Work with systems frameworks that look at 'strong interdependencies of technological, organizational and institutional changes' (p. 13) (e.g., sustainable development)
3. Pay attention to public policies (e.g., impact of digitization)
4. Include a broad range of actors and their interplay (e.g., the introduction of electric cars)
5. Context dependency (e.g., energy transitions across countries around the world)

Several scholars have developed frameworks to explain how sustainable transitions take place in practice and by addressing the aspects pointed out by Markard (2017). We will briefly review those frameworks and explain why we selected the multi-level perspective to investigate the evolution of premodern projects and modern project management. We will comment on how the multi-level perspective might play out in project management addressing the challenges posed by the need for sustainable development.

Some key frameworks used by transition scholars (Köhler et al., 2019) are:

Multi-level perspective used to describe dynamics of transitions (Rip & Kemp, 1998; Geels, 2002; Smith et al., 2010). This perspective combines ideas from 'evolutionary economics, the sociology of innovation and institutional theory' (Köhler et al., 2019, p. 4). It attempts to

explain transitions at the 'interplay of dynamics at three distinct levels: niches, regimes, and landscapes' (Geels, 2002).

Transition innovation systems (TIS) framework which explores 'the emergence of novel technologies together with associated institutional and organizational changes' (Bergek, Jacobsson et al., 2008; Carlsson & Stankewicz, 1991; Markard et al., 2015). It uses ideas from innovation systems theory and industrial economics (Köhler et al., 2019, p. 4).

Strategic niche management (SNM) (Rip & Kemp, 1998; Schot & Geels, 2008) combines ideas from 'sociology of innovations and evolutionary economics' (Köhler et al., 2019 p. 4) that emerge from spaces that shield them from market selection and are more deliberate.

Transition management (Rotmans et al., 2001; Loorbach, 2010) combines ideas from 'complexity science and governance studies' (p. 4) and proposes that policymakers shape transitions.

We propose using the multi-level perspective in our article as it looks beyond institutions and organizations to societal changes. It is also based on institutional theory that has gained more attention in project management research recently (Biesenthal et al., 2018). We consider sustainable development as a societal change promulgated by the General Assembly of the United Nations, which agreed on resolution A/RES/70/1 called 'Transforming our world: the 2030 Agenda for Sustainable Development' (United Nations 2015). This is an aspirational agreement among world leaders for a better and more sustainable world by 2030, which will have an impact on project management practices at a global level.

2.2 Three levels of transition

The literature on technological transitions has proposed ways in which such transitions take place through influences at multiple levels. These studies have investigated how technological changes have, over the long term, contributed to fulfilling societal needs by transformations influencing how technologies evolve due to societal pressures (Geels, 2002, 2004). Recently, researchers from the Sustainable Transitions Research Network (STRN) have urged that management scholars need to start studying technological transitions from the management perspective (Markard, 2017). The notion that project-based management can be considered '*as an innovation that may influence both the technical and social system of the organization through new structures, methods, technical systems, and behavioural patterns*' (Martinsuo et al., 2006, p. 87) has been explored by project management researchers.

In this article, we want to examine project management as a management innovation that was driven by technological needs (e.g., building weapons using complex technologies during World War II), and has been progressively reconfigured due to external pressures to play a socio-technical role by paying more attention to people-oriented factors in managing both technical as well as non-technical aspect of projects. To do so, we will use a multi-level perspective on technological transition (see e.g., Geels, 2002, 2004). The three levels

proposed are landscape level, socio-technical regimes, and technological niche based on similar frameworks used by scholars writing about sustainability transitions.

Based on how sustainable transactions have been depicted by scholars (Geels, 2002) the transition of innovation starts when innovators sense that these changes are taking place at the landscape level, and they need to develop technological niches to cope with these challenges. However, these innovations need the support of socio-technical regimes (markets, policies, political support) for the technological niches to be recognized as able to provide stable solutions to meet the challenges of the landscape level. Thus, there is a lag between when the technological niches start reacting to landscape-level changes followed by socio-technical regimes to address the demands of these changes.

2.2.1   Landscape level

At the highest level (i.e., landscape) we look at how changes in the landscape have influenced or have been influencing project management as an innovation. According to Geels (2002, pp. 1261-2), transitions at niche level happen at a micro-level through innovations while the meso level socio-technical regimes offer some stability and 'provide gradients for trajectories' (p. 1261). The macro-level landscape items are 'slow changing external factors' that influence the socio-technical regimes. In our evaluation of the trajectory of the project domain we will thus look at how the landscape factors triggered micro-level improvements in project management techniques or routines which needed the support of socio-technical regimes to improve project management practices.

2.2.2   Socio-technical regimes

At the second level, we want to study how socio-technical regimes have influenced the evolution of project management. Geels (2002) builds up the concept of socio-technical regimes based on Nelson and Winter's (1982) definition of technological regime, mentioned in the previous section, and Rip and Kemp's (1988) elaboration of the concept to 'complex engineering practices, production technologies, process technologies, product characteristics, skills, and procedures' (p. 340). Geels (2002, p. 1260) argues that 'there is a social element to it as technical trajectories are not influenced by engineers, but also by users, policy makers, societal groups, suppliers, scientists, capital banks etc.'. So, in our evaluation of socio-technical regimes we will look broadly at external influences that have had an impact on how project management transitioned over time to deal with societal-level demands.

2.2.3   Technological niches

The bottom level is that of technological niches or innovations introduced to the management field that are more 'technical'. We use a broad definition of technology here to embrace techniques. This level is thus called technological niches to include innovations introduced. A question could be raised as to whether project management is a niche like the niches used in technology transitions. While niches are usually portrayed as new technologies, we argue that new routines can also be considered as niches. This is in line with Nelson and Winters's (1982) work on evolutionary theory of economic change where business practices (such as the

ones used in project management) 'tend to be routines' (p. 267). Nelson and Nelson (2002, p. 26) define routines as 'a collection of procedures which, taken together, result in a predictable and specific outcome'. Nelson and Nelson (2002) also propose that we often associate 'social technologies' rather than 'physical technologies' with institutions. So, we would like to consider project management techniques (or routines) as social technologies from an institutional theory perspective in constructing our multi-level analysis.

3   Method

A previously mentioned, we base this article on reviewing how project management has developed over centuries but with a focus on the past sixty years when it started becoming recognized as a distinct profession on its own. With this historical overview as a basis, we will map the developments and trajectory along the three levels described above. To do this, we will list the significant events that have shaped the way project management evolved during the two periods (pre-modern and modern). We have used the literature to trace these events to develop a visual representation of events that explain the socio-technical transition of project management over time. We then explore why project management needs to transition further due to the challenges posed by sustainable development as the current methods used in projects will not take it there. Three questions we have focused on when reviewing the literature are:

1. How have authors who have studied the evolution of projects before the development of modern project management, divided the periods of development of projects and depicted their development during the pre-modern period?
2. How have authors who have looked at the history of modern project management divided the periods of the development of project management and depicted its development during the period?
3. What are some future trends predicted by scholars and practitioners that are likely to require modern project management to transition further?

Focusing on the needs of sustainable development (which is the theme of this special issue), we have further considered the following two questions:

4. How have scholars and practitioners described project management's response to the need for sustainable development so far?
5. How can modern project management overcome some of the difficulties expressed by scholars and practitioners to respond effectively to the need for sustainable development?

We have used different sources of literature to answer questions 1 and 2. For the premodern projects we have used two contemporary books (Chia, 2010) and (Kozak-Holland, 2011), which have described and evaluated the evolution of project management during that period. Table 1 provides the chronology of projects according to these sources. We have then used the analysis carried out by Chia (2010) to create Figure 1, which shows the multi-level analysis of the transition of premodern projects. Table 2 explains how we have segregated the periods of modern project management based on several key sources of literature from books and journal articles. Figure 2 shows the multi-level analysis of modern project management. The method we have used for the analysis of the transition to identify items under the three

levels of analysis (landscape, socio-technical regime and technological niche) is explained in Section 4 – Analysis and Findings.

To answer questions 3 to 5 we have reviewed the recent literature on predictions about the future of project management and then looked specifically at the literature on how scholars expect project management to transition further to the answer the call for sustainable development as it is the focus of the special issue in which this article is being published. Based on the analysis of the literature on sustainable project management we have proposed a model/framework shown in Figure 3 to carry out research to answer question 5 while also anticipating how technological niches and socio-technical regimes that are observed now can pave the way to this transition.

4   A brief historical overview of projects and project management

The history of projects and project management has been divided into: premodern projects, before project management became known as a profession; and the development of modern project management, starting around 1940. Based on a review of literature of project history, we will, in the following sections, outline some of the important historical events and projects.

4.1   Project management before it became known as a profession

We all know that large-scale endeavours such as the building of the pyramids must have used processes, tools, and techniques to get the job done. Time and cost may not have been the driving force for these endeavours, but they were considered politically important to the sponsors or champions who financed and resourced them. Although there have been historical accounts of how such endeavours came about, we look at two recent works that have explored the history of project management. The first is an account by an architect and project manager who has traced the history of project management from earliest time to 1900 AD (Chiu, 2010). The second account is by a consultant who has been publishing a series of books on lessons learned from history and has consulted on managing projects to Fortune 500 firms (Kozak-Holland, 2011).

Chiu (2010) classifies his research into the following areas (p. 11): Project environment (divided into *Historical and cultural environment* and *Knowledge and scientific environmen*t); Management (*General management and interpersonal skills);* Knowledge of application area (divided into *Construction technology* and *Master builder tradition*); and Application of expertise areas to project activities. The period over which projects have been investigated by Chiu (2010) range from 30th century BC to 19th century AD. He highlights 20 prominent buildings that have been built from early times in Mesopotamia in south-west Asia until the Industrial Revolution.

Kozak-Holland (2011) covers the history of projects from village to the city, from 2550 BC to the 20th century, when the Second Industrial Revolution, or Technological Revolution, took place. While both accounts cover similar projects, Kozak-Holland (2011) explores these projects using the processes and knowledge areas included in the Project Management Body of Knowledge or PMBOK (PMI, 2017) whereas Chiu (2010) does not use the PMBOK to analyze the projects as he felt that it was a 20th century event. However, Chiu (2010) uses a

broader definition of project management as 'the application of knowledge, skills, tools and techniques to project activities to meet project requirements' (p. 207), which is a definition that PMBOK uses as well. Kirk-Holland's book also lists many projects in China such as the Terracotta Warriors, as well as Angkor Wat in Cambodia, and some significant voyages.

We may be familiar with most of these projects as tourists and have learned about their history from travel books or brochures, often embellished by local tourist guides. In this article, we will look at them as premodern projects that laid the foundation for the birth and evolution of modern project management. Table 1 shows the chronology of projects during this period.

<Insert Table 1 here>

4.2   The development of modern project management

The development of modern project management has been discussed widely in the literature from a variety of perspectives: using history (Kwak, 2005; Garel, 2013; Morris, 1994, 2011, 2013; Stretton, 2007, Weaver, 2007, Jacobsson and Wilson, 2018); trends (Crawford et al., 2006); trends in research (Turner et al., 2011; Gauthier & Ika, 2012; Söderlund, 2004; Kloppenborg et al., 2000; Biedenbach & Jacobsson, 2016); perspectives or schools (Söderlund, 2002; Turner et al., 2010; Jacobsson & Söderholm, 2011); and advances in education (Wirth, 1992). Some scholars have also predicted how project management might change in the future (Morris, 2013; Kloppenborg et al., 2000; Gauthier & Ika, 2012; Walker & Lloyd-Walker, 2019). Additionally, the key project management associations have made predictions about the trends in project management. From the Project Management Institute (PMI), we have looked at an article published in the PM Network by Guarino (2014) and the recent Pulse of the Profession Reports, and from International Project Management Association (IPMA), we have looked at their report that predicts fifteen future trends. Professor Peter Morris has been writing about the history of project management since the 1990s. He has also selected different periods for analysis in his works. Table 2 compares the segregation of the history of project management in terms of time periods and concepts or events that have influenced the development of project management.

<Insert Table 2 here>

5   Analysis and findings

Having outlined a historical account of premodern projects and modern project management, we will now analyze the trajectory of project management using the multi-level perspective described in the background earlier. While our focus is the transition of modern project management, the transition of pre-modern projects also has an influence on some aspects of modern project management.

5.1 Pre-modern projects

Figure 1 shows our multi-level analysis premodern projects. Our multi-level analysis, based Chiu's (2010) review of project management history, is classified under four headings:

- Historical and cultural environment
- Knowledge and scientific environment
- General management
- Construction technology
- The Master Builder Tradition

Items at the landscape level were drawn from the discussion on historical and scientific environment. Items at the socio-technical regime have been drawn from the discussions on knowledge and scientific environment, general management, and Master Builder tradition. Items at the technological niche level have been drawn from construction technology, general management, and knowledge and scientific environment. The itemization is based on our judgment of what we identified as belonging to the three levels.

We supplemented the analysis by Chiu (2010) using Kozak-Holland's (2011) book and the following categorisation.

- Trends and changes (Landscape)
- Impact of changes (Sociotechnical regime)
- New tools techniques and breakthroughs (Niches)

The reason for relying mainly on Chiu's (2010) work is because Kirk-Holland used the PMBOK to analyse the projects, which is a standard developed during the modern project management period in the 1970s.

<Insert Figure 1 here>

5.1.1 The period from ~2100 BC to 500 AD (Antiquity)

This period covers the historical period from the establishment of Mesopotamia through to ancient Egypt, ancient Greece and the Roman empire.

5.1.1.1 Landscape level

The world moved from being a hunter gatherer society to become an agricultural society during the Sumerian period, which led to the development of cities as people moved from forests to urban areas with farms. This created the need for social structures resulting in hierarchical societies ruled by royalty and priests. The Egyptians enhanced the legal and social systems developed by the Sumerians. The Greeks introduced democracy. The Romans used knowledge developed by past cultures to build an extensive empire that led to colonisation.

5.1.1.2 Socio-technical regimes

The Sumerians under Hammurabi established the means to manage people and introduced managerial controls and demanded that transactions be recorded creating a system of checks. The Egyptians developed goals and tasks for managers to build ambitious structures like the pyramids under the leadership of the pharaohs. The Greeks added to the concept of leadership through the treatise of Thucydides and emphasised the need to pay attention to human behaviour. The Romans developed strategies to manage their vast empire including developing alliances to delegate control. The separation of management and leadership was further strengthened by Julius Caesar, as the Roman Empire created a system of distributing power between the executive, legislative and judiciary. During this period, the need for advanced design and construction skills such as the building of the ziggurat created the need for complex skills to build tunnels and operate machinery like levers, pulley, winches, and cranes. Master Builders emerged as the need for people to design and construct complex structures arose, and they also needed skilful apprentices to work under them to carry out specific tasks under their mentorship. The rise of the Master Builder is the first sign that people with project management skills were required.

5.1.1.3 Technological niches

Religious and social concerns led to the development of construction techniques to build dwellings and temples. As more permanent buildings were needed tools such as the Archimedes screw and wheel to act as a pump for water were invented. Egyptians started working with better materials such as stone, wood and copper and are believed to have used levers in the building of the pyramids as well as ramps, scaffolding and cranes. Surveying tools helped Egyptians to align pyramids symmetrically. Greeks developed construction tools further by building a complex crane and introduced hydropower. Romans added concrete to building materials as well as chalk and sand. They also added new machinery such as water mills and the use of pneumatics.

5.1.2 The period from ~600 AD to 1500 AD (Medieval Period)

This covers the historical periods starting from the Byzantine Empire, through to the Islamic Age, Crusades, Romanesque and Gothic Age.

5.1.2.1 Landscape level

During this period, art and architecture developed resulting in taller, more elegant, and decorative buildings. The Roman Empire fell and the development of culture shifted to the East while Europe faced the dark ages. The Crusades were launched by the Vatican to stop the Muslim armies from invading Europe and slowly Europe recovered. As trade and diplomacy advanced Islam rose creating cultural consequences. The Catholic Church reacted to the rise of Islam setting the scene for the Renaissance.

5.1.2.2 Socio-technical regime

The Islamic Golden Age was responsible for the advancement of social knowledge and science. It also created important institutions including a public library. The European

university systems were established during this period. Cottage industries were created with groups working together to produce products. As Gothic cathedrals required decades to build, long-range planning and governance structures were introduced. While buildings were based on the vision of a Master Builder, artisans were needed to support the construction who advanced their craft through artisan guilds.

5.1.2.3 *Technological niches*

Monuments like the Hagia Sophia continued to use several new tools but the major advances were domes that had to be supported. While the Byzantine Empire started building domes and arches, the Islamic mosques added ornamental workmanship to mosques being built at this time. The buildings of the Islamic Age became artistic masterpieces resulting in an aesthetic drive to render beautiful buildings such as the Dome of the Rock in Jerusalem. During the Gothic period, pointed arches influenced by the Islamic architecture appeared. Decorative carved screens also were influenced by the ornamental workmanship that developed in the mosques. Thus, a blending of Western and Eastern practices developed in the construction of religious buildings.

5.1.3 *The period from ~1500 AD to 1940 (Renaissance to Industrial Revolution)*

This covers the historical periods covering the Renaissance, Baroque, and the Industrial Revolution.

5.1.3.1 *Landscape level*

During this period, rational thinking came to the fore despite religion continuing to be important, and that paved the way for the Industrial Revolution. During the Renaissance, the world began to move away from the Catholic Church providing an opportunity for Protestantism to rise and the transition from Church to State began. The introduction of steam power helped create machines that could replace manual labour. People started living in cities contributing to urbanization as they moved away from an agrarian life.

5.1.3.2 *Socio-technical regime*

During this period, management ideas began to be adopted. Leadership moved away from someone who was justified as a moral exemplar to one who possessed manipulative skills and used violent tactics. Reformation gave support to the rise of capitalism and scientific rules for reasoning influenced management. The Industrial Revolution created the need for mechanisation and stressed efficiency and productivity. Standardisation, development of routines and quality control became important, and Frederick Taylor's experiments with scientific management investigated ways to improve productivity. The status of the Master Builder started to decline as general contractors started building structures designed by architects thus creating a division of work.

5.1.3.3 *Technological Niches*

The introduction of steam power introduced during the Renaissance made further inroads. The process of design and construction changed, and demand for buildings exploded creating the

need for mass production to keep up with the demand. Metals became used more in construction as they were now more freely available. The introduction of electricity and locomotives aided in the rapid development of manufacturing and the rate of innovations increased.

In summary, our general observation from the multi-level analysis of the pre-modern period is that this period was mainly concerned with improvements in construction and not on management which seem to have found its importance from 1000AD to 1940 with the Industrial Revolution. While Master Builders in the pre-modern period oversaw projects they also designed and engineered them like modern day architects like Frank Gehry, who also tend to project manage their creations (Korody, 2015).

5.2   Modern project management
Figure 2 shows our multi-level analysis of modern project management.

The landscape level shows our classification of changes at industry, organizations and project levels ending in sustainability. This classification was arrived at from the views expressed by prominent project management researchers (listed in Table 2) as well as our own general awareness of the trends at the global level that have influenced socio-technical regimes. We have also taken note of the classification of the turning points in the evolution of project management by Peter Morris. (Morris, 2011, 2013).

Under socio-technical regimes, we have also included movements like Rethinking Project Management and Making Projects Critical as turning points in project management. Conferences like International Research Network on Organizing by Projects (IRNOP), PMI Research Conference, European Academy of Management (EURAM) and European Group of Organisation Studies (EGOS) where Project Organizing Special Interest Groups (PO SIGs) were established as well as journals that had an influence to steer the field in its research endeavours have been included. These may not be obvious to people who are not familiar with project management research.

For the niche level, the literature reviewed on the history of project management contributed to their itemization. However, some judgment has been exercised in positioning a technique to where it became more important than when it was first used. For example, while risk management was used much earlier in projects it became more prominent after the global recessions from 1970 to 1990.

<Insert Figure 2 here>

5.2.1   *The period from before 1950s*
Although project management started being recognised as a discipline after 1950s, we have included a short period before 1950 as some key tools used in modern project management

evolved then and can be considered as technological niches contributing to the development of modern project management.

5.2.1.1 Landscape level

During the period before 1950, the world was engaged in World War II when defence took priority.

5.2.1.2 Socio-technical regime

The Manhattan Project to develop an atomic weapon provided the place for collaboration between government and scientists that helped project management to be identified as something unique and complex that had to be completed on time with severe constraints.

5.2.1.3 Technological niche

Gantt charts developed in 1910 and are still used in project scheduling. Flowline scheduling was introduced in 1930 followed by the line of balance technique in 1940 and milestone charts in 1940s.

In summary, this period mainly contributed to technological niches that were adopted by the project management profession as it developed in the next period in project scheduling.

5.2.2 The period from 1950s to 1970

5.2.2.1 Landscape level

With the end of World War II, post-war reconstruction started with large pipelines such as the Alaska Pipeline and transport infrastructure was created to help economic renewal. US President Eisenhower signed the Federal Highway Act in 1956 authorizing the construction of highways. Similar development of roadways also started in Europe. Large investments were also made in Aerospace during this time to bolster defense due to the Soviet Union developing nuclear missiles after World War II resulting in the Cold War.

5.2.2.2 Socio-technical regime

While the Manhattan Project has been often cited as the project that gave rise to project management, there has been some recent debate about whether it really did that (Lenfle & Loch, 2010). However, we retained it as a regime as major defence projects did give the impetus to identify project management as being different form general management. Between the 1950s and 1970s project management became recognized as a profession with the establishment of peak bodies, such as PMI and IPMA. Paul Gaddis's article about the project manager in the *Harvard Business Review* of 1959 explained the role of a different type of manager who used a particular process to create a product in a specific way. During this period, project management was influenced by systems theories and practices due to its application in defence systems. The concept of the 'iron triangle' became established as a way of determining project success using time cost and quality as measures. While the *Project*

Management Journal was started during this period, it focused primarily on project management practices.

5.2.2.3   Technological niches

This period resulted in the development of several technological niches as the application of project management spread to cover a variety of industry sectors. The critical path method was developed to ensure that activities on the critical path in a schedule, that could delay a project, received due importance. Due to the uncertainty in estimating duration in schedules, PERT (program evaluation and review technique) analysis was introduced, based on three times estimates (optimistic, pessimistic, and most likely) for every activity. The precedence diagramming method was developed, using nodes to represent activities leading to a project schedule network diagram, which allowed project managers to decide when to start activities so as not to cause delays in projects. Cost/schedule control systems were developed to relate cost and time to manage overruns, which later became known as earned value management. Work breakdown structures were introduced to break down the project into manageable parts. Value engineering to analyze how costs can be reduced and configuration management to keep track of changes were developed. With the publication of the first PMBOK, the professionalization of project management was established. As projects expanded into delivering initiatives within organizations, the sharing of resources between the functional and project parts of the organization gave rise to matrix organizations, where people from the functional parts of the organization were assigned to work in projects for specific durations. The drive to improve the management of procuring materials and services resulted in the development of procurement management, which later grew into the discipline of supply chain management. Graphical techniques were developed to manage scheduling visually as GERT (graphical evaluation and review technique). Program management became recognized as a way of aligning projects working towards a common goal to share resources and pacing of projects.

In summary, the landscape level changes pointed to the importance of post-war reconstruction, which included building large pipelines to transport oil. The technological niches supported the evolution of tools and techniques to improve the project management processes. At the socio-technical regime level project management was supported by its recognition as a new way of managing supported by the establishment of peak bodies that contributed to its acceptance as a new profession.

5.2.3   The period from 1970 to 1990

5.2.3.1   Landscape level

The recognition of effects of complexity such as Chaos Theory and the Butterfly Effect (Gleick, 1987; Lorenz,1995) became important to project management practice as projects started facing uncertainty and complexity that led to major failures of projects. The development of information and communication technologies led to software to support projects as well as facilitating easier collaboration with partners and outsourcing. The importance of corporate strategy promoted by scholars like Michael Porter (1980) provided an

opportunity for projects to become important to deliver organizational strategies instead of merely being used as tactical tools.

5.2.3.2   Socio-technical regime

The period from the 1970s to 1990s saw project management applied to large-scale construction projects such as the Trans-Alaska Pipeline. These projects used some of the experiences gained from large-scale defence projects. The bodies of knowledge to guide project management started appearing in 1980s. Different forms of contracting appeared during this period, which became the forerunners of public-private partnerships that enabled developing countries to undertake large-scale projects urgently needed for the development of basic needs. As projects became bigger, they triggered environmental issues that created an awareness of the environmental impact of projects. The DSDM (dynamic systems development method) added foundations of governance to agile methods and aided continuous customer involvement. Computer-aided design took over from producing drawings manually. The certification of project managers was introduced, adding to the professionalization of project management. Complex projects began to be recognised as wicked problems as urban development projects often did not produce solutions to address the problems they were meant to address (Rittel & Weber, 1973). Project management researchers recognized the need for more theoretical inputs into project management and this triggered the setting up of the *International Journal of Project Management*, which is now the highest ranked project management journal.

5.2.3.3   Technological niches

Although time and cost were important to manage, it became clear that resources also need consideration especially where they are scarce and expensive. This led to the need for resource management techniques (1970). Risk also became an important aspect of projects to manage and risk management techniques such as the risk matrix and risk breakdown structure developed (1980). As the contribution of people and team gained prominence, the performance of teams became critical. Work done on high performance teams in organizational research became relevant to projects. In addition to work breakdown structure, organizational breakdown structure became critical for project control and delegation of authority. This led to the development of the role and responsibility matrix or RACI (responsible, accountable, consulted, and informed) charts (1980). Due to the need for regular review of projects to make go/no go decisions, stage breakdown structures came into play, which later became the Stage-Gate Approach to governance. A broader view of project management using the term 'management of projects' was conceived to move the field's attention from an internal focus on the iron triangle to an external focus on stakeholder satisfaction (Morris, 1994, p. 63). The role of project owner or project champion became prominent as projects needed organizational support and had to deal with organizational politics to be successful. The use of agile project management methods such as Scrum were adopted by software projects to improve project success.

In summary, the landscape level pointed out the recognition of complexity theories on management, the influence of the Information Age and the need for organizations to have a strategic view. The technological niche level responded with more sophisticated tools to improve project management processes, recognizing the importance of projects to organizations, and introducing new ways to manage the increase in IT projects. At the socio-technical regime level, support was provided by the need for accrediting project managers, identifying ways to address complexity in projects and adopting a business orientation of projects. The need for theoretical support to advance project management paved the way for more research in project management.

5.2.4   The period from 1990 to 2010

5.2.4.1   Landscape level

As projects became larger in size and created social issues such as land acquisition and ecological damage, and the focus on megaprojects (Flyvbjerg et al. 2003) and their impact on sustainable development became important. The ethical and social responsibilities of project managers and leaders became important as projects became increasingly used to contribute to international development through aid projects.

5.2.4.2   Socio-technical regime

The period between the 1990s and 2010 made the project management profession realize that projects should be strategic tools, and this led to the development of project portfolio management, project management offices as well as project governance. Nevertheless, projects were failing measured by conventional project management metrics and a rethink on how to manage projects was required (Williams, 2005). This led to the ESPRC-sponsored research program on Rethinking Project Management (Winter et al., 2006). Special conferences and SIGs were organized such as IRNOP, PMI Research Conference and PO SIGs in prominent management conferences that further emphasized the need for applying organizational theories to projects.

Meanwhile, Scandinavian scholars continued to conceptualize projects as temporary organizations (Lundin & Söderholm, 1995) and the term 'projectification' was coined in a study of how Renault improved the efficiency of its product development process by moving from a classical functional organization to a project-based organization and using powerful project teams (Midler, 1995).

Some scholars who were involved with the Rethinking Project Management Network started looking at a critical theory perspective of projects, giving rise to the Making Projects Critical movement (Hodgson & Cicmil, 2006; Jacobsson, Lundin & Söderholm, 2016). As projects became larger and more complex, ways to deal with complexity in projects were developed (Remington & Pollack, 2007; Maylor & Turner, 2017) and organizations such as the International Centre for Complex Project Management were set up to bring together scholars and practitioners to improve the management of large-scale complex defence projects which also benefited other sectors.

The need for an organizational perspective of projects intensified and project leadership came into prominence as it was felt that project managers who managed large complex projects needed to change from being transactional leaders to becoming transformational leaders. Some scholars started promoting the notion that projects are a business in themselves (Artto & Wikström, 2005). The *International Journal of Managing Projects in Business* was started, to signify the importance of projects to businesses.

5.2.4.3 Technological niches

The organizational perspective on project management resulted in the need for strategies and tools to support Organizational Project Management (Müller et al., 2019). As agile project management, which was mainly used in IT projects became more popular, it started spreading to other projects, and organizations adopted hybrid methods to deliver projects successfully.

In summary, the landscape level demanded that more attention be paid to societal responsibilities and the protection of the environment. The rise of megaprojects further exacerbated the concerns for society and the environment. The technological level responded by recognizing that prescriptive ways of managing projects had to change and methodologies needed to be carefully selected to respond to landscape-level needs. The need for an organizational view of project management also received more attention. The socio-technical regime responded by establishing special forums and initiatives to support research and improvements in project management practice to meet the needs felt at the landscape level. The link between business and projects was enhanced by the introduction of a journal linking the two. The need of leadership responsibilities of project managers to address complex issues was recognized. It also became evident that projects were expanding in scope and variety and pervading the society, and a new term 'projectification' became used in practice.

5.2.5   The period beyond 2010

5.2.5.1 Landscape level

There are two major changes at the landscape level that will impact the development of project management. The growing concerns about making our planet sustainable is one of those. Recent dramatic climate changes in Europe and the US are making politicians even more concerned about setting zero emission targets. It is also clear that project management will face technological disruption with advances in artificial intelligence, robotics and data science.

5.2.5.2 Socio-technical regime

In 2018, Scandinavian scholars led by Geraldi and Söderlund (2018) suggested that project management research could use 'project studies' as an umbrella term for 'studies in, on and around projects' (p. 55). PMI also made a radical change to the PMBOK in its 7th edition, which has moved away from processes to principles so that practitioners can identify the right delivery approach (predictive, agile or hybrid) to complete the project as well as deliver value (DePrisco, 2020). A new open-source journal, *Project Leadership and Society,* focused on the

societal responsibilities of project management, is being published. Another open-source journal, *Project Management Research and Practice,* has also decided to focus on societal problems and socially responsible project management. IPMA has declared year 2021 as the year of responsible project management. At EURAM 2021, project management scholars were urged to investigate projects using processual studies to advance project organising (Sergi, Crevani & Aubry, 2020).

5.2.5.3   Technological niches

The main innovations that are observed are the move toward principle-based approaches and AI based techniques to enhance project management processes and the increased use of robotics and the application of Internet of Things (IoT) in managing projects.

In summary, the landscape level showed increasing concerns for the protection of the planet and the re-emergence of artificial intelligence, after it went through a dark period called AI-winter in the 1980s the resulted in reduced funding due to several failures (Haenlin & Kaplan 2019) that could have an its impact on the society. The technological niche level has just started responding to the landscape level by further relaxing prescriptive ways of managing projects.

The analysis of pre-modern and modern project management and an explanation on how items were arrived at in the landscape, socio-technical regime and technological niche levels shows that project management itself can be viewed a management innovation that has successfully transitioned to meet the needs at the landscape level supported by socio-technical regimes to be relevant to society. To continue to do this, project management needs to innovate to meet the future needs, which we address next.

5.3   The future of project management

We will now discuss a sample of the literature on trends that are expected to affect project management focusing on sustainable development, which is the focus of this paper. We start with the work of the Rethinking Project Management Network, which predicted that in the future projects are unlikely to be predefined but will be '*multidisciplinary… permeable, contestable and open to negotiation throughout*'. Gauthier and Ika (2012) point out that in the postmodern world, where discourse and rhetoric take precedence, a project will become a '*discourse of legitimation, and an area of social and power plays*' (p. 12) and '*multiplicity, ambivalence and fragmentation/pluralism [will] characterize project management*' (p. 12). They add that in the hypermodern social world the '*project is a network of actors embedded in a social context and in constant transformation*' (p. 12). Both the postmodern and hypermodern views of project management predicted by Gauthier and Ika (2012) show how projects may have to change the way they are managed to align closely with sustainable development. Morris (2013) urges us to reconstruct project management by referring to Geels's (2004) multi-level perspective as an effective way to move portfolio, program, and project management to address sustainable development. This supports the use of the multi-level perspective presented by Geels (2004) for the analysis of the transition of project management in this article.

From a project management practice perspective, peak bodies have been active in pointing out to a need to rethink project management to meet sustainable development. At the IPMA's international expert seminar held in Zurich in February 2016 fifteen future trends were presented by Professor Yvonne Schoper, who identified *sustainability of projects* as one of the important trends. According to a paper presented at this seminar by Schoper and Gemünden (2016, p. 32), the sustainability of projects and project management implies that the ethical, environmental, social, and life-cycle aspects of projects need to be taken into consideration in the formulation of projects. It also suggested that '*The implication of the trend [sustainability] is that it will increase the accountability of organizations contracting a project beyond their own risks and benefits towards the risks and benefits of external stakeholders who are affected by their project. It will transform the role of project management by challenging if they do the 'right things right'* (p. 33).

PMI's Pulse of the Profession Report 2018 (PMI, 2018) found that sustainable development, climate change and renewable energy were affecting businesses as a disruptive trend that needs to be dealt with by project management professionals. On its 50th anniversary in 2019, PMI reinforced its commitment to being part of the United Nation's Global Compact, whose partners align their strategies and operations with universal principles of human rights, labour, environment, and anti-corruption, and commit to actions to advance societal goals (https://www.pmi.org/anniversary/pmi-un-partnership). The Association of Project Management (APM)'s Vice President Mary McKinlay (2008) urged that '*the further development of project management profession requires project managers to take responsibility for sustainability*' at the IPMA World Congress 2008 (Silvius & Schipper, 2014). IPMA has also dedicated 2021 as the International Year of Responsible Project Management, calling for project professionals '*to deliver better outcomes for society and the environment*' (https://www.ipma.world/2021-is-international-year-of-responsible-project-management).

These trends in managing projects predicted by peak bodies as well as their commitments to support the wellbeing of the environment confirm that there is a growing recognition in project management practice that sustainable development is a challenge we cannot afford to ignore. We next discuss how the need for meeting the requirements for sustainable development has featured in the project management literature.

5.4   Sustainability and project management

The role of project management to support sustainable development has gained momentum since 2009 (Silvius et al., 2009; Garies et al., 2013; Cerne & Jansson 2019; de Toledo et al., 2021). Marcelino-Sadaba et al. (2015), who carried out a comprehensive review of sustainability assessment in various applications of project management, have pointed out that sustainability has been recognized as a challenge for project management in the construction, infrastructure, mining, energy, and new product development sectors. In the past fifteen years, several industry sectors have expressed concerns about the need to incorporate sustainability in project management. In a recent paper, Silvius (2017) predicts that sustainability could

even become a new school of thought in project management, in addition to the nine schools – optimization, modelling, governance, behaviour, success, decision, process, contingency, and marketing – proposed by Turner et al. (2010). In a guest editorial of papers published under the title '*Projects to create the future: Managing projects meets sustainable development*', Huemann and Silvius (2017, p. 1066) argue that '*project management has a vital role in contributing to sustainable development of organizations and society*', raising the issue of societal responsibility of the profession.

However, despite the growing awareness of the importance of the role of project management for sustainable development, it seems ill prepared to deal with sustainability. Silvius (2017) laments that integrating sustainability is a stretch for project management. According to Martens and Carvalho (2016, p. 24), '*there is a gap between perception of importance and the actual use of sustainability in project management (SPM) practice*'. De Toledo et al. (2021) add that while the United Nations Sustainable Development Goals should be included in the critical success factors of projects, this will require future project professionals to be trained in sustainable methodologies.

From an organizational theory perspective, sustainable development seems a bridge too far for both the organization and the projects it carries out. Projects are often constrained by time, cost, scope, and quality, and considered as temporary with a finite end, thus decoupling them from permanent structures to achieve changes (Jones & Lichtenstein, 2008). This poses a conundrum as sustainability challenges are rarely time limited, decoupled from the context, or easily predictable. There is limited research to show that wider organizational aspects are being considered to support projects delivering sustainable outcomes by balancing social, environmental, and economic issues (Silvius & Schipper, 2014). In addition, paying attention to sustainability may interfere with the overarching ends of an organization such as, for example, core strategy or business model. Despite attempts to develop a business case for including sustainability issues, such an attempt is perceived as paradoxical in setting corporate goals (Hahn et al., 2014). Therefore, adding sustainability as a requirement to projects could pose several challenges to organizations (Bromley & Powell, 2014), hindering the ability to achieve sustainable development (Wijen, 2014).

Thus, it looks like project management faces several challenges in closing the 'knowing and doing gap' between the importance of sustainable development and ways in which the field will have to change to deal with this increased awareness of its societal and environmental responsibilities.

6   Discussion

How do we envision project management will transition towards sustainability? At the technological level we expect that tools to include sustainable project management will be introduced by project management researchers and professional bodies. At the socio-technical regime level we expect peak bodies in project management to produce guidelines for the practice of sustainable project management like the change management guides published

because of the emphasis on benefits management. PMI has already adopted the UN SDGs as part of its strategy, while IPMA has declared the year of responsible project management. The construction industry (Sanchez & Haas, 2018) is already promoting the idea of a circular economy, and this will spread to other sectors in which project management is used.

While these steps are encouraging signs, more needs to be done. We have used some key literature published since 2010 by scholars who have proposed a way forward to suggest further research into how sustainable development could become adopted into current project management practices. Silvius (2012) suggested that we need to develop new principles to govern projects if we want to move from traditional to sustainable project management. A systematic literature review carried out by Aarseth (2017) found that it is not enough if only the project organization adopted sustainability strategies. It also requires the host organization authorising projects to provide guidelines so that the project organization can be motivated to adopt sustainable strategies.

Based on a review of the literature on sustainable project management, we would like to propose a model or framework of on how the transition to sustainable project management could take place. After reviewing some key literature and research carried out by scholars to propose models based on various aspects of SPM: success (Martens & Carvalho, 2017); maturity model (Silvius & Schipper, 2015); and SPM framework (Armenia et al., 2019), we conclude that a model that links sustainable project management to benefits (organizational, ecological, and societal) is missing. Figure 3 shows our proposed model that could help with further investigation into how SPM can be achieved in practice.

<Insert Figure 3 here>

We start with sustainability principles as the overarching guideline to move towards SPM which has been discussed in the literature (Labushagne & Brent, 2005; Turner, 2010; Goodknegt & Silvius, 2012; Gareis et al., 2013; Agarwal & Kalmár, 2015). If these principles can be incorporated into the governance of projects (Müller, 2016; Bekker & Steyn, 2009), they could become embedded in the processes, roles and policies governing the projects. As Aarseth (2017) has pointed out, the host organization authorising projects should also adopt guidelines to inform the project organization to adopt sustainable strategies. This is also necessary as supporting sustainability from an organizational perspective might bring politics and power into play (Smith, 2009; Scherer et al. 2016). Thus, both corporate governance in the form of corporate social responsibility and principles of governance discussed in project management literature should guide project governance. Such guidance could assist in influencing sustainable behaviour in projects (Silvius et al., 2014; Silvius & de Graaf, 2019), which can drive SPM. According to Huemann and Silvius (2017), sustainable project management involves both the 'product or deliverable of the project' (p.1066) and the 'process or delivery of the project' (p. 1066). This is echoed by Jacobsson and Lundin (2019) in their comment on an article on projectification of sustainable development (Cerne & Jansson, 2019), stating that 'projects/project management constituting both a means and an end in sustainable development practice' (p.240). In other words, both sustainable

development through projects as well as sustainability of projects should be considered. The two blocks emanating from SPM in the model represents these two aspects. Finally, SPM should lead to benefits that are economic, ecological, and societal (Gareis et al., 2013).

7 Conclusions

In this article, we have attempted to use a multi-level perspective to understand project management as a sustainable management innovation, emphasizing the importance of moving with the times by being conscious of events that are happening at the horizon (or landscape level) and be relevant to deliver outcomes. One challenge that project management will face in the post-Covid-19 world is the increasing importance of sustainable development (Tollefson 2020). Therefore, the project management community needs to evolve as it has done so well in the past to embrace the societal demand to take sustainably into account while delivering projects and implement projects that are established towards sustainable development. These could be projects that strive towards reducing the carbon footprint or deal with climate change, which may require considerations different to conventional projects. Based on recent literature, this article concludes with a model that could be used as a framework for further evolution of project management towards sustainable project management.

While we have carried out our own analysis of how project management has transitioned as an innovation this article has also some limitations that can be addressed by project management researchers in the future. First it has only considered sustainable development as a challenge project management faces, while ignoring how project management will transition to handle digital disruption. This is because the focus of this special issue is on sustainable development. The second, as one of the reviewers, has pointed out that focusing only on project management could be a partial view from a systemic perspective but should also embrace an organizational development perspective with bureaucratic control and power relationships. These issues are discussed in part in the project management literature in dealing with stakeholders but would require further investigation that is beyond the scope of this article.

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