By

John Frederick Rose

A thesis submitted for the Degree of Doctor of Philosophy

School of Systems, Management and Leadership. Faculty of Engineering and IT.

University of Technology, Sydney

10<sup>th</sup> December 2015

# Certificate of Original Authorship

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

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Signature of candidate

Date: 10th December 2015

#### Acknowledgements

I would like to thank my chief supervisor Professor Igor Hawryszkiewycz and cosupervisor Dr Kyeong Kang for their unstinting support and guidance in my research activities and in the preparation of this thesis. The structure and rigor bought by their supervision made all the difference in my efforts to achieve the objectives of my research.

My thanks go to Professor Hung Nguyen for his encouragement and support to submit my application for the PhD candidacy. I am grateful for the advice and encouragement of Professor Jenny Edwards before and during my PhD candidacy. Professor Edwards first spoke to me concerning post-graduate opportunities when I was an engineering student at Sydney University in the 1970's. She supported my application to become a PhD candidate in late 2010. Dr Amip Shah, Senior Research Manager at Hewlett Packard Laboratories also encouraged me and gave his support to my application to become a PhD candidate. Achieving the standards required for academic writing has been a passionate pursuit during the course of my candidacy. I wish to acknowledge the patience, advice and encouragement of Dr Terry Royce, Senior Lecturer, Graduate Research School who helped me to develop my writing skills.

In 2010, Mr Des Saunders, Industry Liaison Manager, IT Programs of UTS acted as the catalyst for my decision to undertake the PhD candidacy and has been a steadfast friend to this day. I am grateful to Mr Timothy O'Connor of Astute Technologies for his support of my case study at the Commonwealth Government Agency and involvement in the effort associated with the grant under the UTS Industry and Innovation Project Scheme. I wish to thank Mr. Justin Butterfield of Mathematica for helping to arrange the State Government Agency case study.

My family has been a constant source of strength and inspiration for undertaking my studies. I dedicate this research to them as an indication of the importance of my family in my studies and in my life.

#### Motivation and Vision

The motivation for my research arose from my experiences in addressing complex social problems associated with group knowledge creation collaborations involving IT process and product innovation (Rose 2009, 2010). In the years between 2002 and 2008, I was involved in helping to improve outcomes of IT knowledge creation collaborations. Later, my focus moved to the issues encountered with the introduction of carbon abatement strategies into large organisations and Commonwealth Government agencies.

When addressing problems associated with introducing carbon abatement strategies, I found problem-solving using sequential or waterfall approaches to be unsuitable. Such approaches could not address the situation where implementing solutions adversely affected other areas related to the problem and often changed the very nature of the problem, thereby forcing a re-start to the sequential problem solving approach. To counter this situation, I formed a group of knowledge creators who could adapt to changing circumstances by using iterative, learning-by-doing techniques to devise and apply solution strategies. Outcomes were functionally acceptable, but the adaptations associated with learning-by-doing consumed valuable project time and required additional resources. Over time, I developed a series of perspectives that brought a focus to the learning-by-doing investigations by putting situations in a new light to reveal previously hidden aspects of the problem. These experiences motivated my desire to not only improve collaborative outcomes but also do it in such a way as to consume fewer resources.

My vision was to create a theory-informed system for studying knowledge creation collaboration for use in improving collaborative outcomes in product and process innovation. The system would inform improving the process of dynamic alignment of roles to the collaboration's purpose. Business designers and knowledge researchers could deploy the system in the form of adaptable customised architectures to track, assess and adjust improvement strategies. Experience teaches the importance of socialising improvements, incorporating feedback from stakeholders to ensure value is realised through use, and that improvement outcomes receive business endorsement. In this light, the system should inform the socialisation of collaborative outcomes with stakeholders. My conviction is that enhancing innovation collaboration leads to improved outcomes and the strengthening of the competitive position of organisations.

#### **Abstract**

The pressures to solve the complex social problems of our modern interconnected society have placed an emphasis on the use of knowledge creation collaborations to devise process and design innovations for tackling complex social problems. Despite extensive discussion in the literature, a theory for collaboration in meta-organisations that would inform improving product and process innovation has yet to emerge. To address this situation I treated a knowledge creation collaboration as a human centric, complex, adaptable social system that organisations use to solve problems in product or process innovation. Progress is monitored by assessing the gap between the current state and the state if the purpose of the collaboration was fulfilled. I call this gap "Collaborative wellness (CW)".

Collaborative processes are characterised by communications in social networks created by the interactions of knowledge creators. A knowledge creator will only participate in such a collaboration if they have the confidence to meet their assigned responsibilities. In deciding to participate, a knowledge creator interprets their responsibilities to create and perform a role-in-use which they dynamically adapt and align to the collaboration's purpose as circumstances change. In collaboration, knowledge creators negotiate compatibility between their roles-in-use and thereby form a shared sense of purpose to fulfil the collaboration's responsibilities. The concept of role-in-use alignment is central to my research.

I devised the "Collaborative Wellness System (CWS)" as a theory informed system of collaborative relationships in a framework with measures to support the evaluation and application of improvement strategies to existing collaborations. CWS may also inform the design of new collaborations. CWS is deployed as a customised architecture to suit a particular collaboration using perspectives developed from my practical experience. Improvement has the goal of enhancing both sustainability (doing more with less) and the value derived from using the created knowledge in process and product innovation. The measures of CWS form a tree structure that provides a detailed assessment across selected perspectives of a collaboration at a particular point in time. CWS relates measures to structures, processes and relationships. Four case studies validated CWS and provided a basis for a collaborative wellness scale to compare collaborations and their processes. The research has application in business process restructuring, logistics and disaster relief.

**Keywords:** Collaborative Wellness System, Role-in-use, Role-in-use Alignment, Knowledge Creation, Organisational Knowledge Creation Theory;

# Contents

Chap	oter :	1 Introduction	1
1.1 Background			
1.2	2 T	he Research Theme	2
1.3	3 T	he Collaborative Wellness System (CWS)	3
-	1.3.1	Stakeholders and the Joint Value Proposition	6
-	1.3.2	The Collaborative Wellness Unit	7
1.4	1 C	WS Components, Knowledge Creators and Measures	7
-	1.4.1	The Knowledge Creator and the Knowledge Contribution	8
	1.4.2	The Role-in-use	8
-	1.4.3	Role and Role-in-Use Alignment	9
-	1.4.4	Collaborative Wellness	10
1.5	5 T	he Research Focus	11
1.6	5 E	xpected Outcome.	12
	1.6.1	Theoretical Contribution	12
	1.6.2	Methodological Contribution	13
	1.6.3	Substantive Contribution	13
1.7	7 S	tructure of the Thesis	13
Chap	oter 2	2 Literature Review	15
2.1	L Ir	ntroduction	15
2.2	2 C	Concept Map and Knowledge Gap Summary	16
2	2.2.1	Concept Map	16
2	2.2.2	Knowledge Gap Summary	18
2.3	3 C	Complex Social Problems	18
2	2.3.1	Characterising Wicked Problems	18
2	2.3.2	Addressing Wicked Problems	19
2	2.3.3	Policy and Strategy	20
2	2.3.4	Knowledge Gaps and Areas for Further Investigation	21
2.4	1 S	ystem, Structure, Process and Function	22
2	2.4.1	Introduction to Systems	22
2	2.4.2	Structure, Process and Function	22
2	2.4.3	Types of Systems	22
2	2.4.4	Areas for Further Investigation	24
2.5	5 C	Complexity	25
2	2.5.1	Complexity Terms	25
2	2.5.2	Emergence	28
2.5.3		Tipping Points	33

	2.5	.4	Causality	33
	2.5	.5	Networks-In-Use	35
	2.5	.6	Knowledge Gaps and Areas for Further Investigation	35
2.	6	Str	ucture and Knowledge Creators	36
	2.6	.1	Miller's Living Systems Theory (LST)	36
	2.6	.2	LST Systems	38
	2.6	.3	LST Sub-Systems	39
	2.6	.4	How LST Systems Interact with their Environment	39
	2.6	.5	Criticisms of Living Systems Theory	40
	2.6	.6	Beer's Viable System Model as an Alternative to LST	41
	2.6	.7	Knowledge Gaps and Areas for Further Investigation	41
2.	7	Val	ue	42
	2.7	.1	Value Concepts	42
	2.7	.2	Value Proposition	43
	2.7	.3	Knowledge Gaps and Areas for Further Investigation	43
2.	8	Kno	owledge	44
	2.8	.1	Data, Information, Knowledge and Ideas	44
	2.8	.2	The Knowledge Worker and Knowledge Creator	47
	2.8	.3	Knowledge Exploration versus Exploitation	48
	2.8	.4	Knowledge and Action	49
	2.8	.5	Tacit Knowing	50
	2.8	.6	Organisational Knowledge Creation Theory (OKC)	54
	2.8	.7	Knowledge Gaps and Areas for Further Investigation	56
2.	9	Col	laborations	57
	2.9	.1	The History of Defining Collaboration	58
	2.9	.2	Kinds of Collaborations	
	2.9	.3	Classifying Collaboration Processes	
	2.9	.4	Innovation	
	2.9	.5	Introducing the Role-in-use	63
	2.9	.6	Describing Interactions	
	2.9	.7	Responsibility and Free Will	
	2.9	.8	Trust and Sharing Knowledge	
	2.9		Wellness of Knowledge Creators	
2.			gnitive Distance Measures	
			Subjective Spatial Distance	
	2.1	0.2	A Measure of the Influence of Novelty	
		0.3	3	
			Wellness of a Knowledge Creator	
			eWellness and eImmunity	
2.	11	The	Extended Mind Hypothesis	73

2.12 Gr	oup Level Processes	74
2.12.1	Group Tacit Knowledge	75
2.12.2	Trait Overlap	76
2.12.3	The Extended Mind and the Group	76
2.12.4	Organisational Culture and Group Collaborations	79
2.12.5	Alignment at the Group Level	80
2.12.6	Leading and Managing Collaborations	81
2.13 Ch	naracterising Improvement Strategies	82
2.14 Sc	ocial Networks	83
2.14.1	Social Network formed by Roles-in-use	83
2.14.2	Messaging	85
2.14.3	Measure of Utilisation and Capacity in Social Networks	87
2.14.4	Strong Ties, Reciprocity and Cliques	88
2.14.5	Social Capital and Structural Holes	89
2.14.6	Knowledge Gaps and Areas for Further Investigation	89
2.15 Cd	onclusion	90
Chapter 3	Collaborative Wellness System (CWS)	92
3.1 In	troducing the Collaborative Wellness System (CWS)	92
3.2 Th	neory Development Guide	94
3.3 Th	ne Collaborative Wellness System (CWS) and Role-In-Use	96
3.4 Re	esearch Scope, Assumptions and Observations	99
3.4.1	Practice Based Research	99
3.4.2	Knowledge Creators	100
3.4.3	Messaging in Collaborations	100
3.5 Cd	ollaborative Dimensions and Aspects	101
3.6 Ty	pes of Groups	103
3.7 De	efinition of Knowledge Creation Collaborations	106
3.8 Kr	nowledge Contributions	107
3.8.1	Introduction	107
3.8.2	Knowledge Creation Processes	107
3.8.3	Usefulness	108
3.8.4	Purpose	
3.8.5	Characterising Knowledge Contributions	
3.8.6	Working Definition of Knowledge Contributions	
3.8.7	How is Ba Created?	
3.8.8	The Group Knowledge Contribution	114
3.8.9	Effective Emergence of Knowledge Contributions	
	bles-In-Use and Collaborative Wellness	
3.9.1	Defining the Role-in-use	
3.9.2	Role-in-use as a Building Block of Collaboration	118

3.9.3	Defining Role-in-use Alignment	119
3.9.4	Definition of Collaborative Wellness	120
3.9.5	Assessing Requisite Variety	121
3.9.6	The Need for a Scale of Collaborative Wellness (CW)	124
3.9.7	The Collaborative Wellness Unit (CWU)	124
3.9.8	The Collaborative Wellness Network (CWN)	125
3.9.9	The Collaborative Wellness Assessment (CWA) Process	126
3.10 The	Research Question and Research Propositions	127
3.11 Exp	ploring the Research Propositions using Scenarios	131
3.11.1	The Scenarios	131
3.11.2	Comparing Scenario Expectations	132
3.12 Cor	nclusion	135
Chapter 4 I	Research Design	136
4.1 Int	roduction	136
4.2 Sui	mmary of Collaborative Wellness System Concepts	137
4.3 Cha	aracterising Group Collaboration	140
4.4 The	e Research Approach	142
4.4.1	Action Plan	143
4.4.1	.1 Action Plan Stage 1	144
4.4.1	.2 Action Plan Stage 2	144
4.4.1	.3 Action Plan Stage 3	145
4.4.1	.4 Action Plan Stage 4 Interviews	145
4.4.1	.5 Action Plan Stage 4 Workshops	145
4.4.1	.6 Action Plan Stage 5	145
4.4.2	Context and Structure	146
4.4.3	Case Study Purpose	147
4.4.4	Service Science and Value Proposition.	148
4.5 The	Research Design	149
4.5.1	The Collaborative Wellness Document (CWD)	150
4.5.2	Deploying the Collaborative Wellness System	155
4.5.3	Discovering the Collaborative Wellness Network	157
4.5.4	What to Measure	158
4.5.5	How to Measure	160
4.5.6	How to Interpret	162
4.5.7	Examples of Applying the Collaborative Wellness Document	163
4.5.7	.1 Knowledge Contribution	163
4.5.7	.2 Requisite Variety Assessments	163
4.5.7	.3 Joint Value Propositions	163
4.6 Co.	nclusion	164

Chapte	r 5 Cas	se Study Experiences	165
5.1	Introd	luction	165
5.2	Case	Study Activity	166
5.3	Verify	ing the Research Propositions	168
5.3	.1 RI	P1: Joint Value Proposition	170
5.3	.2 RI	P2: Requisite Variety	171
5	.3.2.1	Requisite Variety and the Collaborative Wellness System	171
5	.3.2.2	Conflict of Purpose	172
5	.3.2.3	High Utilisation	173
5	.3.2.4	Effects of Structure	173
5	.3.2.5	The Constraint of Time.	174
5	.3.2.6	RP2 Summary	174
5.3	.3 RI	P3 Balancing utilisation	175
5.3	.4 RI	P4 Improving role-in-use alignments and compatibilities	176
5	.3.4.1	Vendor Pack Resizing	176
5	.3.4.2	Mixed Vendor Storage	177
5	.3.4.3	RP4 Summary	178
5.3	.5 RI	P5 Improving knowledge contributions	178
5.3	.6 RI	P6 Improving collaborative wellness	180
5.3	.7 R	esults	181
5.4	Using	the Collaborative Wellness System	181
5.5	The C	ollaborative Wellness Comparative Rating Scale	183
5.5	.1 St	ructure of the Collaborative Wellness Scale	185
5.5	.2 Us	sing the Collaborative Wellness Scale (Scale)	186
5.5	.3 Q	uestions for Collaborative Wellness Scale Ratings of Process	187
5	.5.3.1	Is the purpose clearly articulated?	189
5	.5.3.2	Is there a Many Masters Problem?	190
5	.5.3.3	Does the process cross boundaries and is the group closed?	190
5	.5.3.4	Does the group have capacity for new processes?	191
5	.5.3.5	Can the group adapt to the new process?	191
5	.5.3.6	Further Questions	191
5.6	Concl	usion	191
Chapte	r 6 Dis	cussion of Research Outcomes	193
6.1	Introd	luction	193
6.2	Collab	orative Wellness Scale	194
6.3	Organ	isational Knowledge Creation Theory	195
6.4	Purpo	se and Value Proposition	196
6.5	Path [	Dependence	198
6.6	Deper	ndencies and the Collaborative Wellness Unit	198

6.7	6.7 Complex Emergence		
6.8	Lim	nitations	
6.8	.1	Time Constraint	
6.8	.2	Participant-Observer	
6.8.3		Specialist Nature of Case Studies	
6.8	.4	Limitations Reflect Commercial Engagements201	
6.9	Sur	mmary202	
Chapte	r 7 (	Conclusions203	
7.1	Cor	ntributions to Research203	
7.1	.1	Theoretical Contribution	
7.1	.2	Methodological Contribution	
7.1	.3	Substantive Contribution	
7.2	Cor	ntributions to Business204	
7.3	Орј	portunities for Further Research205	
7.3	.1	Direction One: Extending the Collaborative Wellness System205	
7.3	.2	Direction Two: Investigate Larger Scale Collaborations206	
7.3	.3	Direction Three: Introduce Cultural Diversity207	
7.3	.4	Direction Four: Examine the effects of Causality207	
7.3	.5	Direction Five: Examine Effects of Organisational Circumstances207	
7.4	Cor	ncluding Remarks207	
Append	dices	s209	
State	Gov	ernment Agency Process Case Study Excerpts209	
Wool	wortl	hs Cost Extraction Case Study Report Excerpts209	
Wool	wortl	ns Idea Management Case Study Excerpts210	
Comr	nonv	vealth Government Agency General Approach210	
Comr	nonv	vealth Government Agency (CGA) Issues Summary210	
Glossa	ry of	f Terms	
Confer	Conferences and Publications		
Refere	nces		

# **Figures**

FIGURE 1 EMPIRICAL DIMENSIONS OF COLLABORATION
Figure 2 Groups within an Organisation
FIGURE 3 COLLABORATIVE WELLNESS SYSTEM (ROSE, HAWRYSZKIEWYCZ & KANG 2015) 5
FIGURE 4 LINKED COLLABORATIVE WELLNESS UNITS IN AN ORGANISATION
FIGURE 5. THE RESEARCH QUESTION AND RESEARCH PROPOSITIONS
Figure 6 Concepts mapped to the empirical dimensions of collaboration
FIGURE 7 STRUCTURES OF MILLER'S LIVING SYSTEMS THEORY (1978)
FIGURE 8 TYPES OF KNOWLEDGE. (BOISOT & MACMILLAN 2007, P. 54 FIG 2.1)50
FIGURE 9 ROLES AS COLLABORATION BUILDING BLOCKS
FIGURE 10 EXTENDED COGNITIVE PROCESSES IN A GROUP
FIGURE 11 SOCIAL NETWORK CREATED BY INTERACTIONS BETWEEN ROLES-IN-USE84
FIGURE 12 MESSAGE VALIDATION86
FIGURE 13 COLLABORATIVE WELLNESS SYSTEM (ROSE, HAWRYSZKIEWYCZ & KANG 2015)93
FIGURE 14 ROLE-IN-USE IN THE COLLABORATIVE WELLNESS UNIT98
FIGURE 15 GROUP TYPES105
FIGURE 16 THE KNOWLEDGE CONTRIBUTION
FIGURE 17 KNOWLEDGE VISION TO JOINT VALUE PROPOSITION
FIGURE 18 ROLE-IN-USE
FIGURE 19: ROLES-IN-USE AND ROLE ALIGNMENT118
FIGURE 20 STATES OF COLLABORATION
FIGURE 21: COLLABORATIVE WELLNESS CONCEPT MAP AND RESEARCH PROPOSALS128
FIGURE 22 CASE STUDY EXPECTATIONS (ROSE 2013, p. 426 FIG 4)141
FIGURE 23 CASE STUDY ACTION PLAN (ROSE, HAWRYSZKIEWYCZ & KANG 2015, P. FIG. 4).144
FIGURE 24 CHANGES IN GROUP TYPE AS CASE STUDY PROGRESS146
FIGURE 25 CASE STUDY CONTEXT (VON KROGH, NONAKA & RECHSTEINER 2012, p. 258)147
FIGURE 26 DSR ACTIVITY LAYERS (GILL & HEVNER 2011, p. 239 FIG 1) FOR CWS $156$
FIGURE 27 COLLABORATIVE WELLNESS MEASURES BASED ON ROSE (2013, p. 427 FIG 5) $159$
FIGURE 28 IMPLEMENTING THE COLLABORATIVE WELLNESS ASSESSMENT PROCESS161
FIGURE 29 RESEARCH QUESTION AND RESEARCH PROPOSITIONS
FIGURE $30$ Case Study Issues shown mapped to the Collaborative Wellness System. $182$
FIGURE 31 THE EXTENDED COLLABORATIVE WELLNESS SYSTEM206
FIGURE 32 EXCERPT FROM STATE GOVERNMENT AGENCY REPORT. PAGE 6209
FIGURE 33 EXCERPT FROM WOOLWORTHS COST EXTRACTION REPORT. PAGE 2209
FIGURE 34 EXCERPT FROM WOOLWORTHS IDEA MANAGEMENT REPORT. PAGE 3210
FIGURE 35 EXCERPT FROM COMMONWEALTH GOVERNMENT AGENCY ISSUES REPORT. PAGE 3. 210

# **Tables**

Table 1 Types of Systems (Swanson & Miller 1989)	
Table 2 Identifying Elements of a Concrete System	
Table 3: Complexity Concepts	25
Table 4 Levels of Emergence	28
TABLE 5 TYPES OF COMPLEX SYSTEMS	30
Table 6 Characteristics of Emergence	30
Table 7 Living Systems' Organisation, Group and Organism Levels	38
Table 8 Summary of Data, Information and Knowledge	45
Table 9 Knowledge Types. Reproduced from Gourlay (2006, p. 1426 Table 1)	46
Table 10 Modes of Collaboration from Pisano & Verganti (2008, p. 1)	60
Table 11 Collaborative Options from Pisano & Verganti (2008, p. 1)	60
Table 12. Classification of Collaborative Processes (Davenport 2005)	62
Table 13 Dimensions of Business Cultural Diversity (Hofstede 1989, pp. 393-4)	79
Table 14 Utilisation and Capacity Measures based on Hedman et al. (2013)	88
TABLE 15. GUIDE TO THEORY DEVELOPMENT	94
Table $16$ Interactions between collaborative dimensions and their aspects. $\dots$	.101
Table 17 Classifying Groups by Knowledge Creator Location	.104
Table 18 Group Boundaries	.105
Table 19 Principal measures relating to assessment of Requisite Variety	.123
Table 20 Concept Reference.	.129
Table 21 Scenario Expectations	.133
Table 22 Collaborative Wellness System Concepts Reference	.137
Table 23 Concepts in Service Science	.149
Table 24 The Collaborative Wellness Document. Based on Cockburn (2000)	.151
Table 25 Performance History of a Collaborative Wellness Document	.154
Table 26 Orders of Interpretation. Based on Neuman (2011, pp. 177-8)	.162
Table 27 Case Study Business Purpose Overview	.166
Table 28 Case Study Activity 4/Jan/2012 to 12/Dec/2013	.167
Table 29 Woolworths Ideas (Rose, Hawryszkiewycz & Kang 2014, p. 221 Table 1)	.176
Table 30 Concepts for the Collaborative Wellness Scale	.183
Table 31 Developing the Collaborative Wellness Scale	.186
Table 32 Facilitation based on Rose, Hawryszkiewycz & Kang (2014, p. 223)	.188
TABLE 33 CONFEDENCES AND PUBLICATIONS	227

This page intentionally left blank