



Newcastle Graduate School of Business  
Faculty of Business and Law  
Level 3, University House, Corner King and Auckland Street  
Newcastle 2300 AUSTRALIA

# Creativity and Innovation in Virtual teams

---

**Author: Harbindar Sangha**  
B.E. (Electrical Engg.), MBA  
UON Student No: C3153562

**Supervisor: Dr. Laurence Lock Lee**

**Submitted in fulfilment of requirements for Doctorate in  
Business Administration**

**May 2014**

### Statement of Originality

I hereby certify that the work embodied in this Dissertation Project is the result of original research and has not been submitted for a higher degree to any other University or Institution

---

Harbindar Sangha (UoN Student no: C3153562)

## Acknowledgements

I would like to thank my supervisor Dr. Laurence Lock Lee for his guidance, advice and patience in reviewing my thesis.

I also thank my thesis examiners for their effort in reviewing my thesis and advise.

I also extend my gratitude to the Assistant Dean of Research Training Ms. Suzanne Ryan and Head of Newcastle Business School A/Prof Frank Agbola and Head of School Nominee Dr. Anton Kriz for their support.

I thank Sam Doherty, Fiona Madden, staff in the Graduate studies office and other UoN staff for their support.

I thank the executive management of the organisation who supported my research by allowing me to conduct survey and interviews. I also thank the members of the organisation for participating in surveys and interviews.

Finally I would like to express my gratitude to my family for their patience and support whilst I was pursuing my studies.

Harbindar Sangha

Jan 2015

## Contents

Statement of Originality.....	II
Acknowledgements.....	III
List of Tables .....	X
List of Figures .....	XI
1 Introduction .....	1
1.1 Background .....	1
1.2 Research Aim .....	2
1.3 Topics of interest from literature review.....	2
1.3.1 Virtual teams.....	3
1.3.2 Implementation team effectiveness.....	4
1.3.3 Innovation .....	4
1.3.4 Innovation implementation effectiveness.....	4
1.4 Research Questions .....	6
1.5 Summary of findings .....	8
1.6 Limitations.....	9
1.7 Contribution.....	10
1.8 Organisation of the Research: .....	10
2 Literature review.....	12
2.1 Introduction .....	12
2.2 Virtual teams.....	16
2.3 Implementation team effectiveness.....	22
2.3.1 Project Management .....	22
2.3.2 Project Management theories .....	23
2.3.3 Project success.....	26
2.4 Creativity and Innovation.....	29
2.5 Creativity .....	31
2.5.1 Determinants of creativity .....	33
2.6 Innovation .....	42
2.6.1 Theories of Innovation .....	45
2.6.2 Determinants of Innovation.....	46

2.6.3	Innovation orientation .....	48
2.7	Innovation effectiveness .....	52
2.7.1	Individual factors .....	53
2.7.2	Organisational factors .....	55
2.7.3	Organisational climate .....	56
2.8	Group Identity .....	59
2.8.1	Types of ID .....	60
2.8.2	Benefits .....	61
2.8.3	Theories of Group Id .....	62
	Building Group Identity .....	66
2.9	Presence .....	70
2.9.1	Types of Presence .....	71
2.9.2	Theories .....	72
2.9.3	Building of presence .....	75
2.9.4	Media Richness Theory .....	75
2.9.5	Media naturalness theory .....	75
2.10	Trust .....	79
2.10.1	Types of Trust: .....	81
2.10.2	Benefits/Functions of Trust: .....	82
2.10.3	Building of Trust .....	83
2.10.4	Trust in Virtual teams .....	85
2.11	Conclusion and Research Gaps .....	89
2.12	Research Questions .....	91
3	Method and Research Design .....	93
3.1	Introduction .....	93
3.2	Research Design .....	94
3.3	Research Strategy and Proposed Model .....	97
3.4	Sample and Sampling: .....	100
3.5	Data collection: .....	102
3.5.1	Survey .....	102
3.5.2	Semi-Structured interviews .....	104
3.5.3	Instrument: .....	105
3.5.4	Presence measures .....	105
3.5.5	Group Identity measures .....	106

3.5.6	Trust measures.....	107
3.5.7	Implementation Team effectiveness measures.....	108
3.5.8	Innovation Effectiveness measures .....	108
3.6	Analysis .....	109
3.7	Validity .....	114
3.7.1	Construct validity .....	114
3.7.2	Internal validity .....	114
3.7.3	External Validity .....	115
3.7.4	Reliability.....	115
3.8	Ethical Implications .....	116
4	Data Analysis and Findings.....	117
4.1	Methodology.....	117
4.2	Results.....	118
4.2.1	Response rate .....	118
4.3	Quantitative Analysis .....	119
4.3.1	Step 1: Data Preparation.....	119
4.3.2	Step 2 Univariate analyses. ....	120
4.3.3	Step 3 Bivariate analyses: .....	131
4.3.4	Multivariate analysis .....	136
4.3.5	Hypotheses results.....	144
4.4	Semi-structured Interviews.....	145
4.4.1	Virtual teams/Presence.....	146
4.4.2	Implementation team effectiveness.....	151
4.4.3	Trust: .....	164
4.4.4	Group Identity .....	166
4.4.5	Innovation effectiveness:.....	168
4.4.6	Summary of Structured interviews .....	176
4.5	Summary of Findings and Conclusion .....	177
5	Discussion, Conclusion and Contributions.....	184
5.1	Introduction .....	184
5.2	Research sub questions .....	184
5.3	Summary of major findings.....	185
5.3.1	Effect of trust on innovation effectiveness.....	186
5.3.2	Effect of presence on innovation effectiveness.....	186

5.3.3	Effect of group identity on innovation effectiveness.....	187
5.3.4	Combined and interactions effect of presence, group identity and trust on innovation effectiveness .....	187
5.3.5	Effect of implementation team effectiveness on innovation effectiveness.....	188
5.4	Limitations.....	189
5.5	Contributions .....	191
5.6	Areas for further research .....	195
5.7	Conclusion.....	196
6	References .....	198
7	Appendix A: Survey questionnaire.....	221
7.1	Survey questions.....	221
7.1.1	Demographic Information.....	221
7.1.2	Trust questions.....	222
7.1.3	Group Identity questions .....	223
7.1.4	Presence measures using computer mediated communication .....	224
7.1.5	Implementation Team effectiveness questions.....	225
7.1.6	Innovation effectiveness questions .....	225
7.2	Semi-structured interviews.....	226
7.2.1	Summary Interview Protocol .....	226
8	Appendix B HREC Approval letters.....	227
9	Appendix C Factor Analysis .....	241

# Abstract

---

Advances in communication technology have enabled geographically and temporally dispersed teams to work collaboratively in virtual teams. Organisations worldwide are using or considering using virtual teams to take advantage of the skills located elsewhere to drive innovation and to lower costs.

We have seen growing support for creative/innovative activities to be undertaken by virtual teams and/or non- collocated contributors. On the other hand some high technology organisations suggest that face to face (f2f) collaboration is essential for them to sustain their levels of innovation.

The speed and frequency of large scale technological changes has increased, driving organisations to implement new innovations in an environment of virtual teams, in order to survive and prosper

With many organisations using virtual teams, and implementing new innovations to sustain and grow their business; the factors that make an innovation implementation successful in virtual teams has become an important area for study.

This study investigates the factors required for innovation effectiveness in virtual teams using a case study approach of an organisation employing virtual teams that has implemented a radical innovation implementation. The innovation implemented was sourced from outside the organisation.



Mixed methods were used for the study. Surveys and semi-structured interviews were used for data collection. Quantitative and qualitative methods were used for data analysis.

Innovation effectiveness is dependent on organisational and individual factors. The study investigated the effect of implementation team effectiveness, group identity, trust and presence, the factors specific to virtual teams; on innovation team effectiveness.

Findings indicate that group identity and implementation team effectiveness were the main predictors for organisations that had high intra team trust, high group identification and long tenured virtual teams.

The study concludes that a synthesis of various concepts from the theories on virtual teams, organisational behaviour, resource based view, upper echelon theory and process theory determines innovation effectiveness and suggests new avenues for research.

**Key Words:** Innovation effectiveness, Implementation team effectiveness, Trust, Group Identity, Presence, Virtual teams

## List of Tables

Table 4-1: Independent variables coding.....	119
Table 4-2: Dependent variables coding .....	120
Table 4-3: Descriptive statistics .....	121
Table 4-4: Cronbach's $\alpha$ reliability tests.....	122
Table 4-5 : Presence factors.....	123
Table 4-6: Aggregations of Responses into three levels.....	124
Table 4-7: Trust with tenure .....	125
Table 4-8: Group Identity based on tenure .....	125
Table 4-9: Presence based on tenure .....	126
Table 4-10: Innovation effectiveness ratings.....	126
Table 4-11: Innovation effectiveness based on tenure .....	127
Table 4-12: Trust comparison based on branches.....	128
Table 4-13: Group Identity in various branches .....	129
Table 4-14: Presence in various branches .....	129
Table 4-15 : Innovation effectiveness in branches .....	130
Table 4-16: Correlations.....	131
Table 4-17 : Innovation effectiveness and Trust.....	133
Table 4-18: Innovation effectiveness and Presence .....	134
Table 4-19: Innovation effectiveness and Group Identity .....	135
Table 4-20: Interaction of Presence and Group Identity .....	137
Table 4-21: Interaction of Trust and Presence.....	139
Table 4-22: Interaction of Trust and Group Identity.....	140
Table 4-23: Interaction of Group Identity, Trust and Presence .....	143
Table 4-24: Results of Hypotheses testing.....	144

## List of Figures

Figure 1-1: Research Focus .....	7
Figure 2-1: Structure of the Literature Review .....	14
Figure 2-2: Literature review Virtual teams.....	16
Figure 2-3: Key themes Implementation team effectiveness.....	22
Figure 2-4: Stages of Creativity and Innovation.....	30
Figure 2-5: Creativity - Foundation literature themes.....	31
Figure 2-6: Innovation – Foundation literature themes .....	42
Figure 2-7: Innovation as a process .....	43
Figure 2-8: Determinants and Dimensions of Innovation.....	46
Figure 2-9: Literature review Innovation effectiveness.....	52
Figure 2-10: Group Identity- Foundation Literature themes.....	59
Figure 2-11: Presence themes - Foundation literature.....	70
Figure 2-12: Trust themes - Foundation literature .....	79
Figure 2-13: Research focus and theoretical model .....	91
Figure 3-1: Theoretical model for hypotheses testing.....	100
Figure 4-1: Bivariate linear models for H1a, H1b, H1c.....	132
Figure 4-2: Interaction of Presence and Group Identity .....	137
Figure 4-3: Interaction of Presence and Trust .....	138
Figure 4-4: Interaction of Group Identity and Trust .....	140
Figure 4-5: Interaction of Presence, Group Identity and Trust.....	142
Figure 4-6: Innovation implementation with time .....	171
Figure 5-1 : Various factors and its impact on innovation effectiveness in virtual teams.....	194

*“Innovation is the central issue in economic prosperity” (Porter, 1980).*

# 1 Introduction

## 1.1 Background

The speed and frequency of large scale changes in technology has increased resulting in a shortage of resources with skills in these new technologies. These resources are located in different geographical locations and in some cases, are reluctant to move to a central location to work in traditional face to face teams. Advances in communication technologies have enabled organisations to use geographically and temporally dispersed resources to work collaboratively in virtual teams. Organisations worldwide are also using or considering using virtual teams to take advantage of the skills located elsewhere to drive innovation and to lower costs (Tavčar, Žavbi, Verlinden, & Duhovnik, 2005).

Additionally in order to survive and prosper, organisations have to take advantage of the new technologies and implement new innovations based on these technologies in an environment of virtual teams (Frambach & Schillewaert, 2002; McAdam, Moffett, Hazlett & Shevlin, 2010). Many organisations are using virtual teams, and implementing new innovations to sustain and grow their business; the factors that make an innovation implementation successful in virtual teams is an important area for study.

The researcher's interest in investigating factors that enable successful innovation implementations was triggered by the increasing use of virtual teams by organisations

that he works/ and has worked for. The author is being increasingly asked to be a member of, or lead a virtual team on projects tasked with implementing new enterprise technologies, and personally experiencing the challenges faced, has motivated the author to look more deeply into the important factors which contribute to successful innovation through virtual teams.

## 1.2 Research Aim

This study investigates the factors affecting innovation effectiveness in virtual teams. The factors are identified by reviewing the relevant literature, finding gaps in the current knowledge and developing research questions based on the gaps. The study uses mixed methods to collect data for an innovation implementation in an organisation. The collected data is analysed to answer the research questions resulting in addition to the knowledge on this topic. These topics and gaps are briefly discussed below, and are discussed in detail in the relevant chapters of this thesis.

## 1.3 Topics of interest from literature review

Literature review found the following as main topics of interest.

- Virtual teams: A review of organisational behaviour theories highlighted that trust; group identity and presence were the main constructs that affected virtual teams' effectiveness. A review of project management theories revealed that Innovation implementation was dependent on implementation team effectiveness.

- Innovation and Innovation effectiveness in virtual teams: The dimensions and determinants for Innovation and innovation effectiveness were synthesized from Upper Echelon Theory, Resource Based view and Process theories.

Research gaps and questions were then developed from the above topics. These topics are briefly discussed below and described in detail in Chapter 2.

### 1.3.1 Virtual teams

Virtual teams consist of team members who are geographically distant from each other. The members can be temporally distant in some cases, working in different time zones. Virtual teams differ from face to face (f2f) teams in that they use computer mediated communication to create presence. Longitudinal research has found that long tenured virtual teams are as effective as f2f teams, as humans adapt to new communication technologies (DeRosa, Hantula, Kock, & D'Arcy, 2004). Achievement of organisational goals is dependent on teams (virtual or co-located) being effective. Virtual teams differ from face to face teams in terms of physical presence of members. Presence affects two other constructs of team effectiveness namely trust and group identity.

The three constructs of Presence, Group Identity and Trust are enabled by communication. These three constructs affect virtual team effectiveness (Riva, 2009; Kauff & Schreer, 2002; Newell, David, & Chand, 2007; Jarvenpaa, Knoll, & Leidner, 1998; Relja & Bandalović, 2008).

Presence, Group Identity and Trust, as well as their roles in making effective virtual and face to face teams are discussed in Chapter 2.

### 1.3.2 Implementation team effectiveness

The success of the innovation project implementation is dependent on the implementation team effectiveness. Koskela and Howell (2002) define project success in terms of benefits to users and organisational factors of project budget, schedule and team well-being. Users find an innovation useful if the innovation meets their requirements.

### 1.3.3 Innovation

The creative and innovation process consists of the generation of ideas, evaluation of ideas, interaction between members to form concepts and designs, adoption of design ideas, experimentation by building prototypes, testing prototypes, feedback from users on prototypes to improve the prototype (Mumford, Hester, & Robledo, 2012).

The implementation of an idea/solution has multiple levels of acceptance. Firstly the innovation needs to be accepted by the team responsible for innovation. Secondly the users of the innovation need to accept it. Users will accept it if the innovative solution is easy to use and fulfils their requirements. The implementation team needs to involve users to gather their requirements and seek their feedback to improve prototypes (Alencar, 2012; Reiter-Palmon, Wigert & De Vreede, 2012). Sharing of knowledge and ideas during requirements gathering and feedback depends on trust between the users and the implementation team. Trust depends on presence and group identity (Simonton, 2012).

### 1.3.4 Innovation implementation effectiveness

Innovation implementation is affected by two factors, innovation climate and innovation-values fit. Innovation climate is the expectation, support (information

sharing & collaboration) and rewards given to employees by the organisation for using the innovation. Users will be committed to using the innovation if it fits with their values. This condition is known as innovation-values fit. An Innovation is considered fit when the system supports the task requirements valued by the users (Dong, Neufield & Higgins, 2008). Innovations are accepted if they are useful to the users (easy to use and useful) (Mumford, Hester & Robledo, 2012).

Information sharing and collaboration between users and the innovation design/ implementation team makes it easy for users to use an innovation. Collaboration and information sharing of ideas, solutions and workarounds is also required amongst team members in case of problems with the implementation, which in turn depends on trust among team members (Mumford, Hester & Robledo, 2012).

Presence (Jarvenpaa, Knoll, & Leidner, 1998) and group Identity (Gajendran & Joshi, 2011; Webster & Wong, 2008) are required to build trust for collaboration and information exchange (Jarvenpaa, Knoll, & Leidner, 1998). The literature review did not find any study which had investigated the effect of the constructs of presence, trust, group identity and implementation team effectiveness on innovation effectiveness in virtual teams.

The effect of presence, group identity, trust and implementation team effectiveness on innovation effectiveness needs to be investigated leading to the Research question: What is the effect of group identity, trust, presence and implementation team effectiveness on innovation effectiveness in virtual teams?



## 1.4 Research Questions

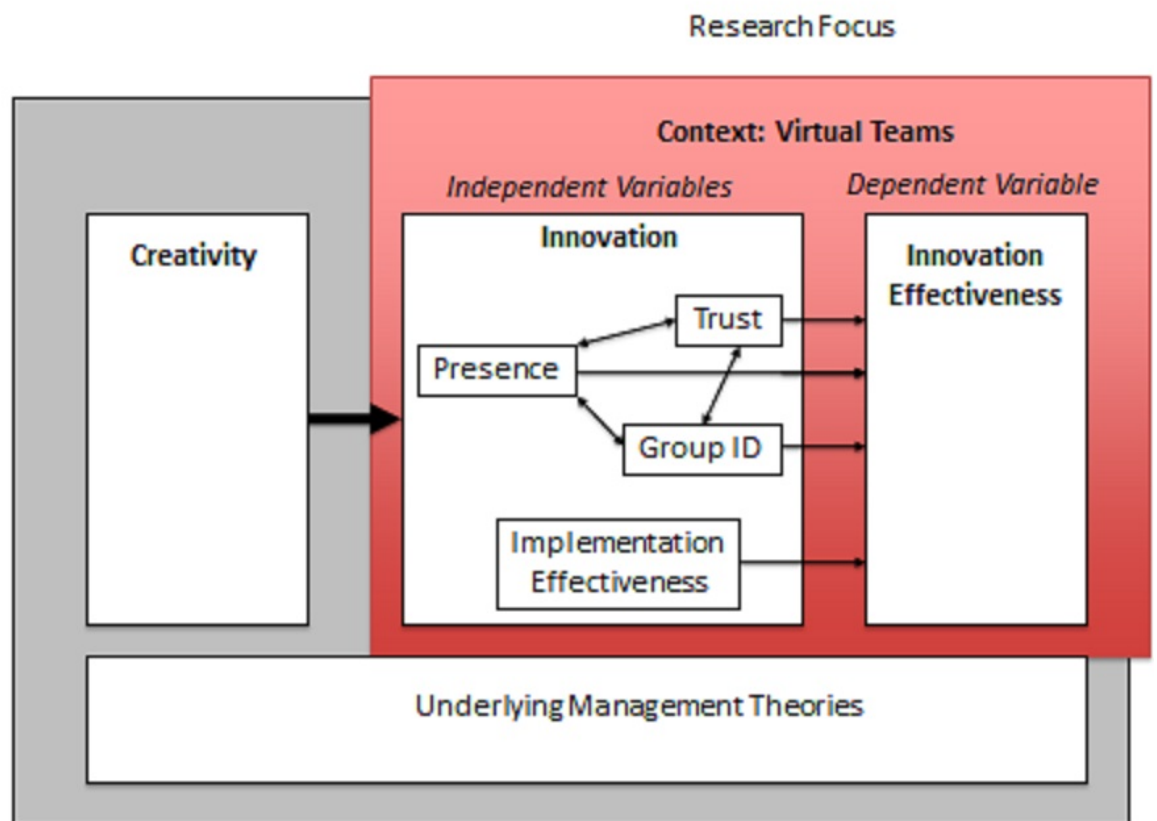
The following research questions aim to find the organisational conditions that are conducive to innovation effectiveness in virtual teams. The original research question “What is the effect of group identity, trust, presence and implementation team effectiveness on innovation effectiveness in virtual teams?” has been split into three sub questions.

RQ1: What is the relationship between Trust, Presence, Group Identity and Innovation effectiveness?

RQ2: Do Presence, Trust and Group Identity interact with each other to affect innovation effectiveness?

RQ3: Does Implementation team effectiveness affect innovation effectiveness?

The relationship of Presence, Group Identity Trust and implementation team effectiveness are explored in the context of innovation in virtual teams with the constructs shown in the Figure 1-1 below.



**Figure 1-1: Research Focus**

The methods described in the section below were used to answer these questions.

## 1.5 Research Approach/Design/Methods

Suppes (1970) states that human behaviour is volitional as well as the result of external events; hence the causal relationships between constructs will be probabilistic rather than deterministic (Suppes, 1970). Mixed methods that use quantitative surveys and qualitative interviews are most suited for this type of studies as questionnaire surveys are practical and have the ability to answer research questions, interviews help validate the findings of the surveys and provide additional details that the survey questions did not address (Bryman & Bell, 2011)

This study is non-experimental. A case of innovation implementation in an organisation using virtual teams within Technology Services Division of a Federal Government agency was investigated using surveys and semi-structured interviews. The survey questions measured behaviour patterns with the aim to find/explain relationships between trust, presence, and group identity. Surveys were followed by semi-structured and focussed interviews with a select group of people to investigate the effect of implementation team effectiveness on innovation effectiveness, validate the findings of the survey and provide additional details that the survey questions did not address (Bryman & Bell, 2011).

## 1.6 Summary of findings

The quantitative and qualitative analysis demonstrated that innovation effectiveness in long tenured virtual teams does not depend on presence. Innovation effectiveness increases with stronger group identity. Innovation effectiveness also depends on ease of use, engagement of users in the requirements gathering and design phase, face to face support, better project management, communicating the vision and benefits of

the innovation and better training. These factors are part of the Implementation team effectiveness and managers need to ensure that these are taken care of for an effective innovation implementation.

In conclusion, at a higher level the analysis shows that the strategic choices, motivation, resourcing, the ease of use of the innovation, right business processes and use of project management methodologies were necessary for innovation effectiveness. These determinants are part of upper echelon theory (Hambrick & Mason, 1984); resource based view theory (Hamel & Prahalad, 1994; Wemerfelt, 1984) and process theory (Soh & Markus, 1995), organisational behaviour theories (Rogers & Lea, 2005; Relja & Bandolovic, 2008) and project management theories (Koskela & Howell 2002).

The study concludes that a synthesis of various concepts from the theories on virtual teams, organisational behaviour, resource based view, upper echelon theory, process theory and project management determines innovation effectiveness and suggests new avenues for research.

## 1.7 Limitations

The limitation of the study is that it was conducted on an innovation implementation in a technology services division in a single federal government agency. Specific variables of trust, group identity, presence and implementation team effectiveness were investigated for their effect on innovation effectiveness. The survey questions on trust measured intra-team trust and did not measure the trust between users and the implementation team. Implementation team effectiveness data was collected via surveys, but as there were only 25 members in the implementation team, the data was

not used for quantitative analysis. The interviews provided rich detail and highlighted implementation team effectiveness factors that affected innovation effectiveness for this particular case. In spite of these limitations, the study adds to the knowledge on effective innovation implementations and the results may be generalizable to organisations with a similar history of virtual teams.

## 1.8 Contributions

The study provides guidance to practitioners for effective innovation implementation in organisations using virtual teams. Innovation effectiveness depends on effective communication of vision and benefits, ease of use, face to face support, training, effective project management practices and strong group identity.

## 1.9 Organisation of the Research:

The research is organised in five chapters.

Chapter 1: Introduction

Chapter 2: Literature review

Chapter 3: Method and Research Design

Chapter 4: Data analysis and Findings

Chapter 5: Discussions, Conclusions and Contributions

Chapter 1, this chapter introduces the background of the research. It introduces the research questions and outlines the research design and methodology and a summary of findings, contributions and limitations. Chapter 1 also outlines the organisation of the dissertation.

Chapter 2 reviews the literature on creativity, innovation, presence in virtual teams, trust, and group identity. Chapter 2 concludes with research gaps and research questions. A theoretical model is developed to address the research gaps.

Chapter 3 describes the research design and methodology in detail. It discusses the mixed methodology used and the justification for its use. Chapter 3 describes the survey instrument, topics for semi-structured interviews, the sample, reliability tests for the variables, the methods used to analyse the quantitative data, validating of quantitative data with interview data.

Chapter 4 documents the results of the analysis conducted on the quantitative data collected by surveys and qualitative data collected by semi-structured interviews.

Chapter 5 discusses the findings, contributions, managerial implications and limitations of the study. Chapter 5 also suggests some areas for further research.

*“The world needs a better understanding of how to encourage innovation. And innovators need to get better at it.” (Robert Metcalfe).*

## 2 Literature review

### 2.1 Introduction

Advances in communication have enabled geographically and temporally dispersed teams to work collaboratively in virtual teams. We have seen a major growth in business process outsourcing to off shore locations facilitated by virtual teaming. Organisations worldwide are using or considering using virtual teams to take advantage of the skills located elsewhere to drive innovation and to lower costs (Tavčar, Žavbi, Verlinden, & Duhovnik, 2005). In a survey conducted for Bradman University in 2011 by Forrester Consulting, 40 % of Fortune 500 companies stated that 40% or more of their staff work in virtual teams (Bradman University news Online, 2011).

Open innovation platforms and Crowdsourcing has been used by some companies like Audi, BMW, Procter & Gamble and Intel to reduce their reliance on internal R&D units (Fuller, Bartl & Ernst, 2006), indicating that there are benefits from virtual teaming even for less standardised creative processes. On the other hand we have seen organisations like Yahoo and Google; which are acknowledged for their creativity and innovation suggesting that f2f collaboration is essential for them to sustain their levels of innovation (Warkentin, Sayeed, & Hightower, 1997; Guynn, 2013).

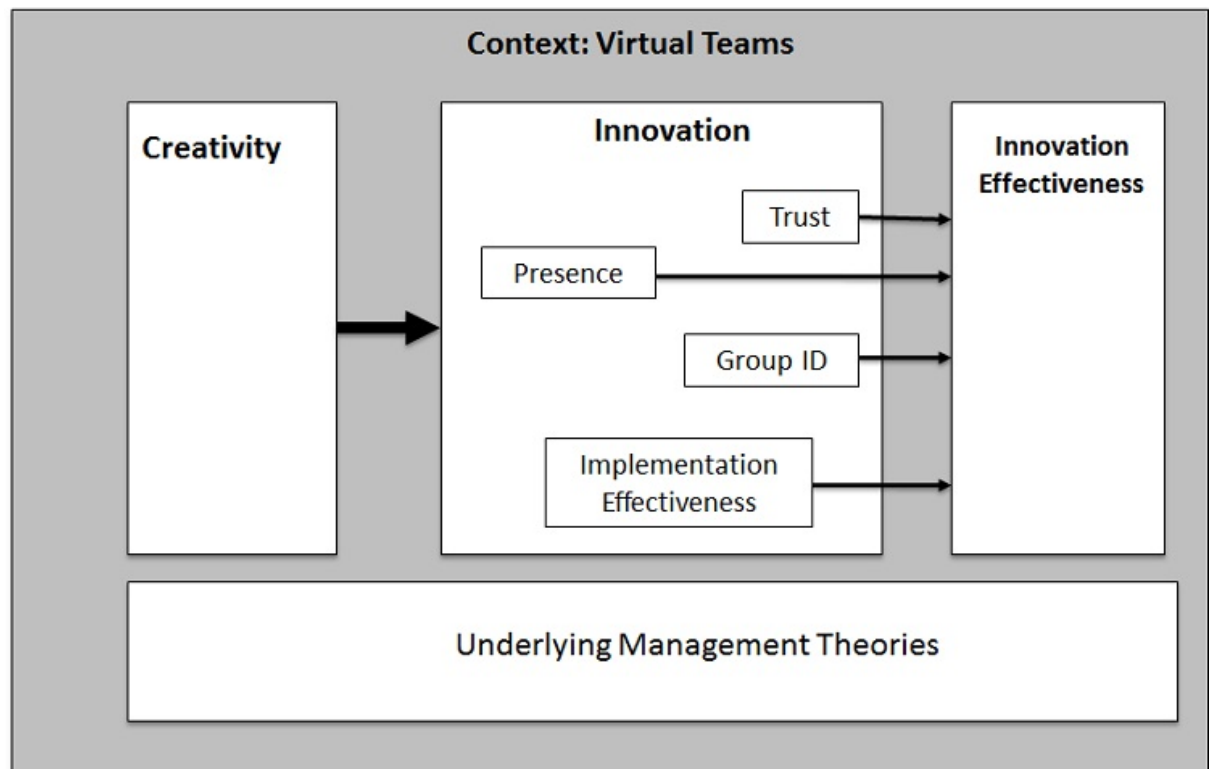
Due to the speed and frequency at which large scale technological changes are becoming available, organisations need to adopt and implement innovations to remain successful (Frambach & Schillewaert, 2002; McAdam, Moffett, Hazlett & Shevlin, Harbindar Sangha

2010). Organisational and individual factors determine the success of the innovation implementation (Frambach & Schillewaert, 2002). Organisational innovations usually change existing business processes (Davenport, 2013), business process factors are explained by process theory. Innovation implementation needs senior management support and resources to be successfully implemented (Crossan & Apaydin, 2010). These determinants are part of Upper Echelon theory, Resource based view and Process theory (Crossan & Apaydin, 2010). In addition to these determinants, innovation is affected by organizational behaviour factors, of the users and the innovation implementation team. These factors include trust and group identity (Ferlie, Fitzgerald, Wood & Hawkins, 2005) and in the case of virtual teams, the additional factor of geographical and temporal dispersion of team members i.e. lack of physical presence and use of communication technologies to overcome this (Martins, Gilson & Maynard, 2004).

As indicated above various authors have linked innovation with selected management theories, though no comprehensive study linking innovation with these determinants from all the major management theories listed above could be located. Due to the proliferation in the use of virtual teams and large scale technological changes necessitating innovation implementations, there is an imperative to study innovation adoption in virtual teams which holistically researches the effects of these determinants from the major management theories listed above.



These determinants are depicted in a diagram below. Research journals and academic literature was reviewed to study the constructs as per the diagram below and is documented in the following sections.



**Figure 2-1: Structure of the Literature Review**

## Literature Review

Creativity and Innovation in organizations is a result of interaction between individual, team and organisational factors (Woodman, Sawyer, & Griffin, 1993). At the individual level, creativity and innovation level is affected by the physical environment, especially Presence in the case of virtual teams which is different from Face to Face teams. Group factors like Trust and Group Identity also affect Creativity and Innovation (Woodman, Sawyer, & Griffin, 1993).

Innovation is preceded by creativity. Creativity is generation of new and useful ideas. Innovation is implementation and adoption of new ideas by the group and users. Innovations are accepted if they are useful to the users (easy to use and useful) (Mumford, Hester & Robledo, 2012). Innovation depends on collaboration and information sharing amongst team members, which in turn depends on trust among team members (Mumford, Hester & Robledo, 2012).

Presence is a key construct that is different in virtual teams from f2f teams. Presence (Jarvenpaa, Knoll, & Leidner, 1998) and group Identity (Gajendran & Joshi, 2011; Webster & Wong, 2008) are used to build trust for collaboration and information exchange (Jarvenpaa, Knoll, & Leidner, 1998).

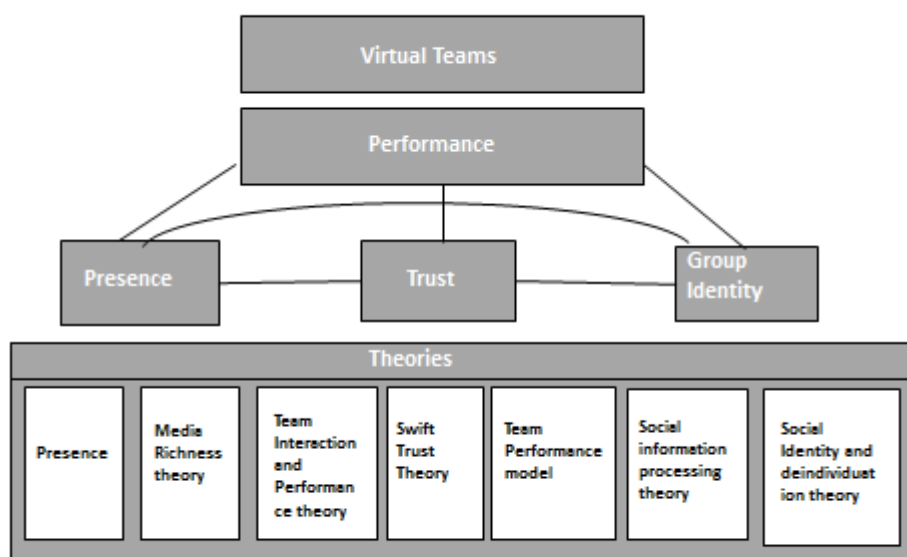
Virtual teams differ from f2f teams in that they use computer mediated communication to create presence. Longitudinal research has found that long tenured virtual teams are as effective as f2f teams as humans adapt to new communication technologies (DeRosa, Hantula, Kock, & D'Arcy, 2004).

Each of the constructs of Virtual teams, Implementation team effectiveness, Creativity, Innovation, Presence, Group Identity, and Trust are explored below.

## 2.2 Virtual teams

The key themes from foundation literature for virtual teams are summarised below.

Association between themes is shown by connecting lines. Key themes in virtual team performance have been identified as Presence, Trust and Group Identity. Various theories that support these constructs are also shown in the figure below.



**Figure 2-2: Literature review Virtual teams**

Schiller and Mandviwalla (2007) in their paper describe global competition and advances in information & communication technology as the two drivers that have led to the proliferation of virtual teams. Virtual teams are defined as teams composed of geographically dispersed members, working on interdependent tasks using computer mediated communication (Schiller & Mandviwalla, 2007). Jarvenpaa and Leidner (1999) define a virtual team as group of geographically and temporally dispersed members working together with the help of technology to achieve an organisational

task (Jarvenpaa & Leidner, 1999). Bell and Kozlowski (2002) define four types of virtual teams. These four types of virtual teams are distinguished by temporal distribution, boundary spanning (organisational/team boundaries), lifecycle (discrete lifecycle – virtual team disbands after task; continuous lifecycle – virtual team members are permanent) and member roles (single role or multiple roles for a member). The virtual teams adopt the four characteristics based on their collective task complexity (Bell & Kozlowski, 2002).

Coordination in geographically and temporally distributed virtual teams is challenging, as non-verbal cues are not visible or delayed, feedback is delayed, and leaders do not get problem information in real-time to execute corrective action (Montoya-Weiss, Masse., & Song, 2001). Bell and Kozlowski (2002) outline three challenges from the perspective of virtual team leadership. They list performance management and skill development of virtual team members as challenges. Monitoring task performance of remote team members and taking corrective action that may involve skill development of remote members is more difficult compared to f2f teams (Bell & Kozlowski, 2002). Cohesion and collaboration in virtual teams for complex tasks is necessary. This can be a challenge in virtual teams. Members do not get a chance to form relationships necessary for collaboration due to temporary membership of virtual teams. Bell et al. (2002) suggest semi-permanent membership (continuous lifecycle) and singular role (to avoid role conflict) for members in virtual teams as a solution (Bell & Kozlowski, 2002). Another challenge faced in virtual teams is related to new innovations and its implementation. New innovation and its implementation needs sharing/ and sometimes two way exchange of knowledge between members who

create/implement the innovation and members who use it. The sharing of knowledge is facilitated by rich social experiences. The environment for rich social experiences is lacking in virtual teams as members are distributed geographically and temporally leading to lower performance (Alawi & Tiwana, 2002). Zakaria, Amelinckx and Wilemon (2004) in their paper state similar views about the difficulty of sharing of knowledge and ideas in virtual teams as forming interpersonal relationships is not easy. They also state that Virtuality affects group cohesion and trust impacting work group effectiveness (Zakaria, Amelinckx & Wilemon, 2004). Lipnack and Stamps (2008) found that virtual teams that are separated by distance face issues of communication and participation. Oldham and Baer (2012) state that relationship conflict has a negative effect on creativity (Oldham & Baer, 2012) and it is more difficult to fix communication breakdowns across distance using tenuous electronic links (Lipnack & Stamps, 2008).

Performance in virtual teams is dependent on collaboration and communication is important for collaboration. Collaboration is dependent on trust and trust enables sharing information and knowledge, important factors for innovation. Schiller and Mandviwalla (2007) state that social interaction is an important component for collaboration in teams and social interaction between virtual team members is dependent on computer mediated communication. They state that team members working together are dependent on group behaviors and identification with the group increases collaboration. They suggest that to analyze virtual team effectiveness, behaviors in virtual teams should be analysed at team level and individual level. In their review of literature on research on virtual teams they found that the papers used

25 theories from Information Systems and other disciplines. They suggest that the choice of theories for research should depend on the problem being studied (Schiller & Mandviwalla, 2007). Virtual teams differ from face to face teams in terms of presence and the present study is researching innovation effectiveness in virtual teams, so the focus is on theories of presence, trust and group identity in virtual teams.

Warkentin and Beranek (1999) define social presence as the ability of the communication medium to make virtual team members feel the presence of other members so that they can engage in fruitful action. The Social Presence theory states that presence is dependent on the number of channels that the computer mediated communication provides for communication. They state that social presence theory does not explain the effect of presence on team performance. Computer mediated communication technology that enables rich communication with multiple channels with the capability to transmit facial expressions, verbal and non-verbal cues enables more social presence (Warkentin & Beranek, 1999).

Majchrzak, Rice, King, Malhotra, and Ba (2000) describe differences in computer mediated communication using Media Richness theory. They describe media richness based on the number of cues conveyed by various media in virtual teams (Majchrzak, Rice, King, Malhotra, & Ba, 2000). Andres (2002) explains the need for media richness in communication in virtual teams because virtual team members use communication as their primary mechanism to share information required for task execution. They state that different interpretations of the task requirements results in information ambiguity in teams and clearance of this ambiguity requires rich information rather than facts. The communication medium must be capable of transferring rich

information including verbal, non-verbal, emotional cues and provide immediate feedback to clarify any doubts and ambiguities. This helps in creating presence for members (Andres, 2002). Presence is discussed in detail in section 2.9 below.

Warkentin et al. (1999) use Social information processing (SIP) theory to help understand team performance in virtual teams and its effect on trust and group identity. SIP states that exchange of social information helps build relational links between team members. Members in Face to face teams exchange this information naturally, aided by visual, verbal and non-verbal cues enabling them to pick up subtle cues. Social information theory states that these relational links help improve team performance (Warkentin & Beranek, 1999). Warkentin et al. (1999) use the Social Information processing theory to conclude that virtual teams take longer to exchange relational information than face to face teams, impeding formation of bonds thus affecting trust and group identity (Warkentin & Beranek, 1999).

Coppolla, Hiltz and Rotter (2004) list coping with task uncertainty as the reason for swift trust formation in temporary virtual teams , swift trust is based on the belief that others will not harm them, enabling them to take the necessary risks, resulting in positive outcomes for the self and group (Coppolla, Hiltz & Rotter, 2004). Jarvenpaa, Knoll & Leidner (1998) suggest the use of swift trust to help achieve positive outcomes for virtual teams. They describe swift trust as trust based on action and suggests that in virtual teams, members do not have a choice to select team members and have to get the job done, so swift trust development is necessary. They suggest that timely responses and task communications develop swift trust (Jarvenpaa, Knoll & Leidner, 1998).

Warkentin et al. (1999) use the team performance model to explain the key role of trust in performance. They describe the model in terms of seven stages of the team building i.e. the seven stages of orientation, trust building, goal/role clarification, commitment, implementation, high performance and renewal (Warkentin & Beranek, 1999). Forrester and Drexler (1999) use the model to explain task outcome as well as relationship development. They state that interaction with other members during the orientation stage, leads to learning about them and lays the foundation for trust. The second stage is building trust by sharing information with others. Goal/role clarification provides focus and accountability for task fulfilment. Commitment ensures that members contribute fair share, implement ideas and decisions leading to high performance (Forrester & Drexler, 1999).

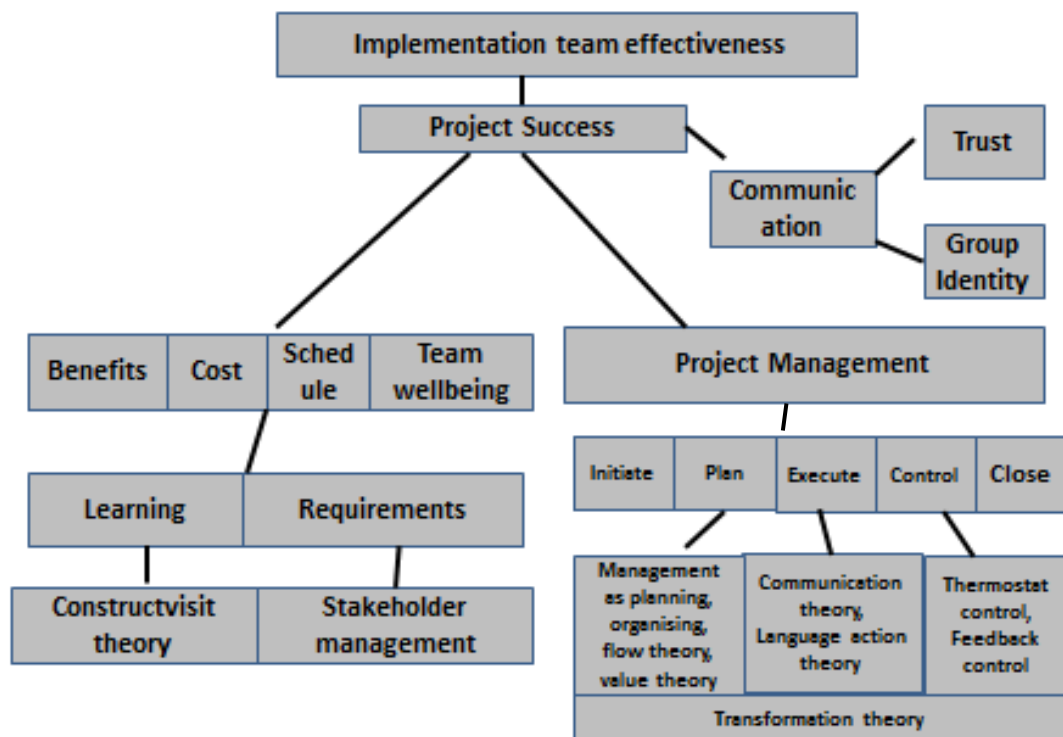
Warkentin et al. (1999) use the Time interaction and performance theory to suggest that trust is formed by supporting members and caring for them (Warkentin & Beranek, 1999). Andres (2002) states that socio emotional activities like inclusion, cooperation, acceptance of the contribution made by virtual members helps in building trust and increasing performance (Andres, 2002).

Team performance is affected by innovation implementation. Innovation implementation is dependent on the effectiveness of the implementation team. The factors that affect implementation team effectiveness are reviewed in the next section.



## 2.3 Implementation team effectiveness

The key themes from foundation literature for implementation effectiveness is summarised below. Association between themes is shown by connecting lines. The key theme for implementation team effectiveness is success of the implementation project. Project success is dependent on other factors and these are summarised in the diagram below.



**Figure 2-3: Key themes Implementation team effectiveness**

### 2.3.1 Project Management

The study involves researching the implementation of an innovation project in an organisation with virtual teams. The contribution of project implementation team to the effectiveness of the innovation use necessitates the review of project management literature. Beise (2004) describes projects as temporary endeavors with unique Harbindar Sangha Student Number: C3153562

specific goals, start and end date. Projects are staffed with resources with diverse skills and knowledge necessary for implementation. Beise states that project managers are a key resource. The project manager plans, coordinates tasks & processes, and implements formal communication & coordination mechanisms. Beise suggests that cost, time and quality are the criteria for judging project implementation effectiveness. He states that projects are also evaluated based on the criteria of risk management, integration of systems, resources utilisation, scope delivery and team member well-being. Beise suggests using a project management methodology to manage these outcomes. Project management methodology divides the project lifecycle into five processes of initiation, planning, implementing, controlling and closing. He states that Planning, implementing and controlling are the key processes. Cohesion and group identification are key requirements in project implementation and these increase project team performance. In virtual teams, lack of face to face communication reduces commitment, group identification and trust causing leading to loss in performance and project implementation effectiveness (Beise, 2004).

### 2.3.2 Project Management theories

Koskela and Howell (2002) describe projects as being composed of two kinds of processes, project management processes and product creation processes. They state that project management is achieved by decomposing the work into small activities and tasks that are sequentially executed. The decomposition of work is called Work Breakdown structure. As per Koskela et al. (2002) project management is based on the transformation theory, one of the theories underpinning operations management. Transformation theory explains production as inputs transformed into outputs by a

small series of transformations with a focus on minimizing the cost of each transformation (Koskela & Howell, 2002).

Koskela et al. (2002) states that the key project management process of planning can be divided into core processes and facilitation processes. Core processes are executed in a sequence due to dependencies of one process on the output of previous one. Scope planning and definition, activity definition, resource planning, activity sequencing, duration calculations, cost calculations, schedule development, budgeting and plan development are the core processes and used in the same sequence in each project. Facilitation processes are performed as needed and include quality planning and risk management. Koskela et al. (2002) states that the planning processes are based on the theory of “management as planning”, one of the theories of operations management that explains causal relationship between management plans and outcomes (Koskela& Howell, 2002).

Koskela et al. (2002) state that, project execution has only one process, the process of authorisation to proceed with the project. Koskela et al. (2002) states that, the communication of authorisation to the project manager and his team is based on the theory of communication.

As per Koskela et al. (2002) the controlling process is based on feedback from the output back to executing process and planning process. They suggest that feedback is based on the two sub process of performance control and change control.

Performance control measures the deviation of output from the performance baseline and feeds the deviation back to the execution process to effect the necessary correction. Koskela et al. (2002) state that the controlling process is based on the

management theories of thermostat control and feedback control theory. Thus project management is based on three theories; “management as planning”, “theory of communication” and “thermostat control” (Koskela& Howell, 2002).

Koskela et al. (2002) suggests that a lot of projects fail, as the current theories do not explain project management adequately and successful projects use a lot of informal communication and management. They suggest adding more theories to explain project management to account for the gap. They suggest adding the “flow theory” and” value theory” to the planning processes. Flow theory is focused on reducing waste by accepting uncertainty. Uncertainty leads to additional time being added to the schedule. They cite Just in Time as a process to reduce uncertainty in given requirements. They suggest adding Value theory to support the third goal of project management i.e. projects should deliver “business value”. Value theory is based on the premise that customers do not know their requirements at the start of the project and allocation of unknown work to different stages of the project is a difficult problem. Repeated meetings with the customers may help clarify requirements and these can be added to scope delivering business benefit (Koskela& Howell, 2002).

Koskela et al. (2002) further state that management as planning is to be supplemented with management as organizing due to changing scope. Management as organizing states that management cannot be separated from execution reality; and activities need to be coordinated as circumstances change. These changes require de-centralised coordination and communication between various organisational subunits. They further suggest that the theory of one-way communication in the execution process needs to be supplemented with theory of language/action, as execution

requires commitment of the project team members to follow orders/requests of the project manager. They also suggest that the controlling model theory of thermostat control needs to be supplemented with the theory of learning and improvement. The theory of learning and improvement focuses on finding root causes of deviation from performance (Koskela & Howell, 2002).

### 2.3.3 Project success

Cooke-Davies (2001) defines project success as the benefits derived by the stakeholders. They recommend interaction of project team with stakeholders to deliver benefits effectively. Stages and gate reviews are recommended with stakeholders to ensure that project is delivering the benefits (Cooke-Davies, 2001)

As per Kotlarsky and Oshri (2004) social ties, formal & informal communications improve co-ordination and collaboration in projects. For virtual teams, informal communication and developing social ties is difficult affecting team effectiveness negatively. They state that team effectiveness depends on open communication and open communication is dependent on trust. People in virtual teams are also less likely to identify with the team/group. Knowledge sharing is required for collaboration and coordination in large virtual teams. Knowledge sharing builds trust and trust enables knowledge sharing. They state that technical solutions are important for communication in virtual teams but social factors are also important. They define Project success by product success and team well-being. Product success can be objectively measured. Personal satisfaction with team members leads to more collaboration and is dependent on multiple open, informal, stress free communication and collegial environment (Kotlarsky & Oshri, 2004).

### *2.3.3.1 Stakeholder Engagement*

Bourne and Walker (2006) state that; the success of a project is dependent on stakeholder engagement and stakeholder acceptance of project goals. They use Stakeholder theory to recommend that project teams needs to understand stakeholder power and influence; project team needs to develop relationships with stakeholders by understanding the project's dependence on stakeholders and the stakeholder's expectation and requirements from the project. The project team should use this understanding to maximize stakeholder's positive influence and minimise their negative influence. They define five different types of stakeholders as end users, client organisation, the project sponsor, project team members, and external team members e.g. suppliers. Stakeholder management involves identifying, prioritising and engaging stakeholders. They state that stakeholder relationships can be of three types, exploitation- one party exploits the other, reciprocity – two persons help each other and mutuality – helping each other reach their goals. They state that project teams should have reciprocal or mutual relationships with stakeholders. They recommend communication strategy should be tailored for stakeholders based on the power and impact a stakeholder has on the project. They recommend that Stakeholder engagement should be part of a risk management process and plan. Social networks aid stakeholder management and the execution of the project, and these are difficult to build in virtual teams (Bourne & Walker, 2006).

### *2.3.3.2 Learning*

Implementing an innovation involves learning new skills. Jonassen, Davidson, Collins, Campbell, & Haag (1996) state that learning new skills needs interaction and the

students need to work together with each other and the instructor for effective learning. For virtual training to be effective, Technology should facilitate interactions and working together for students and instructor. They use constructivist theory to explain that students learn by their experiences, interactions with others and reflection. They state that constructivism is associated with learning by doing. Jonassen et al. (1996) state that constructivist theory explains learning as creating meaning out of real world experiences. This involves reflection internally and discussing with others. Collaboration with others enables the discussion of ideas and sharing of knowledge. Technologies that aid interaction, aid constructivist learning. Computer group chat, computer supported collaborative work (CSCW) help with interactions (Jonassen, Davidson, Collins, Campbell, & Haag, 1996).

### *2.3.3.3 Requirements Gathering*

Young (2002) states that requirements gathering is a major factor in delivering benefits in projects. He defines requirement as a capability that the user values and is useful in their work. He defines requirements gathering as helping users figure out what they want, rather than documenting what they need. The process of requirements gathering starts with understanding the business requirements leading to a vision and scope document. Multiple meetings with customers and users is required to refine the scope. Brainstorming and requirement workshops, use cases and storyboards are techniques to gather requirements. He suggests peer reviews and inspections of requirements as good method to remove ambiguities and inconsistent requirements. Gathering requirements in virtual teams is difficult due to geographical dispersion (Young, 2002).

In summary project success is dependent on requirements gathering, stakeholder engagement and learning. All these require rich social interactions. Rich social interactions in virtual teams are a challenge. This study investigates the factors required for effective innovation implementation in virtual teams. Innovation is preceded by creativity. The next section reviews Creativity and Innovation

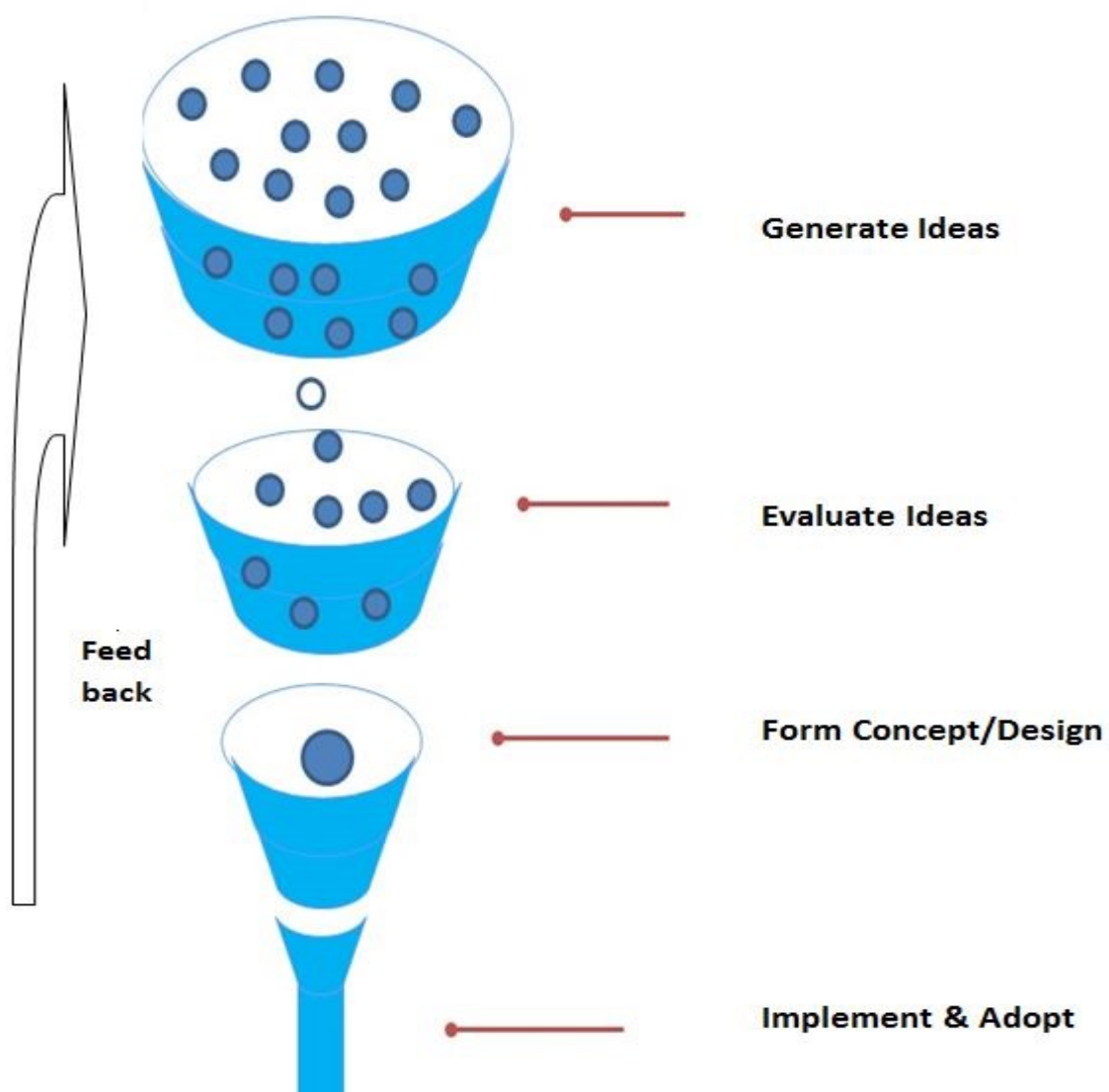
## 2.4 Creativity and Innovation

Creativity and Innovation can be broken down into four stages (Mumford, Hester & Robledo, 2012). These four stages are

- Generation of ideas
- Evaluation of ideas
- Forming a concept/design using the selected idea (from evaluation stage)
- Implementation of the design, also known as innovation effectiveness

The first two stages are classified as part of creativity and the last two as part of innovation (Mumford, Hester & Robledo, 2012). These four stages are illustrated in the diagram below, followed by a review of the creativity and innovation.





**Figure 2-4: Stages of Creativity and Innovation**

Source: Diagram adapted from Handbook of organizational creativity (Mumford et al., 2012)

## 2.5 Creativity

Creativity can be viewed from two perspectives; Individual perspective and an organisational perspective. Literature review found different themes for these perspectives. The foundation literature is summarised with key themes in Figure 3 below. Associations between themes are shown by lines.

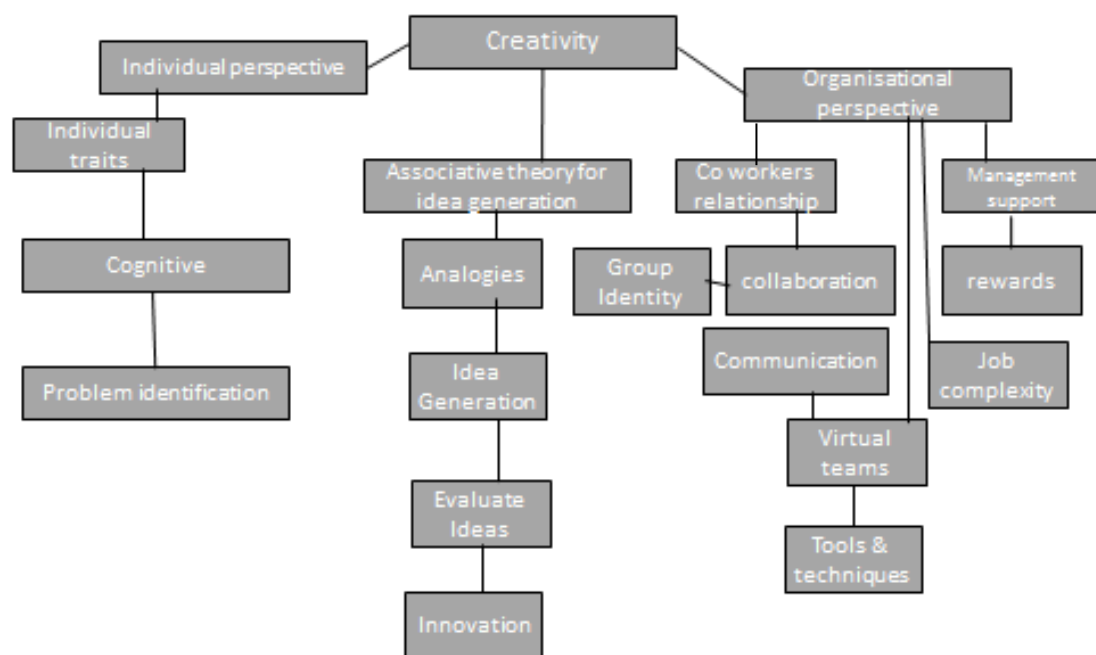


Figure 2-5: Creativity - Foundation literature themes

### **What is creativity?**

Creativity is development of new ideas. Innovation encompasses both thinking about new ideas and implementing them. Innovation is a cyclic process with creativity as the first part of the process followed by implementation, followed by feedback about issues to the creativity stage to come up with ideas and workarounds after innovation implementation to make it more effective (West, M. A., Sacramento, C. A., & Fay, D., 2006). Other authors have divided the innovation process into creativity and innovation stages. The creativity stage consists of idea generation for new products and services; and idea evaluation (Mumford, Hester & Robledo, 2012; Shalley, Zhou, & Oldham, 2004). Creativity could range from incremental change in processes to radical ideas for new products and services (Shalley, Zhou, & Oldham, 2004), and Innovation stage consists of idea adoption and implementation (Alencar, 2012). The implementation part involves experimenting by building prototypes, testing prototypes and feeding the issues back to idea generation stage (Reiter-Palmon, Wigert & De Vreede, 2012). Damanpour and Aravind (2012) observe that activities in creativity stages do not follow a set pattern and are disorderly whereas activities in the innovation stages follow a systematic social process (Damanpour & Aravind, 2012). Creativity is combining information in different ways to produce an entity that is original and useful (Mumford, Hester & Robledo, 2012).

Mumford et al. (2012) described creativity as a process consisting of four stages. These stages include 1) identifying an opportunity/problem 2) collecting information 3) generating ideas 4) evaluating and modifying ideas. The skills required for these four stages are problem identification, combining various pieces of information, generating ideas and evaluating ideas (Mumford, Hester & Robledo, 2012).

As per Csikszentmihalyi (1996), creativity is generation of new ideas by seeing new patterns or changing the configuration of symbols of a given domain (Csikszentmihalyi, M., 1996). She decomposes creativity into five stages. The stages to creativity are preparation, incubation, insight, evaluation and elaboration. In the preparation stage the creative person thinks about the problem, the incubation stage is a subconscious stage where ideas are churned, the insight stage is where the solution appears. The requirements for Insight are, thinking and hard work done in the preparation stage. The evaluation stage involves checking whether the insight is a valid insight. In the elaboration stage, the solution is developed using the latest developments and theories in the domain, and feedback from colleagues about the solution direction (Csikszentmihalyi, M., 1996).

## 2.5.1 Determinants of creativity

### 2.5.1.1 Individual factors

Shalley et al. (2004) states that creativity depends on an individual's personal characteristics and the organisational context that s/he works in (Shalley, Zhou, & Oldham, 2004). An individual's creativity depends on personal characteristics like diverse thinking, experience, domain knowledge and contextual factors like engagement with the task, risk taking, relationship with co-workers, supervisors and support from organisation all of which affect intrinsic motivation. Intrinsic motivation affects curiosity, persistence and risk taking necessary for creativity (Acar & Runco, 2012; Dunne & Dougherty, 2012; Shalley, Zhou, & Oldham, 2004).

Csizkmentalhyi (1996) describes creativity as the generation of new ideas by seeing new patterns or changing the configuration of symbols of a given domain. She describes domains as little worlds that use symbols and a set of rules to create order (Csizkmentalhyi, M., 1996). Shalley et al. (2004) describes creativity in similar terms and states, that the individual's characteristics and their cognitive style decide their level of creativity. Individuals, who have a personality trait of openness to new experiences, seek out new experiences, use the new information gained, and combine it in novel ways with existing information to generate creative ideas.

Csizkmentalhyi (1996) describes the trait of creative person as one who has internalized the rules and the symbols of the domain, can focus and concentrate on a problem for a long time, and are open to new experiences (Csizkmentalhyi, M., 1996), whereas Shalley et al. (2004) adds that creative Individuals have the innovator cognitive style trait, they question accepted paradigms, develop radical new methods/ and new solutions; and are more creative compared to individual's whose cognitive style is that of adaptation and who work within accepted paradigms (Shalley, Zhou, & Oldham, 2004).

Shalley et al. (2004) also lists positive mood states as an important factor for creativity. They state that positive moods affect intrinsic motivation and cognitive states. Positive moods enable enhanced problem solving and creative thinking. Positive moods enable individuals to make more divergent connections and associations among stimuli (Shalley, Zhou, & Oldham, 2004).

Csizkmentalhyi (1996) further states that the acceptance of a creative idea is dependent on the gatekeepers of the domain who decide whether a new idea is worth

adding, as adding every new idea will create chaos. The gatekeepers are known as the field. If the field does not appreciate the creative person, the creative person's ideas may not be accepted, and s/he will not be given a chance to explore their ideas further or learn new things (Csikszentmihalyi, M., 1996).

#### *2.5.1.2 Organisational factors*

Acar and Runco (2012) describe organisational features that promote creativity. These include diverse skilled team members, autonomy in choosing means to reach a goal, incorporation & recognition of other's ideas and support by management (Acar & Runco, 2012). Shalley et al. (2004) support the view that teams need to be composed of diverse members with innovative traits, and openness to new experiences trait; to generate more creative ideas (Shalley, Zhou, & Oldham, 2004).

Shalley et al. (2004) list additional contextual organisational factors that affect creativity are factors that affect intrinsic motivation. Information and controlling cues communicated subtly or otherwise by the management can increase/dampen intrinsic motivation. Job complexity, relationship with supervisors and co-workers are factors that affect intrinsic motivation. They state that complex job with autonomy increases creativity. A nurturing supervisor who provides individual consideration, intellectual stimulation, and non-judgmental feedback increases intrinsic motivation and creativity. Nurturing non-competitive co-workers also increase intrinsic motivation and creativity. Organisational contextual factors which provide informational or controlling cues include rewards, evaluation, and spatial settings. They state that non-judgmental evaluation increases creativity compared to judgmental, controlling and critical evaluation. Time pressures and deadlines have mixed effects on creativity. Lower

Harbindar Sangha                      Student Number: C3153562

intrusions and lower noise from co-workers helps creativity, hence spatial configuration which helps shield creative workers from noise and other co-workers will increase creativity (Shalley, Zhou, & Oldham, 2004).

Stahl (2005) describes creativity from a shared meaning perspective. He goes on to describe the process of development of shared meaning. He states that the team working on creativity needs to develop a shared meaning of the problem. Group meaning and knowledge is developed through interactions as one individual does not have all the answers and skills. If an individual already possesses the skills, then the individual does not need a team. Collaboration requires mutual understanding or common meaning. Common meaning or common interpretation is based on common language and culture. Common meaning is interpreted by individual members and may be slightly different for each member. The divergent interpretations that individuals have of a problem are in fact an asset to the process of creativity (Stahl, 2005).

Arias, Eden, Fischer, Gorman, & Scharff (2000) describe creativity from a collaboration perspective and the role of externalisation in collaboration. They state that complex design problems require collaboration between different people as one individual does not possess all the knowledge required. Different individuals/stakeholders bring their own perspectives about the problem based on their culture, the symbols and rules used in their domain. Collaboration requires synthesising the different perspectives. For the knowledge to be available to all, the individual has to make his/her knowledge explicit i.e. externalised. Externalisation makes the individual's mental records explicit for others to critique and negotiate. Externalisation allows conversation between

stakeholders increasing their cognitive abilities (Arias, Eden, Fischer, Gorman, & Scharff, 2000).

Shneiderman (2007) describes creativity using three different world views of structuralists, inspirationalists and situationalists. Structuralists think of creativity in terms of stages. Progress indicators for different stages are tools that a structuralist uses to view creativity. Inspirationalists believe in moving away from normal structures and routines to enable creativity. Inspirationalists use visual strategies like concept mapping to see the big picture. Situationalists on the other hand believe that creativity is a social process where encouragement, a collaborative climate and recognition is required for creative work (Shneiderman, 2007).

#### *2.5.1.3 Communication*

Shalley et al. (2004) state that team creativity is enhanced by moderate frequency of communication and decentralised communication. Moderate frequency of communication ensures that members can go back and reflect on the ideas and decentralised communication ensures that different opinions are shared and no one person is dominating the conversation (Shalley, Zhou, & Oldham, 2004).

Oldham and Baer (2012) state that weak ties (infrequent communication) with a wide variety of social contacts enables access to new information leading to more creativity, contradicting the requirement of face to face work for creativity (Oldham & Baer, 2012)



#### *2.5.1.4 Additional Specific determinants for Virtual teams' creativity*

Nemiro (2002) suggest selecting different types of communication medium for use by virtual teams for different stages of creativity. He states that virtual teams use the same four stages of creative process as face to face teams. These stages include idea generation, idea development (elaboration), idea finalisation and evaluation.

Communication during the idea generation stage can be face to face or electronic. The mode of communication depends on the personality of the people, the complexity of the problem, geographic dispersion and the material resources available to team members. Information collection during idea generation stage may be best served by people working alone and sharing information electronically (Nemiro, 2002). Communication mode during the idea development stage is electronic using email, teleconferences, shared databases and phone, as the work is divided and assigned to individuals, removing the need for face to face contact (Nemiro, 2002).

Reiter-Palmon (2012) suggest brain-writing as a technique for virtual team creativity. They describe brainwriting as individuals writing their ideas, sending these ideas to their group members by electronic communication medium. This gives group members more time to reflect and consider other people's ideas than an immediate response verbally; suiting virtual teams (Reiter-Palmon, 2012).

Nemiro (2002) suggested that virtual teams use tools with archival capability to record the creative approach taken to resolve a client problem. This recording could be used as a framework or template to be used in future situations. Another advantage of virtual teams is that it enables the facility to connect to peripheral members and members external to the team, helping widen the creative pool (Nemiro, 2002).

Nemiro (2002) found that the communication flow was based on the work design structure that creative virtual teams used. The work design structure ranged from wheel design, where all communication passed through a central leader; modular design in which the group divided their work, worked on their own part and brought it back to the team for feedback, to iterative design where members do their initial thinking alone based on their skills and expertise, work on the idea with some small actions and bring it back to the team for feedback. This iterative process is repeated. The iterative work design method avoids expending a lot of effort prior to getting team's approval. Email and phone are used in the iterative mode (Nemiro, 2002). Nemiro (2002) found that virtual teams use modular work design combined with an iterative approach. The communication was frequent vocal contact or real time electronic conversations (Nemiro, 2002).

Sarmiento and Stahl (2007) suggests using simple and easy to use tools such as shared chat boards, electronic whiteboards, shared databases and wikis for communication and articulation of new ideas between group members. The use of a shared electronic white board in conjunction with a chat board helps with the sharing and recording of the interactions between group members that are synchronous or over a long period of time. The synchronous interactions between group members with a shared whiteboard help in the joining, contrasting, reframing of ideas, building different configurations of ideas leading to generation of new ideas and group creativity. The drawings on the whiteboard are referenced in a chat board, where chat messages explain and point to different drawings on the white board to create a shared meaning. This system is used during the idea generation stage. They state that,

interactions which are spread over a long period of time need group remembering.

Group remembering can be enabled by group interactions recorded using a chat board and shared whiteboard. Bridging objects are required for new members of team who do not have a past history of the team. These bridging objects are generated by interactions between new and old members. The older members help the new members understand the shared meaning. This is accomplished by interactions via chat board, whiteboard, working shared databases and wikis (Sarmiento & Stahl, 2007).

#### 2.5.1.4.1 Tools

Shneiderman (2007) states that creativity support tools can help in all stages of creativity process from idea generation to idea evaluation. In idea generation, search engines can help with information collection. In idea selection, software tools can help with hypothesis generation; the software can help with generation of multiple alternatives and reverting back to original if needed. He suggests that the software tool used should save history and the decisions, to enable understanding and rollback if necessary to a previous stage. The software should enable the alternatives to be modified with different parameters easily and test its feasibility. In idea elaboration and evaluation stage software tools can help in selection and prioritisation of ideas using Quality Function deployment and Analytic Hierarchy processing. Wikis and Shared Databases help in sharing and dissemination of ideas (Shneiderman, 2007).

Shneiderman (2007) suggests using different kinds of tools for different creative personalities. For structuralists, he recommends progress indicators showing the progress of a creative idea through different stages. For Inspirationalists he suggests

Harbindar Sangha                      Student Number: C3153562

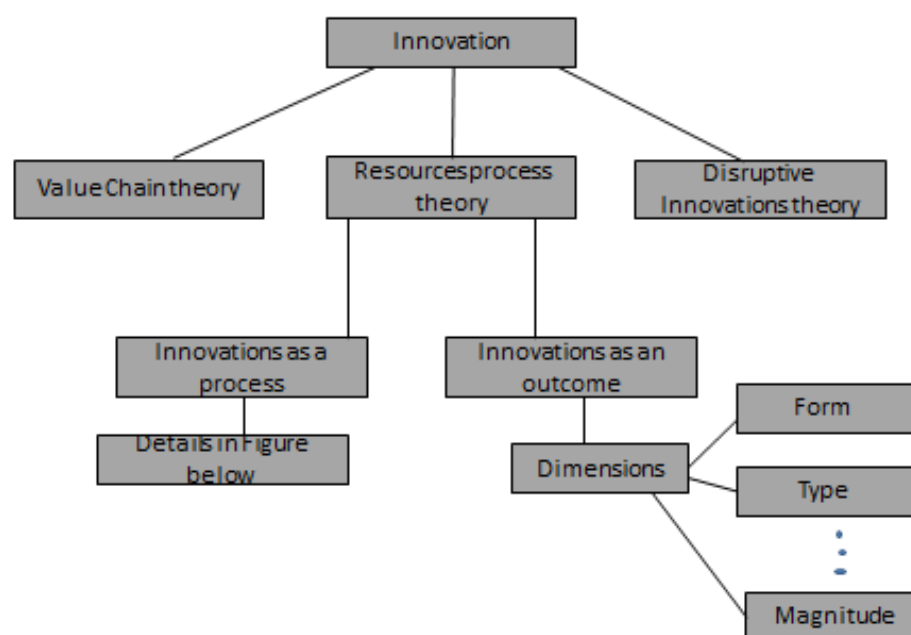
using software tools which support visual strategies like concept mapping to see the big picture, image libraries linking and visualisation tools. For situationalists he recommends collaborative tools like shared Working Databases and emails. For creative projects which have a long duration he recommends search tools with features that include exploration of previous research, dynamic filtering by narrowing of filters, ranking, clustering, collaboration by email, chat messages, annotation, tagging, saving of history and progress indicators of what has been done and what needs to be done. He recommends that software should record which ideas have been tried and which need to be tried, as well as the author of those ideas in interests of fairness and recognition. Tools need to be easy to use as well as provide rich features. This is achieved by creating different workspaces for novices and expert users (Shneiderman, 2007). The individual and organizational features for creativity can flourish in virtual teams as well.

In summary creativity is affected by individual cognitive traits, organisational factors of support, diversity, suitable methods and tools of communication.

Creativity is of not much use if it is not implemented and that leads us to innovation. In the next section innovation literature is reviewed.

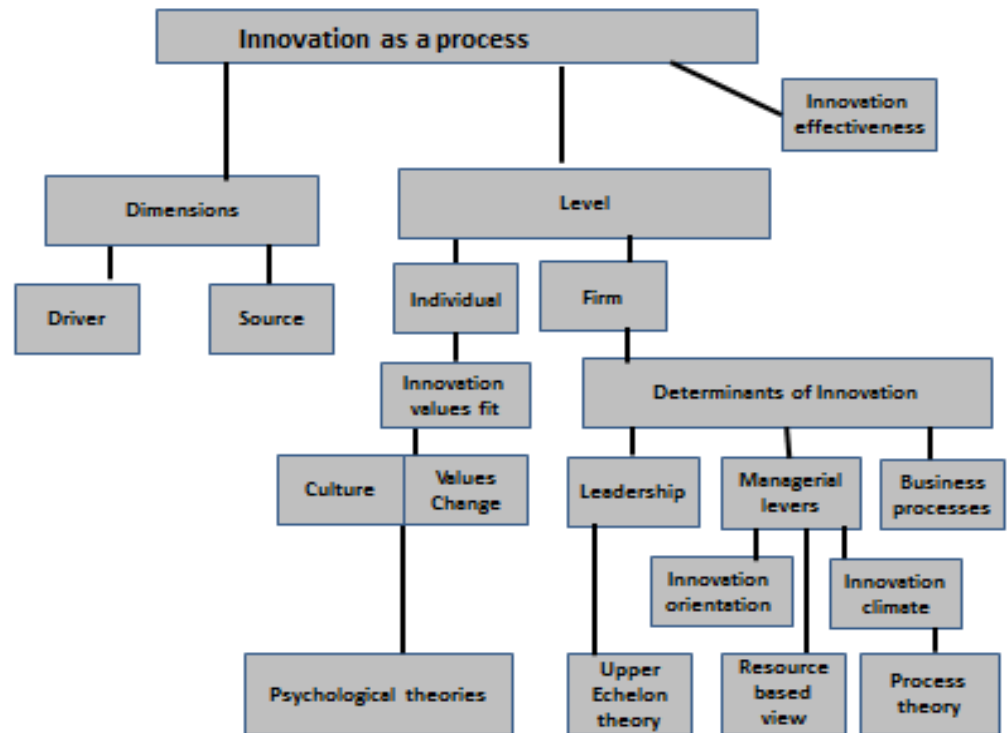
## 2.6 Innovation

Literature review explains Innovation with the use of the Value Chain theory, Resource process theory and Disruptive Innovations theory. The foundation literature on Innovation is summarised with key themes in Figure 4 below. Associations between the themes are shown by arrows.



**Figure 2-6: Innovation – Foundation literature themes**

As this study is investigating an innovation implementation, the review focusses on Innovation as a process theme within the Resource processs theory . The diagram below shows key themes for Innovation as a process.



**Figure 2-7: Innovation as a process**

### **Why study innovation?**

Firms have to be innovative to maintain their competitive edge. Management of innovation is one of the key competences that managers need. Managers need to anticipate, adapt and transform the products, services and processes to survive and prosper (Igartua, Garrigós, & Hervas-Oliver, 2010).

Carland, Carland and Stewart (1996) state that, the two important qualities an entrepreneur requires are creativity and innovation. An entrepreneur creates innovative products and services for fulfilling a gap in the market (Carland, Carland, & Stewart, 1996). Managers need to be entrepreneurial to enable their organisations to retain their competitive edge (Igartua, Garrigós, & Hervas-Oliver, 2010).

Innovation and entrepreneurship use the same processes of exploration and exploitation of opportunities (Crossan & Apaydin, 2010).

### **What is innovation?**

Crossan and Apaydin (2010) define Innovation as the implementation of new product, process or business mode with the aim of adding value and providing additional benefits to the organisation (Crossan & Apaydin, 2010). New product or process requires the creation of the product/process. Dunne (2012) defines Innovation as the legitimization of the creative act by the group. Innovation has three components: Individual creating the idea; transmission of the idea; and organisation acceptance of the creative act as useful (Dunne, 2012).

Friedrich, Mumford, Vessey, Beeler and Eubanks (2010) have categorised innovation into four types. These are simple (incremental), complex (radical), process and product innovations. Complex (radical) innovations involves integration of new and original knowledge domains for the organisation. Incremental innovations are changes to existing process or products. Product innovation consists of new product development and process innovation consists of new or changed processes for the production of services/products (Friedrich, Mumford,, Vessey, Beeler, & Eubanks, 2010). Crossan et al. (2010) categorise innovations as technical (product, technology) or administrative (organisational structure, human resources, and administrative processes). The technical or administrative innovations are similar to product and process categorisations and can be radical or simple (Crossan & Apaydin, 2010).

### 2.6.1 Theories of Innovation

Innovation can be viewed as consisting of a process and an outcome (Crossan & Apaydin, 2010). Crossan et al. (2010) state that the process of innovation (the how) always precedes innovation as an outcome (the what).

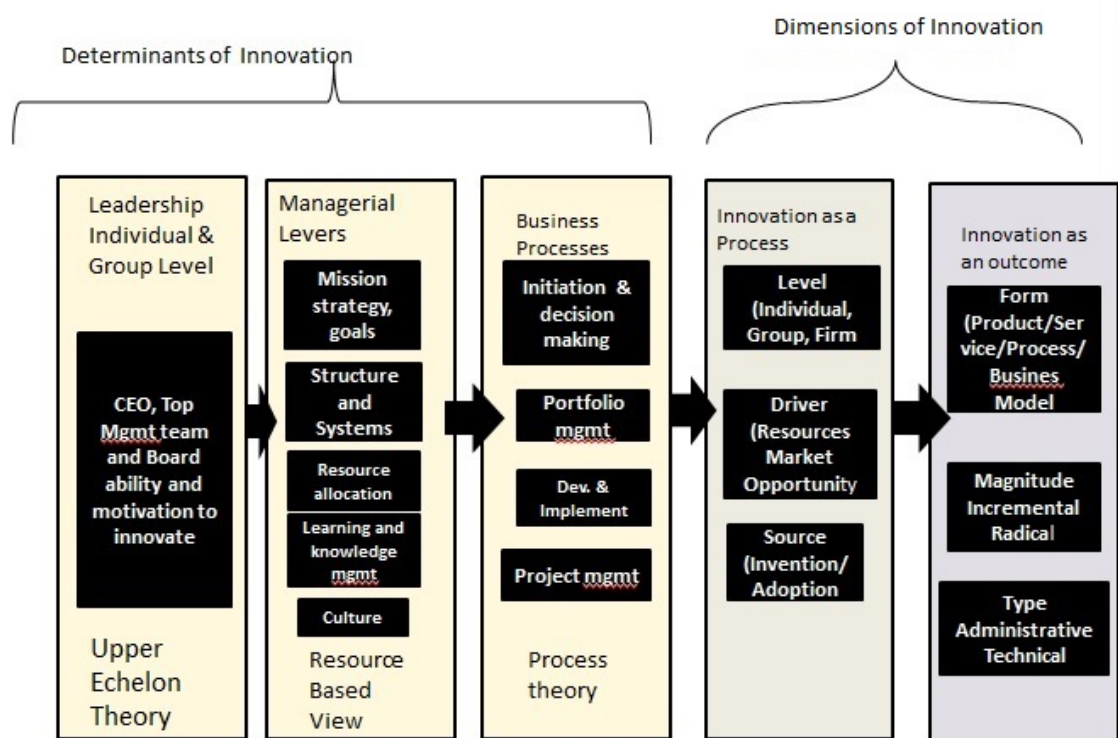
Crossan et al. (2010) state, that the process of innovation in organisations has three dimensions. These dimensions are driver of innovation, source of innovation and level of innovation. Drivers for innovation could be internal knowledge or regulations imposed externally. Source could be internal ideas generated by employees or innovation adopted from external sources. The level dimension of the process defines whether the innovation is firm, division or group wide. Innovation at the firm level can be analysed and studied using network, learning and knowledge theories, resource based view and adaptation theories. Innovation at the individual level can be analysed using psychological theories. Learning theories use the exploration exploitation model for innovation. The exploitation/implementation is considered successful if the organisation/end user derives value from the innovation (Crossan & Apaydin, 2010).

Crossan et al. (2010) define the outcome of innovation having dimensions of referent, form, type magnitude and nature. The relative newness of the Innovation to the organisation decides its referent, an innovation may have existed outside, but is new to the organisation; in this case the referent is the organisation. The form of innovation can be product or process or business model. The type of innovation can be technical (product) or administrative (process). The nature of innovation can be tacit or explicit. Ultimately innovation as an outcome is more important than innovation as a process (Crossan & Apaydin, 2010).



### 2.6.2 Determinants of Innovation

Crossan & Apaydin (2010) in their book on organisational innovation have classified the determinants of innovation into three major categories. As per them the categories that enable/hinder innovation are leadership, managerial levers and business processes. The determinants of innovation are represented in the theoretical framework in figure 2-8. The leadership qualities are described by the upper echelon theory, management levers described by the dynamic capabilities theories (a subset of Resource based view), and business processes by the process theory (Crossan & Apaydin, 2010). The categories are listed in figure 2-8 and described below.



**Figure 2-8: Determinants and Dimensions of Innovation**

Adapted from Multidimensional framework of Organisational innovation - (Crossan & Apaydin, 2010)

### *i. Leadership Individual and Group Level:*

Crossan et al. (2010) list the individual leadership qualities needed to support innovation as tolerance of ambiguity, openness to experience, determination to succeed, unconventionality, originality, initiative and pro activity. A leadership group should comprise of leaders with diverse backgrounds, experience, education and external industry ties. Leaders decide strategies that guide innovation selection. These innovations are implemented with the help of managerial levers using processes (Crossan & Apaydin, 2010).

### *ii. Managerial levers:*

Crossan and Apaydin (2010) list the managerial levers to enable innovation as innovation strategy, mission, goals, resource allocation, organisational structures, organisational learning, knowledge management tools and organisational culture. Tanewski, Prajogo and Sohal (2003) suggest that managers should adopt prospector strategies and organic structures which enable open communication and flexible decision making to support innovation. Crossan et al. (2010) suggest that managers should support experimentation and tolerate failures to foster innovation and learning. Managers should also provide formal idea generation tools, support employees to develop external linkages and foster an environment of risk taking to encourage innovation (Crossan & Apaydin, 2010; Tanewski, Prajogo & Sohal, 2003).

### *iii. Business processes:*

Process theory states that similar inputs will be transformed into similar outputs using the same process. Process involves same pattern of core activities. Crossan et al.

(2010) state that; innovation can be divided into five core activities of initiation, portfolio management, project management, development and implementation. Initiation involves generation or adoption of innovation ideas. Portfolio management involves decisions on strategy, technology and resource allocation based on economic benefits versus resources consumed. Development and implementation activities involve experiments and trials of innovations. Project management includes managing the innovation process in a systematic manner, communicating with stakeholders and post implementation review. Project efficiency is measured by project costs and adherence to schedule (Crossan & Apaydin, 2010). Linton and Walsh (2008) state that; the process of innovation is tightly coupled with the outcome of innovation (Linton & Walsh, 2008).

### 2.6.3 Innovation orientation

Hurley and Hult (1998) define organization's innovation orientation consisting of two dimensions. These dimensions are innovativeness (organizations openness to new ideas) and innovative capacity (organizations capacity to implement innovation). Innovativeness is supported by organization's learning orientation, participative decision making and collaboration. An organization's learning orientation will enable innovation. Innovation implementation is supported by organisational culture. Implementation of innovation will lead to increased competitive advantage and performance (Hurley & Hult, 1998).

Innovation outcomes and firm performance depend upon innovation determinants. Innovation outcomes may mediate between innovation determinants and firm performance (Crossan & Apaydin, 2010).

### 2.6.3.1 Learning

Lumpkin and Lichtenstein (2005) state, that organisational learning enhances organisation's opportunity recognition (OpR) to pursue new innovative ventures. There are three types of organisational learning; behavioural, cognitive & action learning. Behavioural learning is trial and error learning based on repeated behaviours and is used to improve performance or fix gaps. They state that behaviour learning is usually used for incremental innovation. They describe cognitive learning as exploiting external knowledge or transforming internal knowledge by instituting processes to convert the data to information and then to knowledge. They advise to develop processes to capture tacit knowledge held by employees so that other employees can learn, thus enabling improved performance for the firm (Lumpkin & Lichtenstein, 2005).

Lumpkin et al. (2005) describe action learning as focusing moment to moment on correcting misalignments between stated theory and actual theory in use i.e. what individuals/organisations do and what they say they do. This focus leads to improvement in individual commitment and organisational alignment. The focus on moment to moment actions leads to reframing of beliefs and action. Action learning can be single loop or double loop. Single loop learning is incremental by focusing on behaviours to improve efficiencies and double loop is transformative. Double loop learning questions the context in which actions are conducted i.e. will the organisations and individual actions lead to the right goals. This reflective learning leads to a change in cognitive schema and a commitment to new rules of engagement. Lumpkin et al. (2005) further state that reflection on action learning leads to cognition

and learning by trial and error i.e. behavioural learning, action learning thus leads to new learnings. Behavioural learning is used during the formation phase of creativity and innovation which involves evaluation and elaboration by implementing new ideas and learning from their failures (Lumpkin & Lichtenstein, 2005).

Lumpkin et al. (2005) state that, organisations need to innovate or fix problems they face to survive and prosper. They define opportunity recognition (OpR) as identification of a good idea and converting it into a business concept leading to value generation for customers and revenues for the organization. They define OpR consisting of three main stages. These stages are cyclic processes of discovery, evaluation and exploitation similar to creativity and innovation. The discovery phase involves cognitive learning, using knowledge from outside or tacit knowledge from inside. Evaluation & Exploitation involves behavioural learning. Action learning challenges the assumptions held by the individual and organisation recursively and informs discovery, evaluation and exploitation phases. Lumpkin et al. (2005) states that new opportunities are created by insights enabled by rreframing, synthesizing of already available cognitive knowledge. They state that cognitive learning is enabled by reading, reflecting and discussing ideas with people who have divergent opinions (Lumpkin & Lichtenstein, 2005).

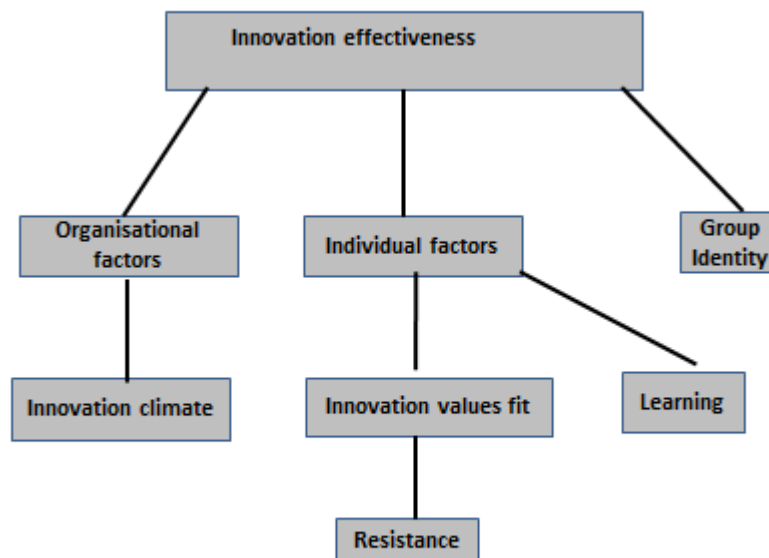
Lumpkin et al. (2005) suggest using action learning for OpR. They describe action learning as a combination of cognitive and behavioural learning. The cognitive part consists of challenging beliefs and assumptions, questioning whether rules of engagement are appropriate, this leads to increased awareness of whether the organisation is following the theories it is espousing. This process is not about finding

a solution, but about changing the foundation of the problem itself, helping the emergence of new solutions. The self-questioning and reflection can lead to cognitive breakthroughs in the discovery phase of the OpR. This coupled with actions in the formation stage leads to implementation of new ideas. The action and reflection are iterative, leading to successful innovations. Changing the rules of engagement may involve iterative process of collaborative dialogue with the stakeholders. They suggest asking questions and information to find the problems, gaps and creative solutions (Lumpkin & Lichtenstein, 2005).

In summary managerial levers, business processes, learning affect innovation implementation (the outcome) or innovation effectiveness and it is reviewed in the next subsection.

## 2.7 Innovation effectiveness

An Innovation implementation is considered effective if it is accepted by the users and benefits the organisation. Literature documents organisational, individual and group Identity as key factors influencing innovation effectiveness. These key themes from foundation literature for innovation effectiveness are summarised in the figure below. Association between themes is shown by lines.



**Figure 2-9: Literature review Innovation effectiveness**

Giardia, Garages, and Hera's-Oliver (2010) & Whittington (2006) state that, innovation is effective if users find it useful. They state that the implementation and use of innovations is an individual activity, that affects organisation performance and the individual use of innovations is impacted by organisational context that includes environment and society. The wider organisational and societal practices include

theories, norms, procedures, and shared behavioral routines. They found that innovation practitioners use improvised techniques from accepted practices to develop long term innovation road map and use. These practices include techniques like scenario analysis, environmental scanning for trends, opportunities and threats, Porter's analysis, SWOT analysis, portfolio analysis and technology road mapping for strategy development (Giardia, Garages, & Hera's-Oliver, 2010; Whittington, 2006).

Whittington (2006) further states that practitioners chose techniques for praxis that they are familiar with. He recommends enrolling elites who have influence over other users to help with diffusion of new practices including innovation (Whittington, 2006).

### 2.7.1 Individual factors

Bardi and Goodwin (2011) analyse innovation implementation and use in terms of resistance and individual values. They state that innovation results in change. They suggest that resistance to change may be related to an individual's values of security, achievement etc. These internal values guide perception, goals and behaviors subconsciously and act as motivators. They state that values are formed by socialisation, traits, temperament, culture, needs and personal experience. They believe that people do not give much thought or think deeply about their values or challenge them, thus making these values relatively stable. They believe that value change is possible but using persuasion to change values does not work as values are part of self-identity. They suggest the process to change values is making individuals aware of their values either by asking them to elaborate and think about it or giving strong environmental cues repeatedly to prime them to contemplate about their values. They found that people can revert back to their original values once the



stimulus that changed their values is gone. They suggest continual reminders of the reasons for their initial change via socialization or intervention programs to convert the initial change in values to permanent change. They also suggest priming to change values (mental schemas) by repeatedly presenting alternative schemas to enable automatic long term value change. They state that language aids in creation and elicitation of mental schemas, so a common language leads to common mental schemas or values. Common language thus is also partly responsible for creating group identity. They add that membership of a new group can also result in change in individual's values as a consequence of integration and assimilation. This leads to identification with the values of the group thus changing values of an individual. Changes in life situations like a new job or a new environment also leads to adaptation or change in values except for the most important values like security. They suggest that another way to change an individual's value is by creating cognitive dissonance or dissatisfaction between their self-concept and the values they hold. Practically this is achieved by asking people to write down their values and point out how it does not fit with their self-concept, or writing an essay on how their expressed values fit their self-concept to make them realize that their held values need to change to match expressed values. They state that since values are related to needs, goals and behavior, it implies that changing any or all of these will lead to change in values. Values exist in a system, so if a value increases in importance, complementary values increase in importance as well and values which are opposite decrease in their importance (Bardi & Goodwin, 2011).

### 2.7.2 Organisational factors

Moorman and Miner (1997) describe the effect of culture on innovation implementation and use. They describe organisational culture in terms of experience stored as memory. Organizational memory is stored in three basic forms. These forms are beliefs and legends, formal and informal routines and physical artefacts. Organizational memory performs two roles, interpretation and action. It interprets experience and the resulting interpretation (information) is categorized and stored. Organizational action is guided by formal and informal routines. Organizational memory can also be classified in terms of amount, dispersion and accessibility. Large amount of memory about a particular area makes it difficult for organization to search for external new information. Organizational memory may not be evenly dispersed in different divisions. For memory to be accessible, organizations need to develop practical mechanisms to record, store experiences and easy retrieval so that failures are not repeated. There are two types of organizational memory: procedural i.e. skills required for a process or steps in a process, and declarative memory about concepts, facts, customers and events. Both these type of memory is evident in an organizations culture (Moorman & Miner, 1997).

Moorman et al. (1997) then go on to describe the effect of higher amount and level of memory, i.e. it inhibits thinking and actions different from existing patterns (resistance to change), leading to lower creativity. Newer creative products require a change in the way people think and act, to reduce this resource burden; new product/service needs to be offered free. Moderate levels of memory dispersion leads to sharing a language, understanding of solutions and problems, but does not enable a unified

mental model where all organizational routines and actions are religiously followed; this leads to a mixture of homogeneity and heterogeneity where functions retain their distinctive skills and knowledge leading to increased creativity and innovation. High speed environmental change makes previous experiences (stored memory) useless. It destroys values of old competences. Internally heterogeneous organizations where the amount/level of memory and the dispersion is low can unlearn old memories and develop creative ideas better than homogenous organizations (Moorman & Miner, 1997).

Moorman et al. (1997) conclude that creativity during high level of technological change is enhanced by heterogeneity in organizational information and homogeneity in information enhances creativity during low levels of change. Interactions with different sources of information within and outside the organization will help creativity during high levels of organizational change. General shared knowledge is seen as enabling creativity more than specialization, which is fragmentation of organizational knowledge. Learning creates memory. During times of change, there is no organizational memory to rely upon. Formal experimentation, rapid prototyping and improvisations are recommended to build up the knowledge (Moorman & Miner, 1997).

### 2.7.3 Organisational climate

Crossan et al. (2011) state that the decision to adopt an innovation in an organisation is usually taken by senior management. Innovation effectiveness is the benefits received by the organisation due to the implementation of the innovation. Klein and Sorra (1996) define implementation effectiveness in an organisation as measured by Harbindar Sangha

the use of the innovation. The use can range from avoidance (non-use) to compliance (non-enthusiastic use) to commitment (enthusiastic use). Thus the fundamental challenge in effective innovation implementation is getting organisational members consistent, skillful use of the innovation. Organisational effectiveness depends on the skills of its members. An organisation where all members use the innovation with moderate levels of skill compared to an organisation where only a few members use it with high levels of skill, has implemented the innovation more successfully (Crossan & Apaydin, 2011; Klein & Sorra, 1996). Klein and Sorra (1996) state that implementation effectiveness is dependent on the organisational climate; support for innovation use, rewards for innovation use and whether the innovation is user friendly. Support includes training, and removing obstacles to innovation use (this includes listening to user feedback). Klein et al. (1996) suggest that individual compliance to use innovation is based on getting rewards or avoiding punishment. Commitment on the other hand is based on internalisation which is dependent on whether the innovation is congruent with their values. Values are beliefs about personal and social desirability of conduct or existence. Organisational values can be external focused on dealing with customers and competitors or internal including how to relate with and work with one another. Innovation fit is the targeted users' perception whether the innovation fosters or inhibits organisational/group values. Innovation fit affects the success or failure of innovation implementation. Klein et al. (1996) state, if an innovation is against group/individual values, then commitment to innovation use will be low. In a strong implementation climate with poor innovation values fit, employees will resist the use of innovation. Implementation climate is created by senior managers with support for innovation including training and incentives, but it is important that the innovation fits

in with the values of targeted users otherwise the best that can be expected is compliant use or resistance from the users. Innovation implementation effectiveness is thus dependent on implementation climate and values-fit. An innovation which is implemented effectively may not yield the desired organisational objectives thus making the innovation ineffective. Innovation effectiveness is the end goal and an ineffective innovation reduces support for future implementation climate and values. The strategies to change innovation values fit include employee participation in decision making and senior management explanation about the need for innovation. Employee participation in decision making ensures that the innovation decisions fit with employee values and participation also leads to change in employee values. Multiple innovations being simultaneously implemented also need to be complementary in values fit; otherwise one innovation implementation will obstruct the implementation of another (Klein & Sorra, 1996).

In summary, implementing innovations effectively requires the implementation team to know the values or change the values of users and exchange of knowledge between the implementation team and users. This requires rich social interactions. In virtual teams creating rich social interactions are challenging. These rich social interactions are dependent on factors of Group Identity, Trust and Presence. The next few sections review these constructs.

## 2.8 Group Identity

Literature states that Group Identity is a key factor for virtual team performance.

Group Identity is explained by Theories of Group Identity. Literature states that Group Identity also depends on Trust and Presence. The foundation literature for Group Identity is summarised with key themes in Figure 6 below. Association between themes is shown by lines

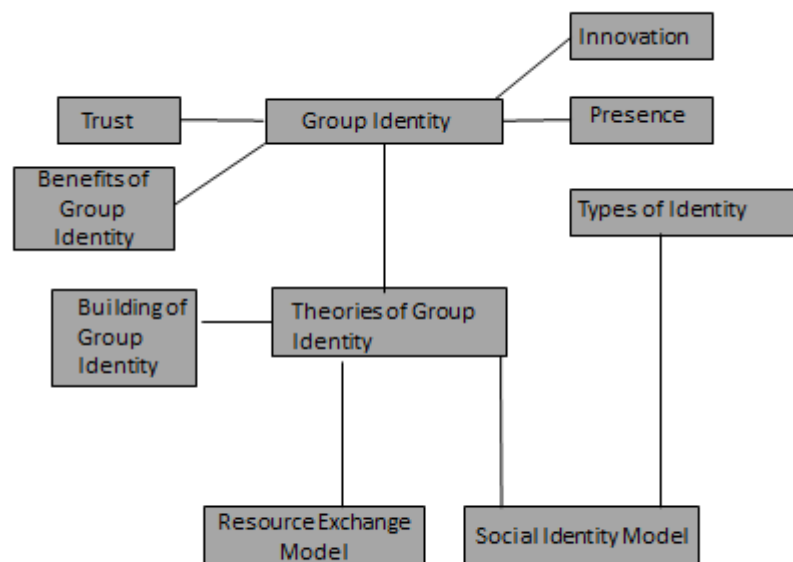


Figure 2-10: Group Identity- Foundation Literature themes

Adarves-Yorno Postmes and Haslam (2007) in their empirical study found that identification with the groups and its norms affects whether an innovation is accepted or not (Adarves-Yorno, I., Postmes, T., & Haslam, S. A., 2007). In their paper they state that creativity and innovation is context dependent. Social consensus about a person's contribution is instrumental in evaluating a person's creativity rather than their achievements. Identification with the group results in internalizing the group values inducing conformity with group norms. Ideas and products that fit in with the group norms are perceived as innovative when group identity is salient (Adarves-Yorno, Postmes, & Haslam, 2007).

Kärreman and Alvesson (2004) state an individual's identification with Social Identity provides comfort and security connecting the individual to an imaginary collective. Similar appearances and conformance leads to social identity, this homogeneity promotes group think, low creativity and low innovation capacity (Kärreman & Alvesson, 2004).

### **Definition of Group Identity**

Group identity satisfies individuals' need for belonging, inclusion and uncertainty reduction. Group identity is composed of a sense of belonging, emotional attraction and shared goals. Members view their group members positively as their self-esteem is based on group membership (Gajendran & Joshi, 2011; Webster & Wong, 2008).

#### **2.8.1 Types of ID**

Haslam, Ryan, Postmes, Spears, Jetten, and Webley (2006) have classified Group members identities into three types; Group, Role and Person. Group Identity is based

on similarities with other group members, role identity is based on expectations of the role. Personal identity is based on personal idiosyncrasies. These identities are activated depending on the situational context. Group identity involves de-individualisation and role identities emphasize the differences the role has with another counter role. Role identity may increase or decrease group identification. Role identity is based on self-efficacy whereas Group identity is based on the cognitive process of self-esteem i.e. members feel good when they are accepted and supported by the group, whereas in role identification the cognitive process of self-efficacy is involved i.e. a person feels good when they perform their role well (Haslam, Ryan, Postmes, Spears, Jetten, & Webley, 2006).

### 2.8.2 Benefits

Team members, who identify with the group trust each other, cooperate with each other and perform better (Gajendran & Joshi, 2011; Webster & Wong, 2008).

Interpersonal trust leads to sharing information, helping each other and working to achieve collective goals (Gajendran & Joshi, 2011; Webster & Wong, 2008).

Cooperation (exchanging ideas, solving problems) involves relational behaviour typically directed at task achievement in the workplace. Identity confirmation leads to interpersonal attraction and hence cooperation. Group identity helps build shared understandings leading to building of trust. These can be difficult to build in a virtual environment making the issues of trust and identity more challenging to manage (Kimble, 2011).

Ellemers, De Gilder and Haslam (2004) state that identification with the group motivates the members to perform better (Ellemers, De Gilder, & Haslam, 2004).



Members who strongly identify with the group have strong emotional attachment to the group, internalize group goals and are more motivated. Identification with the group also reduces social loafing also known as motivational loss. Additionally reward systems in organisations can enhance self-identification or collective identification (Ellemers, De Gilder, & Haslam, 2004).

The identification with the group motivates members to work collaboratively towards group goals sometimes even at individual cost. The shared social identification with the group has initially no impact on commitment towards group decisions. The commitment grows with time as the social identity is reinforced and consolidated (Haslam, Ryan, Postmes, Spears, Jetten, & Webley, 2006).

People have considerable discretion regarding the amount of effort they invest in groups. There are two types of behaviours, mandatory behaviour stipulated by the group and discretionary under the control of the individual. Mandatory behaviours are motivated by incentive and sanctions provided by the group. Discretionary behaviours are the ones which increase cooperation and these are motivated by their attitude and values. A positive attitude towards the group leads to behaviours that are beneficial to the group. Values are feelings of responsibility and shape behaviours towards the groups (Tyler & Blader, 2003).

### 2.8.3 Theories of Group Id

Tyler et al. (2003) explained group identity in terms of the resource based exchange model and the social identity model. Using the social identity model, they explained that identification with the group involved merging the sense of self with that of the

group, thinking of the group in similar terms as one self and defining oneself in terms of membership of the group. Group identification involved pride in belonging to the group increasing a person's self-esteem. The feedback received from the group about one's status in the group has implications for the maintenance of personal identity. Respect from group members shows that they are valued by other group members, increases self-worth whereas negative feedback can be harmful to one's identity (Tyler & Blader, 2003). They used the resource exchange model as well to show that people interact with groups cooperatively to exchange resources. The desirability of the resources gained from a group compared to resources that can be gained from another group decides the person's loyalty/membership of the group. Getting more/better resources from a particular group makes a person feel better about being part of the group affecting their identity and indirectly affecting cooperation (Tyler & Blader, 2003).

S. Alexander Haslam, Powell, and Turner (2000) used the social identity model to explain group identification using identity salience with hierarchy of needs. They explained that people's behaviour is motivated to fulfil needs based on their aspirations. These aspirations depend on the identity that is activated in the person. Each identity has its own norms and goals. Personal goals like personal advancement are important when personal identity is activated and group goals like relatedness, group esteem are important when group identity is activated. In the western world, lower order physiological and safety needs are satisfied, and people want higher order needs of affiliation, and self-actualization satisfied. Personal identity can be defined at various levels of abstraction from individual identity which is different from other

individuals to group identity which is depersonalized, shared with others in the group. Group identities can again be categorized hierarchically from membership ranging from team to division to organization to nation etc. A particular identity is activated depending on the stimuli from the environment. The selection of stimuli is influenced by the social history and expectations of the perceiver, which are influenced by their group membership. Social identity activation leads to member's alignment with issues related to the shared social identity and influences work motivation. Membership in high status groups and respect from group members increases commitment to group and organizational citizenship. Internalization of shared social identity leads to self-regulation and reduced need for managerial intervention (S. Alexander Haslam, Powell, & Turner, 2000).

Van Knippenberg (2000) explains organisational performance relationship with group identity using group goals. He states that one of the important factors affecting performance is the motivation to do well in the job and organisational identification affects motivation. Shared social identity becomes part of the self, affecting perception and behaviour to treat group goals as one's own. The self is composed of various social identities and one of them becomes salient depending on the situational context. Shared Social identity motivates one to exert more effort to achieve group goals. Higher performance is also related to whether the group goals are aligned with organisational goals. He explains that performance can be subdivided into two; task performance is the performance on the job that one was hired for and contextual performance is performance that helps the group by creating the right organisational psychological environment to enable task performance. Contextual performance

includes helping others and looking after other members interests. Task performance is a condition of employment for individuals, but contextual performance is volitional and is more affected by group identity than task performance. Task performance is higher for individuals when the social identity is salient, individuals identify with the group and there is competition with another group. Contextual performance i.e. altruism and citizenship behaviour is also high when social identity is salient and activated. Complex tasks which require co-operation and abilities of other members is also dependent on contextual performance and hence on team members having shared social identity. Goal setting is found to increase performance for groups and individuals. Participative goal settings for groups are found to increase social identification and identity salience (Van Knippenberg, 2000).

Hogg and Terry (2003) explain individual's identification with a group in terms of social identity and as a mechanism to deal with uncertainty. They explain that individuals self-categorise themselves to belong to certain groups which are significant to them in terms of emotion and value. These categorisations help in defining an individual's place in society and aid in their self-esteem. Self-categorisation transforms the self-concept into in-group (cluster of people who show loyalty to each other) prototype that includes beliefs, attitudes and behaviours; maximising similarities between group members and maximising differences between out group members. Individuals no longer have unique individual self either for oneself or the out group. They are all perceived as prototypes of their respective groups. Individuals store these prototypes in memory. These group prototypes are dynamic and activated depending on the context. The need for positive self-esteem drives individuals to associate with groups

which they evaluate as having a positive or high status social identity. The need for certainty which defines what to expect from the physical and social environment and expected behaviours also drives the need for identification with a group. The in-group provides validation for the individual self and behaviours, which have been consensually agreed upon, thus reducing uncertainty (Hogg & Terry, 2000).

### **Building Group Identity**

Ellemers et al. (2004) state that, group identification is built by a process of categorisation, comparison and identification. The process of categorisation involves checking for similar characteristics in others for a particular situation or context. The comparison process involves checking for characteristics that are different from others and identification involves the group member perceiving group characteristics as describing their self and makes them adopt group norms. People find high status and high power groups more attractive candidates for group identification, as it contributes to positive sense of self (Ellemers, De Gilder, & Haslam, 2004).

Haslam et al. (2000) has a similar view on building group identification. They state that Individuals identify with groups based on self-categorization. People identify with a Group identity based on that they are similar in certain categories using a social categorisation process and different from other groups using a social comparison process. They state that group members share a common perspective, views and support ideas that agree with group norms by processes of mutual influence. They state that shared social identity leads to escalation in commitment to failing projects as failure is seen as a threat to group identity (Haslam, Ryan, Postmes, Spears, Jetten, & Webley, 2006).

Haslam et al. (2006) compare Group identity of an individual with Role based identity of an individual. Identification with the group makes an individual becoming similar to others in a group and having common perspective. In comparison Role based identity is based on having different perceptions compared to individuals having counter roles. These perceptions lead to different behaviours when role based identity is salient and involves interactions and negotiations between the two individuals to achieve goals (Haslam, Ryan, Postmes, Spears, Jetten, & Webley, 2006).

Group identity is made salient by addressing members by their group names and making group members working collectively on common outcomes norms (Adarves-Yorno, Postmes, & Haslam, 2007).

Tyler and Blader (2003) state, that fairness is very important for building of group identification. They state that for people to identify themselves with a group, they should perceive that the group makes good quality fair decisions and treats people well. Unfair decisions in groups based on biases can give rise to favouritism; prejudices and stereotyping of minority group members and cause members not to identify with the group. Treatment of people with politeness, dignity, caring for their needs and concerns shows that they are valued building identity security (Tyler & Blader, 2003).

Kärreman and Alvesson (2004) state, that identification with a group provides comfort and security connecting the individual to an imaginary collective. Similar appearances and conformance leads to social identity. They state that common uniforms in organisations can help build group identity (Kärreman & Alvesson, 2004).

Kärreman et al. (2004) suggest using human resource management systems (HRM) and procedures to build shared goals and enable higher performance in a group. They state that shared goals are built as an interaction of the technocratic structure of the organisation and the individual's social identity. An individual's social identity in an organisation consists of ideas of an individual's hierarchical position, opportunities for career progression, loyalty and commitment to the organisation. The hierarchy, career progression is promoted by the technocratic structure of the organization and it interacts with the individual's social identity to create meaning and identification by regulating feelings, thinking and activities thus creating shared values and goals. The provision of opportunities for natural career advancement to higher level creates a belief that all positions are temporary except the highest one and hence the belief system of the topmost position is accepted as one's own. This employee identification with the elite of the organization generates loyalty and long working hours. Shared values and goals also lead to social pressures to perform and meet deadlines resulting in long hours at work, reinforcing group identities and leaving limited time for other activities and hence other identity activation. This sociological identification is different from psychological penetration where goals are internalised. The social identity in this case is produced by corporate HRM systems and procedures (Kärreman & Alvesson, 2004).

Hogg and Terry (2000) explain building of group identification by social attraction. They describe three mechanisms to increase social attraction. They suggest creating uncertainty to increase group identification, creating intergroup competition to make the group salient and highlighting the desired attributes of the group increasing its

status. Group members whose behaviour is different from the in-group, threaten the distinctiveness of the group creating uncertainty and are thus rejected to create a clear prototype so that group members can identify with the group. Positive deviants i.e. high achievers are accepted by the group if the group members want self enhancement by basking in the glory of the high achiever and if the high achiever credits his success to the group rather than claiming/boasting it all to his/her capabilities. Since identity salience is dynamic, changing the intergroup comparative context to make the in group look favourable (by benchmarking with other groups), can change the identity. They suggest that demographic similarity between group members also creates social attraction and cohesion. Social attraction increases group cohesion (Hogg & Terry, 2000).

Kärreman et al. (2004) also suggest using uncertainty as a mechanism to create group identities. They explain that identities are formed by sense breaking and sense giving. Sense breaking involves disrupting an individual's sense of self to create a loss of meaning by creating a gap in the present state and future state that an individual should aspire to. This gap is then filled by creating new aspirations and goals and building commitment to these new goals. Sense breaking initialises identification. Sense making/ Sense giving completes the identification process. The sense giving process involves positive programming/ feedback to individuals about their behaviour and reducing the negative destructive feedback (Kärreman & Alvesson, 2004).

The next section discusses Presence, another key factor in virtual team performance.



## 2.9 Presence

Literature states that Presence is another key factor in virtual team performance.

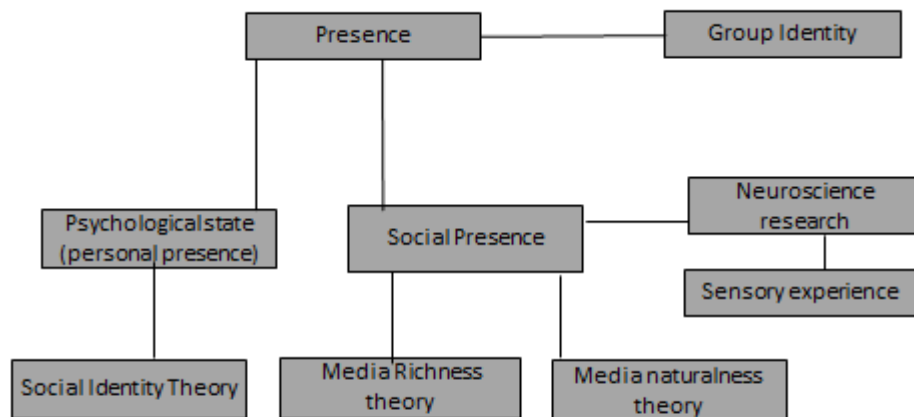
Literature classifies Presence as two types; Psychological Presence and Social Presence.

These two Presence are dependent on factors explained by Social Identity theory,

Media naturalness and Media richness theories. Literature states that Presence also

depends on Group Identity. The foundation literature on Presence is summarised with

key themes in Figure 7 below. Associations between themes are shown by lines.



**Figure 2-11: Presence themes - Foundation literature**

### **Why study presence in an innovation effectiveness study**

Lin (2007) conducted an empirical study of 50 large organisations in Taiwan and

concluded that knowledge sharing enables development of new solutions and

products giving an organisation competitive advantage. Zakaria, Amelinckx and

Wilemon (2004) in their paper state that sharing of knowledge and ideas is difficult in virtual teams because forming of interpersonal relationships is not easy. This impacts creation and sharing of knowledge and ideas, necessary for creativity and innovation. Virtuality also affects group cohesion and trust impacting work group effectiveness (Zakaria, Amelinckx & Wilemon, 2004).

Lipnack and Stamps (2008) found that virtual teams that are separated by distance face issues of communication and participation. Oldham et al. (2012) state that relationship conflict has a negative effect on creativity (Oldham & Baer, 2012) and it is more difficult to fix communication breakdowns across distance using tenuous electronic links (Lipnack & Stamps, 2008). Conflict resolution is also positively impacted by presence. Low conflict increases trust and increases performance (Oldham & Baer, 2012).

Lee Yates, Clark, and El Sawy (2010) in their paper write that virtual presence imposes cognitive effort on the recipient and anything which reduces cognitive effort will aid the recipient to use the additional cognitive effort in other areas. Enhanced presence leads to increased social interaction and better user experience (Lee, Yates, Clark, & El Sawy, 2010).

### 2.9.1 Types of Presence

Lee et al. (2010) classify human experience as real or virtual. They state that real experience is based on sensory experiences of actual objects whereas virtual experience is a psychological state in which virtual objects are experienced by the senses; mediated by technology (for example state of presence based on sound of

remote person via telephone, state of presence based on the video of a remote person transmitted by videoconference) (Lee, Yates, Clark, & El Sawy, 2010).

Chertoff Schatz, McDaniel, and Bowers (2008) describe the virtual experience in holistic terms by decomposing the psychological component of presence. Besides sensory experience they include cognitive, affective, active and relational factors (Chertoff, Schatz, McDaniel, & Bowers, 2008).

Flach and Holden (1998) describe virtual experience in terms of the ability/intention to respond to perception of the stimulus of the remote environment (Flach & Holden, 1998).

Lee defines social presence as the experience of presence of others mediated by technology (Lee, 2004). Riva defines presence as human beings trying to develop meanings with verbal and visual interaction (Riva, 2009).

Nunez (2003) in his paper writes about three models of presence. They are social presence, personal presence and environmental presence (Nunez, 2003).

### 2.9.2 Theories

Nunez (2003) describes social presence as created by computer mediated communication (CMC), which supports collaboration and interactions. The personal model of presence focuses on individuals and their psychological states. The environmental model focuses on the environment and the tasks performed in it.

Nunez (2003) describes personal presence as cognitive presence, a psychological concept, which defines presence as thought process or behavioural response (action) as a result of perception, previous knowledge and experience. Knowledge is stored as

schemata (complex concepts and their relationships) and experience is stored as scripts which are sequence of behavioural events, Presence (thought process or behavioural responses) is thus a result of perception and the cognitive state of the user. Presence is increased if the preferred mode of perception for a user is strengthened (for example if the user prefers visual stimuli, increasing visual stimuli will increase presence). Knowledge and experience with virtual work increases the chances of feeling of presence even with low stimuli (Nunez, 2003).

Nunez (2003) describes that social influence in computer mediated communication (CMC) and virtual environment is dependent on interpersonal interactions. These virtual environments provide less non-verbal cues impacting interpersonal communication. This leads to the conclusion that technology which emulates face to face (f2f) communication and enables more communication of nonverbal gestures enables more social presence.

Rogers and Lea (2005) have a different view on creation and maintenance of social presence. They use social identity theory to explain social presence. They state that an individual has multiple social identities including group identities stored cognitively internally and a particular identity gets activated within a social context. The virtual group shared purpose already exists cognitively inside the group members as part of their shared identity. As social category cues already cognitively exist inside the individual, social presence does not need rich virtual communication; concluding that Group identity can occur with relatively low sensory information. Shared identity leads to more collaboration between members. They state that Group identity is not an

aggregation between interpersonal bonds and hence CMC need not emulate f2f to increase social presence (Rogers & Lea, 2005).

Singer and Lamm (2009) use neuroscience research to explain the need for vision and other senses to explain presence. They state that social presence requires social interaction, which requires an understanding of other people's intentions, beliefs and predicting their actions. They quote neuroscience research which states that mirror neurons in the prefrontal cortex are used to attribute intentions to other people's actions. These mirror neurons are fired when observing other people. Thus vision and other senses are quite important for interaction and hence presence (Singer & Lamm, 2009).

Plutchik (2001) writes that emotions are an important signaling mechanism for communication. Emotions communicate to others, one's fear, anger, and joy. Emotions are expressed by face and body. In Virtual teams emotions cannot be seen, hence an important signaling method is lost and presence is diminished (Plutchik, 2001). Harvey and Sanche-Vives (2005) also use neuroscience to explain presence. They state that brain can fill missing information to create a sense of presence implying that the technology does not need to be rich to convey presence. The brain uses selective attention to discard stimuli that it does not need. Group of cells related to a common percept oscillate together, hence stimuli need to be temporally coherent. However incoherent stimuli break the sense of presence (Harvey & Sanchez-Vives, 2005).

### 2.9.3 Building of presence

Nunez (2003) suggests that the CMC should be vivid and interactive i.e. it should include the richness and breadth (number) of stimuli, and it should have fast predictable response and be simple to use (Nunez, 2003).

### 2.9.4 Media Richness Theory

Daft and Lengel (1984) state that for teams working with ambiguity and complex task interdependence to be effective; quick feedback, visibility of facial cues, body language and voice helps reduce ambiguity. Face to face communication is the most media rich communication followed by video, voice and then email. Virtual teams that have complex task interdependence, and ambiguity, can be effective by using rich media (Daft et al., 1984).

The above theory is supported by Nunez (2003) who writes that social presence generation needs the CMC to be vivid and interactive. Vividness includes the depth (richness) and breadth (number) of stimuli, whereas interactivity includes the speed of response, predictability of response and the simplicity of use of channels available to the user for interaction (Nunez, 2003). He states that multimodal perception increases presence (Nunez, 2003).

### 2.9.5 Media naturalness theory

Kock (2005) states that evolution; optimized human beings for f2f communication. Media naturalness has five requirements; these five requirements are Space time dimensions of colocation and synchronicity; perception-expressive dimensions of visibility of facial - body expressions and speech. A loss in any of these five requirements leads to higher cognitive effort as the brain tries to compensate for the

missing stimuli by filling in the missing bits based on an individual's mental schema, leading to communication ambiguity (Kock, 2005).

Harvey et al. (2005) use the neurophysiological relationship of brain with stimuli to guide the creation of a virtual environment necessary for perceptual and cognitively coherent experience. They state that an environment with rich visual stimuli is not needed, but an environment which creates perceptually and cognitively coherent stimuli is needed (Harvey & Sanchez-Vives, 2005). Brotons-Mas, O'Mara, and Sanchez-Vives, (2006) focus externally on stimuli for the break in sense of presence and state that change in the timing sequence or delays in the communication medium can break the sense of presence supporting the synchronicity dimension stated in the media naturalness theory above. They state that presence can be generated by walking in a real or virtual environment, as this makes the place neurons in brain fire due to neurophysiological activity (Brotons-Mas, O'Mara, & Sanchez-Vives, 2006).

Chertoff et al. (2008) in their paper state that sensory presence can be enabled by technology, but cognitive, affective, active and relational factors are internal to the participant. These factors depend on the internal schema that the participants have built over time. They state that to create a holistic virtual experience, virtual presence created should match the internal schema of the participant. They also state that information overload, external and internal distractions can cause a break in the presence. To reduce these distractions, quiet rooms should be provided to minimize external distractions and compelling narratives should be created to engage the participant and reduce their internal distractions (Chertoff, Schatz, McDaniel, & Bowers, 2008).

Nunez (2003) states that the medium should suggest non-mediation to the user i.e. the user should not be able to distinguish the difference between the virtual and real environment. Learning and experience with the virtual environment improves presence, more attention devoted to the virtual environment increases task performance. He states that the user needs to be attentive and concentrate as the user has two sources of information, one from the virtual and one from the real environment (Nunez, 2003).

Current communication technologies do not provide all the features of f2f communication and hence lead to more cognitive effort. Technological communication is also less emotionally fulfilling than f2f communication. The Media naturalness theory also states that humans adapt to new communication technologies with time, and that long tenured virtual teams are as effective as f2f teams (DeRosa, Hantula, Kock, & D'Arcy, 2004; Rhoads, 2010).

Rogers and Lea (2005) state group cohesion within a distributed environment is created by interpersonal communication between group members. This interpersonal communication enhances personal identity rather than group identity. They suggest that shared group identity be made salient by emphasising group goals (which are not in conflict with individual goals) and its differences with other out-groups. This leads to enhanced social presence and reduces the need for visual cues to create presence. Social presence leads to enhanced group cohesion and group performance, assuming that group norms were appropriate. High technology solutions that emulate face to face communications are not needed to create presence. A shared group identity based on internal cognitive representation is good enough to create social presence.



The shared cognitive representation also removes the limit on group size affecting group cohesion; which is based on the difficulty for additional group members to develop interpersonal bonds with other members. If group goals differ from personal goals, then interpersonal relations with visual cues are more relevant and f2f communication might be better to generate social presence (Rogers & Lea, 2005).

To increase the presence and richness of user experience, Lee et al. (2010) advise that virtual communication systems be designed that satisfy user needs of physical and social presence. They advise creating a virtual communication environment that resembles the real environment to increase the presence and enrich the user experience (Lee, Yates, Clark, & El Sawy, 2010).

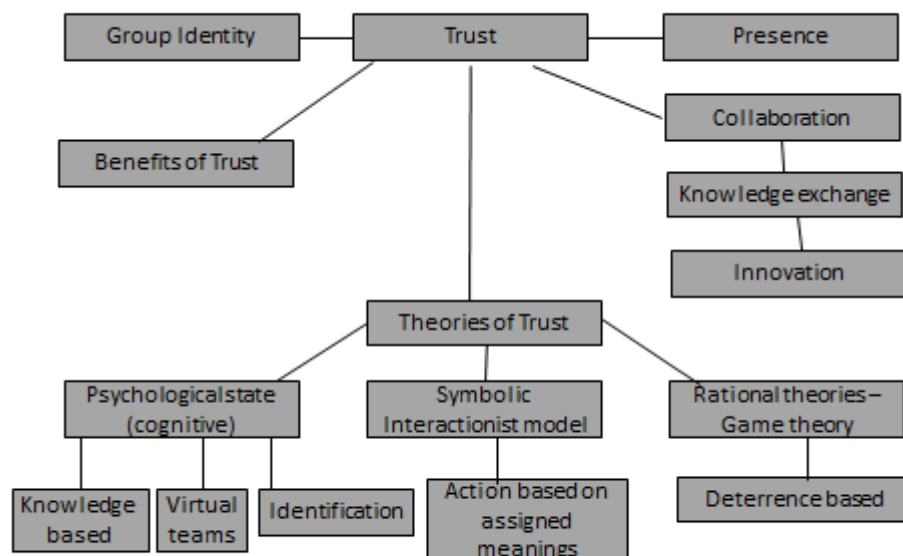
Slater and Wilbur (1997) state that presence is important if knowledge shared in a virtual environment is to be used in real life. Training is an example where presence of trainer is important for trainees. In other cases the user interface is more important than Presence (Slater & Wilbur, 1997).

The next section reviews Trust, another key factor for virtual team performance.

## 2.10 Trust

Literature states that Trust is another key factor for virtual team performance.

Literature also states that Trust depends on Group Identity and Presence. Trust is explained by theories of trust. The foundation literature for trust is summarised with key themes in figure 8 below. Associations between themes are shown by lines.



**Figure 2-12: Trust themes - Foundation literature**

### Why study trust for innovation?

Sztompka (1999) in his book 'Trust: A sociological theory' traces the origins of the concept of trust to modern times. As per Sztompka (1999), the division of labour in modern organisations leads to interdependence on other employees. Other employee's future actions cannot be predicted and this creates an element of risk.

Trust helps reduce the risk, that other employee's future actions will not be harmful to

oneself (Sztompka, 1999). Rusman, Van Bruggen, Sloep, & Koper (2010) state a similar view that trust is an uncertainty and risk reducing mechanism (Rusman, Van Bruggen, Sloep, & Koper, 2010).

Gibson and Gibbs. (2006) states that trust between team members allows interpersonal risk taking and enables psychologically safe communication, facilitating open information and knowledge exchange necessary for innovation (Gibson, & Gibbs, 2006). Chow & Chan (2008) in their paper add to the above view that trust enables sharing of explicit and tacit knowledge (Chow & Chan, 2008).

Jarvenpaa et al. (1998) state that equality and trust are the two basic human values required for cooperation. Cooperation leads to information sharing (Jarvenpaa, Knoll, & Leidner, 1998).

In their study on trust and innovation, Ming-Huei and Ming-Chao (2008) write that trust facilitates knowledge exchange enabling innovation. Innovation leads to competitive advantage. They also point to the negative impact of extreme trust between team members in internal social networks. Teams with extreme levels of trust rely only on team members for information, accepting information without verifying its veracity; and a belief that the team has monopoly on knowledge, leading to the development of the “not invented here syndrome” (NIH). These teams do not accept external ideas lowering creativity and innovation. In contrast, innovative capability is high for teams which use external social networks for information and knowledge for example teams using customers for ideas about products and services are more innovative (Ming-Huei & Ming-Chao, 2008).

In the next subsections a review of the definition of Trust is followed by subsections on different types of trust, trust building and trust in virtual teams.

### **Trust Definition**

Trust is faith in a person's integrity, reliability, fairness, expertise and belief that the other person will make their fair contributions to the group (Jarvenpaa, Knoll, & Leidner, 1998). Trust is behavioral expectations from others, so that uncertainty and risk can be managed and gains can be optimized from cooperation (Jones & George, 1998).

#### **2.10.1 Types of Trust:**

Lander, Purvis, McCray, and Leigh (2004), classify trust into three types. Deterrence based trust, knowledge based trust and identification based trust. Deterrence based trust is trust based on both parties keeping their word and retribution (discontinuation of the relationship) if word is not kept. Knowledge based trust is based on knowing the other and predicting their behaviour. The third level of trust is based on identification trust where one has internalized the preferences of the other (Lander, Purvis, McCray, & Leigh, 2004).

Rusman et al. (2010) define two types of trust based on its dimensions. Trust has two dimensions cognitive (trustworthiness assessment) and emotional (Rusman, Van Bruggen, Sloep, & Koper, 2010).

Jones and George (1998) classify trust as conditional and unconditional trust. Their analysis is based on values, attitudes and emotions. They define values as standards and guiding principles, used to evaluate others' trustworthiness. Attitudes are built on

knowledge of previous experiences of trust and decide interactions with others.

Emotions and feelings are signals about the quality of trust in the relationship. As per them, conditional trust is trust that is based on the two parties having the same interpretative schemes and it lasts till the other person behaves as per expectations and is good enough for most transactions. The trust in most organizations is conditional trust. Unconditional trust is trust based on shared values and is not situation based. Trust is dissolved in different ways for conditional and unconditional trust. Conditional trust is dissolved when behaviour expectations are not met.

Unconditional trust allows for a few behavioural lapses and the trust relationship is maintained, unless the behaviour is highly incongruent with values, in which case it leads to immediate breakdown of trust. Emotional outbursts in behavioural lapses are signals to other party to improve their behaviour in line with expected values.

Conditional trust enables people in organizations to cooperate to get the work done, but unconditional trust leads to superior performance. Developing unconditional trust needs a lot of effort from the management to be supportive of their employees and may not suit all organizations (Jones & George, 1998).

The three typologies can be synthesized into one typology. Deterrence based trust, knowledge based trust and conditional trust can be mapped to cognitive trust and identity based trust, unconditional trust to emotional trust.

#### **2.10.2 Benefits/Functions of Trust:**

Trust helps collaboration by lowering transaction costs. In uncertain environments and tasks, trust is required to take risks to produce outcomes (Elias, 2013). Elias (2013)

views trust as a complexity reducing mechanism as humans do not have all the information and depend on each other to complete complex tasks (Elias, 2013).

Gibson et al (2006) lists the benefits of trust as increased cohesion between team members leading to more information exchange and innovation. Strong ties found in cohesive groups make individuals more comfortable to share information that may entail some risk. Different members' tacit knowledge can be shared by internal communication creating a shared vision necessary for innovation. Psychologically safe communication is based on trust, which allows interpersonal risk taking and thus facilitates innovation in virtual teams by allowing open information exchange (Gibson, & Gibbs, 2006). Bell (2002) and Berry (2011) state similar views, Collaboration depends on communication amongst team members, which is dependent on trust between team members (Bell & Kozlowski 2002; Berry 2011).

Jornoza, Orengo, and Pennerroja (2009) list increased group cohesion and satisfaction as benefits of trust, leading to increased team effectiveness (Jornoza, Orengo, & Pennerroja, 2009).

### 2.10.3 Building of Trust

Jones and George (1998) used the Symbolic Interactionist perspective to model evolution of trust. Symbolic Interactionist perspective is based on two assumptions. 1) People act in social situations according to the meanings that they have assigned to them 2) Meanings are assigned to social situations by their experience in interactions over time. Thus trust is built by experience of interaction over time (Jones & George, 1998). A similar view is provided by Saonee, Manju, Suprateek and Kirkeby (2011) who state that trust is based on behavioural evidence. High levels of communication

between the trustor and trustee are needed to enable evaluation of the behaviour of the trustee to build trust.

Jones & George (1998) provide a detailed analysis of building of trust. Their analysis is based on values, attitudes and emotions. They define values as standards and guiding principles, used to evaluate others' trustworthiness. People's attitudes are built on knowledge of previous experiences and attitudes influence interactions with others. Emotions and feelings are signals about the quality of trust in the relationship. As per them, when two parties meet and start working together for the first time, both parties suspend their beliefs about trust/distrust and engage in an interaction. Each party will be trying to know the other person's values during the interaction. If during their interactions, their emotions signal to them that their values match, then this creates positive attitude and trust with the other party. This trust is conditional trust and it lasts till the other person behaves as per expectations and is good enough for most transactions. The trust in most organizations is conditional trust. Unconditional trust is trust based on shared values and is not situation based. Trust is dissolved in different ways for conditional and unconditional trust. Conditional trust is dissolved when behavior expectations are not met. Unconditional trust allows for a few behavioral lapses and the trust relationship is maintained, unless the behavior is highly incongruent with values, in which case it leads to immediate breakdown of trust. Emotional outbursts in behavioral lapses are signals to other party to improve their behavior in line with expected values. Conditional trust enables people in organizations to cooperate to get the work done, but unconditional trust leads to superior performance. Developing unconditional trust needs a lot of effort from the

management to be supportive of their employees and may not suit all organizations (Jones & George, 1998). Though Jones & George (1998) talk about using emotions to evaluate conditional trust, it is a cognitive decision and unconditional trust is an emotional decision.

Lander et al. (2004) describe building of cognitive trust based on the behaviour of the trustee. In the initial stages trust is built with repeated concurrent interactions, and based on competence reputation. If competence is lacking, willingness to learn mitigates lack of capability and is a useful strategy for building trust. Integrity (being forthright and truthful in interactions with others and fulfilling promises), consistency of word and deed, dependability, communication mechanisms (including the sharing of relevant information and knowledge, explaining decisions, open communications), fairness of decision making processes, achieving pre-set milestones, showing concern and recognition for others, frequent group interactions, sharing of control/group decision making, listening, admitting mistakes and apologizing all help in building trust (Lander, Purvis, McCray, & Leigh, 2004).

#### 2.10.4 Trust in Virtual teams

Saonee, Manju, Suprateek and Kirkeby (2011) in their study on trust in global virtual teams, state that modern organisations are composed of three types of teams.

Organisations have local teams, virtual teams and a hybrid model composed of some local members and some virtual members. They state that trust development is based on behavioural evidence, both in virtual as well as face to face teams, the difference being that virtual teams have to rely on computer/technology mediated communication to build this trust (Saonee, Manju, Suprateek & Kirkeby, 2011).



In virtual teams trust is cognitive. Team members assess other members' trustworthiness rationally and logically based on their reliability and competence, rather than affect based as in f2f teams, where trust is developed based on past history of members caring for each other (de Leede, Kraan, Hengst & Van Hoof, 2008; Henttonen & Blomqvist, 2005; Jarvenpaa, Knoll, & Leidner, 1998; DeRosa, Hantula, Kock, & D'Arcy, 2004). Virtual teams are characterised by geographical and or temporal dispersion.

Saonee et al (2011) state that team performance is affected by levels of trust and communication between members. A trusted member with a central position in the network, with high levels of communication increases team effectiveness (Saonee, Manju, Suprateek & Kirkeby, 2011).

Lander et al. (2004) state that, virtual teams which have no history, depend on building swift trust to perform effectively. Swift trust is composed of deterrence based trust, knowledge based trust and identity based trust. Members assess trustworthiness of other members by evaluating reputation, integrity, fairness and predictability, assessing the level of information shared, whether feedback was timely and control was shared (Lander, Purvis, McCray, & Leigh, 2004).

Information gathering about trustworthiness in virtual teams is based on initial interaction and sometimes on stereotypes, as members do not have shared history (Rusman, Van Bruggen, Sloep, & Koper, 2010).

Rusman et al. (2010) state that interpersonal trust can be analysed using the input - cognitive processing - output model. The input model is visible and includes signs and

signals. Signals collected include physiognomy (face), gestures, postures and para verbal clues of intonation pitch and speed. The cognitive process is invisible and involves information collection of individual and situation, to make trustworthiness assessment. The output process is also visible and includes trusting behaviour and results. In virtual teams some of the signals are difficult to collect making trustworthiness assessment difficult (Rusman, Van Bruggen, Sloep, & Koper, 2010).

Rusman et al. (2010) provide some guidance on facilitation of trust building in virtual teams. They advise to make information about virtual teams members available to all team members. They state that if information is not readily available about the trustee or their performance, initial trust/distrust formed persists in a virtual team. They also advise that sharing information about ability, benevolence (willingness to help, share information) and Integrity (honesty, fairness and loyalty) at the start of the team formation helps the formation of trust (Rusman, Van Bruggen, Sloep, & Koper, 2010).

Greenberg, Greenberg, and Antonucci, (2007) have similar advice for trust formation during team formation. During the inception stage managers should share the functional qualifications and expertise for choosing the member with the virtual team, as it helps in building cognitive trust. They advise that virtual team members selected should have predisposition to trust. Their reasoning is that a member with a predisposition to trust will attribute positive reasons if another member is unable to communicate initially or has some issues enabling development of swift trust in virtual teams. They advise that virtual team members need to be trained in using communication tools and software. They also need to be made aware of differences of cultural and technical backgrounds. They advise that members should not joke or

exclude other members otherwise the benevolence trust cannot be formed. They advise against offering competitive rewards to members as these rewards inhibit sharing of information and promote secrecy lowering perceptions of integrity.

Managers should provide endorsements of members, set rules of engagement like frequent communication, and be explicit about their thoughts. In the organizing stage, members should get together and develop a roadmap to accomplish tasks and set rules for sharing information. Members should recognize others contribution to build trust. Frequent communication amongst members and inclusion of non-participating members leads to building of trust. During the transition and accomplishing tasks stage, affective trust is required. Emails acknowledging others work help in creating affective trust. Meeting interim deadlines also helps in building trust in the later stages (Greenberg, Greenberg, & Antonucci, 2007).

Lewin & Cross (2004) in their paper focus on knowledge transfer and trust. They state that people are more likely to seek information from other people than databases or Internet, making interpersonal relationships more important for knowledge transfer. Relationships are important in learning how to do your work and solving complex problems. Social networks with weak ties, characterised by infrequent and distant interaction are sources of novel information whereas strong ties are more accessible and willing to help, but may provide information which the knowledge seeker already knows. Trust relationships make people more willing to share information and recipients more willing to listen and absorb it. Trust also reduces conflict and the need to verify information, making the knowledge transfer less costly. They state that knowledge transfer depends on both cognitive and affective dimensions of trust.

Knowledge transfer depends on competence, the cognitive dimension and benevolence, the affective dimension of trust. They state that explicit knowledge transfer is not dependent on trust; tacit knowledge is dependent on competence based trust. Trust in competence is more important than the benevolence of the sharer. Knowledge transfer can also be viewed from a social capital model of opportunity (ties), motivation (benevolence) and ability (competence) (Levin & Cross, 2004).

Longitudinal studies have shown that trust in virtual teams is the same as f2f teams (DeRosa, Hantula, Kock, & D'Arcy, 2004).

Presence and Group Identity effect trust. Trust affects collaboration and knowledge sharing, necessary for innovation and performance. Reliance on technology by virtual teams focuses the effectiveness argument on the how communication through technology can enhance effectiveness of virtual teams (Bell & Kozlowski 2002; Berry 2011).

## 2.11 Conclusion and Research Gaps

The review above has covered the concepts of virtual teams, implementation team effectiveness, creativity & innovation, trust, presence and group identity. The relationship of each of the constructs of trust, presence, group identity and implementation team effectiveness with the innovation effectiveness of virtual teams is seen as a gap in the literature that this research aims to address.

Effective use of innovation depends on its implementation which is dependent on implementation team effectiveness. This in turn depends on collaboration and

information sharing amongst implementation team members and users, which in turn depends on trust among team members (Mumford, Hester, & Robledo, 2012).

Presence (Jarvenpaa, Knoll, & Leidner, 1998) and group Identity (Gajendran & Joshi, 2011; Webster & Wong, 2008) are used to build trust for collaboration and information exchange (Jarvenpaa, Knoll, & Leidner, 1998).

Organisations worldwide are using or considering using virtual teams to take advantage of the skills located elsewhere to drive innovation and to lower costs (Tavčar, Žavbi, Verlinden, & Duhovnik, 2005).

Open innovation platforms and Crowdsourcing have been used by some companies like Audi, BMW, Procter & Gamble and Intel to reduce their reliance on internal R&D units (Fuller, Bartl & Ernst, 2006), indicating that there are benefits from virtual teaming even for less standardised creative processes. On the other hand we have seen organisations like Yahoo and Google; which are acknowledged for their creativity and innovation suggesting, that f2f collaboration is essential for them to sustain their levels of innovation (Warkentin, Sayeed, & Hightower, 1997; Guynn, 2013).

These contrasting experiences of how virtual teaming can help or hinder creative/innovative activities identify the research problem to be addressed. Under what conditions within the creative/innovation regime is virtual teaming a good or bad choice?

The relationships of Presence, Group Identity, Trust and implementation team effectiveness are explored in the context of innovation effectiveness in virtual teams with the constructs shown in the Figure below.

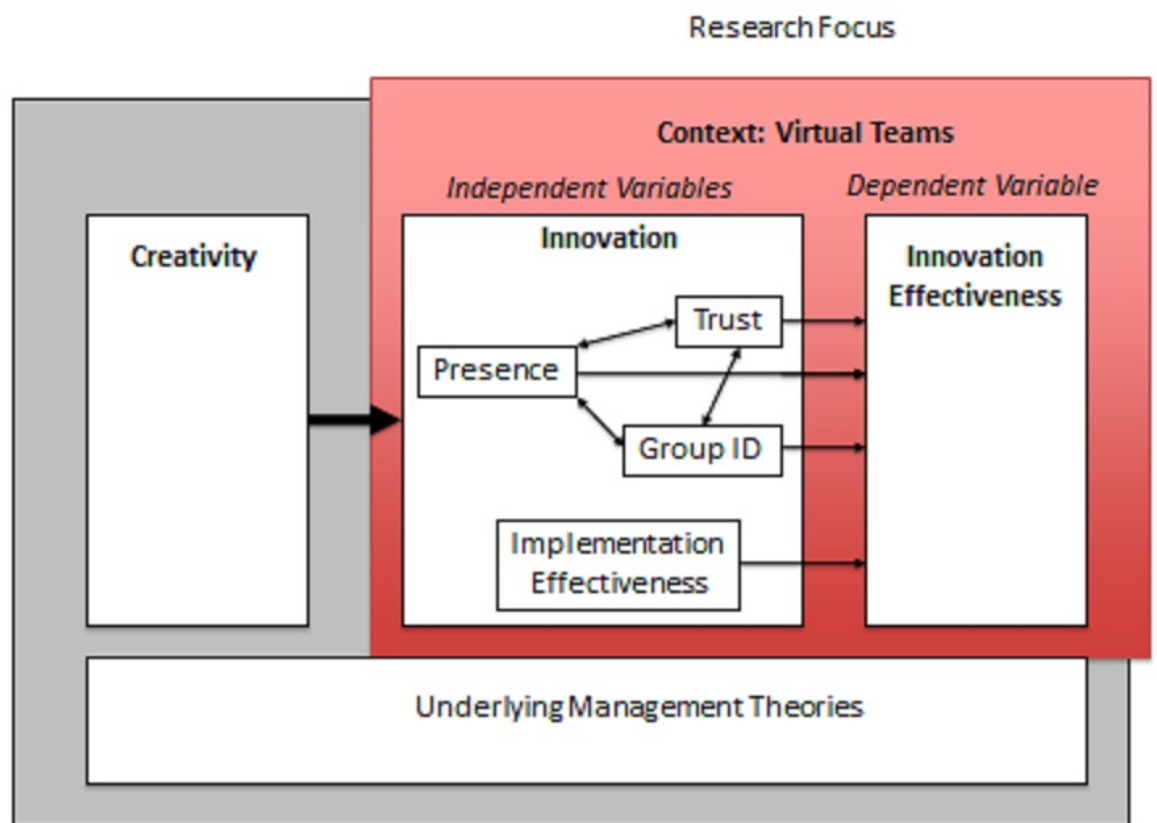


Figure 2-13: Research focus and theoretical model

## 2.12 Research Questions

The following research questions seek to find the organisational conditions that are conducive to innovation effectiveness in virtual teams. Hypotheses are formulated for each of these research questions to test predictions that may help guide practitioners.

**Research question: What is the effect of group identity, trust, presence and implementation team effectiveness on innovation effectiveness in virtual teams?**

This research question is split into three research sub questions and hypotheses below.

**RQ1: What is the relationship between Trust, Presence, Group Identity, and Innovation effectiveness?**

H1a: Trust is positively related to Innovation effectiveness.

H1b. Presence is positively related to Innovation effectiveness

H1c. Group Identity is positively related to Innovation effectiveness

**RQ2: Do Presence, Trust and Group Identity interact with each other to affect innovation effectiveness?**

H2a: Interaction of Presence and Group Identity affects innovation effectiveness

H2b: Interaction of Presence and Trust affects innovation effectiveness

H2c: Interaction of Group Identity and Trust affects innovation effectiveness

H2d: Interaction of Group Identity, Presence and Trust affects innovation effectiveness

**RQ3: Does Implementation team effectiveness affect innovation effectiveness?**

H3a: Implementation team effectiveness affects innovation effectiveness.

The first seven hypotheses are investigated both quantitatively and qualitatively. The last hypothesis was evaluated qualitatively.

### 3 Method and Research Design

#### 3.1 Introduction

This chapter deals with the research design and method that aids systematic data collection to test the hypotheses developed in literature review.

This study tests proposed hypotheses deductively. It aims to find/explain any causal relationships between trust, presence, group identity and innovation effectiveness quantitatively and the relationship between implementation team effectiveness and innovation effectiveness qualitatively. Suppes (1970) states that the causal relationships between constructs is probabilistic rather than deterministic because human behaviour is volitional as well as result of external events (Suppes, 1970).

The methodology used for the study is based on mixed methods. Mixed methods incorporate data collection and analysis using interpretive and statistical methods helping understand the social constructs in more depth (Uma & Pansiri, 2011). The methodology is a combination of positivism, and interpretivism. Qualitative research methods like semi-structured interviews are used to supplement, add depth, add perspective of participants and validate the data from the quantitative methods (Johnson & Onwuegbuzie, 2004), providing a richer set of data than with either of the methods alone.

The research is non-experimental, as the questions are measuring behaviour patterns. A case study approach is used. Questionnaire surveys were chosen as they are practical and have ability to answer research questions. A computer based survey is



chosen because it can handle complex questions, helps with data collection, controls interviewer effects and is cost-effective (Bryman & Bell, 2011). The surveys will be followed by semi-structured and focussed interviews covering the topics of trust, presence, group identity, implementation team effectiveness and innovation success with a select group of people to validate the findings of the survey (Bryman & Bell, 2011).

The chapter is organised into the following topics; research design, data collection method, the measurement technique, survey instruments, sampling method and ethical implications.

### 3.2 Research Design

May (2001) writes that the two dominant perspectives on testing theory in social sciences research is Positivism and Interpretivism. Positivism is interested in using social facts observed by senses to verify theory, similar to the way a physicist studies objects to predict physical laws. Positivism explains and generalises human behaviour in terms of cause and effect. Interpretivism on the other hand focuses on the meaning people give to their environment. May defines occurrence as social when people give it roughly the same meaning (May, 2001).

Positivism uses a quantitative methodology to collect data and statistics to analyse data. Quantitative methodology enables replication (Bryman & Bell, 2011). Winter (2000), states that Interpretivism uses qualitative methods. Quantitative research tries to find whether the results are internally or externally generalizable, internal validity confirms whether there is a causal relationship between the dependent and independent constructs. Co-relation and causality are two tests for internal validity.

External validity confirms whether the results can be applied to populations at large.

Internal validity is important in qualitative methods, but external validity is usually not important (Winter, 2000).

This study uses a combination of Positivism and Interpretivism, known as mixed methods. Hove and Anda (2005) write about the advantages of mixed methods. They state that mixed methods combine the various viewpoints of quantitative and qualitative perspectives. Mixed methods support validation and confirmation, when findings for the same phenomena converge from quantitative and qualitative methods. Qualitative methods augment data collected by quantitative methods, enhancing interpretation of findings. Mixed methods also help in thinking about resolution of contradictions, if the data from the two sources are inconsistent. Interviews are often used to clarify data collected by quantitative methods in empirical software research (Hove & Anda, 2005).

Yin (1993) states that, the purpose of research design is to collect data to test the proposed hypotheses as well as be open to rival hypotheses and other explanations. Research design is independent of data collection methods (Yin, 1993).

Case studies are used to study a particular area of interest in an organisation. Case studies help discover the “why” and “how” of complex events (Noor, 2008). Case studies allow detailed examination of series of events that occurred in the past. A single case study investigates the causal mechanisms in operation in detail, facilitating a historical explanation (George & Bennett, 2005).

A case study design with mixed methods is used. The purpose is to explain causal relationships between the constructs of trust, presence, group identity, implementation team effectiveness with innovation effectiveness. The case study method will also help in investigating if any other factors are at play.

The study aims to answer the following research questions

**RQ1: What is the relationship between Trust, Presence, Group Identity and Innovation effectiveness?**

H1a: Trust is positively related to Innovation effectiveness.

H1b. Presence is positively related to Innovation effectiveness

H1c. Group Identity is positively related to Innovation effectiveness

**RQ2: Do Presence, Trust and Group Identity interact with each other to affect innovation effectiveness?**

H2a: Interaction of Presence and Group Identity affects innovation effectiveness

H2b: Interaction of Presence and Trust affects innovation effectiveness

H2c: Interaction of Group Identity and Trust affects innovation effectiveness

H2d: Interaction of Group Identity, Presence and Trust affects innovation effectiveness

**RQ3: Does Implementation team effectiveness affect innovation effectiveness?**

H3a: Implementation team effectiveness affects innovation effectiveness.

The first seven hypotheses are investigated both quantitatively and qualitatively. The last hypothesis was evaluated qualitatively.

Mixed methods is a comprehensive methodology enabling holistic, deep insights by combining data collected by quantitative methods and qualitative methods to explain subjective social experiences (Uma & Pansiri, 2011). Interviews provide soft data to confirm and strengthen hard data collected through questionnaire surveys (Parkhe, 1993). Divergent data from two different sources allows comparison and integration enabling triangulation, leading to better inferences (Jack & Raturi, 2006).

There are four types of mixed method designs. The design can be based on either quantitative or qualitative as the dominant methodology or both can have equal status, the mixed methods could be sequential i.e. data is collected by one method and then followed by another or both the methods can be used concurrently to collect data (Tashakkori & Teddlie, 1998; Creswell, 2003). In this study, quantitative data collection will be followed by qualitative data collection to re-examine, explain, interpret and support the quantitative results; both the qualitative and quantitative methods will have equal status.

### **3.3 Research Strategy and Proposed Model**

Cohen et al. (2013) recommends the strategy of stating a theoretical causal model with the dependent and independent variables for research study (Cohen, Cohen, West & Aiken, 2013). Bladock (1985) recommends simple recursive models. He states that simple recursive models provide a simple heuristic device to extend regression analysis. A simple recursive model allows each equation to be treated independently of the other. Simple recursive model is based on one way causation i.e. dependent variable is dependent on independent variable but the independent variable does not affect the dependent variables (Bladock, 1985). Simple recursive model arranges

variables hierarchically assuming that the variables higher in the hierarchy do not affect lower level variables as they occur earlier in time (Cohen, Cohen, West & Aiken, 2013; Simon, 1954). The emphasis is to analyse causal relationships between two variables by decomposing total correlations into simple effects between two variables and compound effect between two variables (Bladock, 1985).

All independent variables occurred before innovation effectiveness, hence correlation between them can be assumed to be causal (Simon, 1954).

Given below is the mathematical representation of the linear regression model to test the hypotheses.

Symbols used:

IE = Innovation effectiveness
T= Trust
G = Group Identity
P = Presence
B <sub>1</sub> , B <sub>2</sub> , B <sub>3</sub> , B <sub>3</sub> , B <sub>5</sub> , B <sub>5</sub> , B <sub>7</sub> , B <sub>7</sub> , B <sub>9</sub> , B <sub>10</sub> , B <sub>11</sub> , B <sub>12</sub> , B <sub>13</sub> , B <sub>14</sub> , B <sub>15</sub> , B <sub>16</sub> , B <sub>17</sub> , B <sub>18</sub> , B <sub>19</sub> are parameter coefficients
error = measurement error and effect of other variables

The theory proposed is expressed in the equations below

Single effects of independent variables on the dependent variable

$$1 \text{ IE} = \text{intercept} + B_1 P + \text{error}$$

$$2 \text{ IE} = \text{intercept} + B_2 T + \text{error}$$

$$3) IE = \text{intercept} + B_3G + \text{error}$$

Combined effects of Dependent variables

$$4) IE = \text{intercept} + B_4T + B_5P + B_6G + \text{error}$$

Interaction effects

$$5) IE = \text{intercept} + B_7P + B_8T + B_9P*T + \text{error}$$

$$6) IE = \text{intercept} + B_{10}P + B_{11}G + B_{12}P*G + \text{error}$$

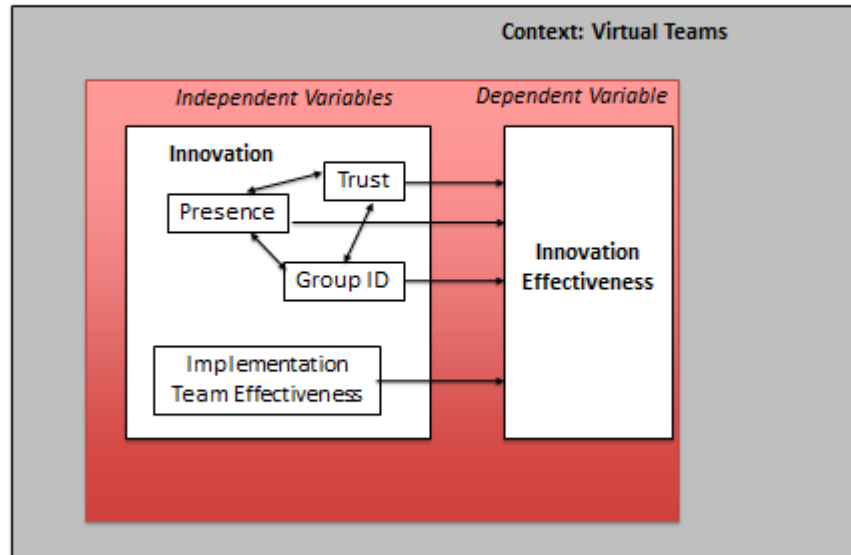
$$7) IE = \text{intercept} + B_{13}G + B_{14}T + B_{15}G*T + \text{error}$$

$$8) IE = \text{intercept} + B_{16}P + B_{17}T + B_{18}G + B_{19}P*T*G + \text{error}$$

The theoretical model is shown in figure 3-1 below. The model depicts the independent variables of Presence, Trust, Group Identity and Implementation team effectiveness and the dependent variable Innovation effectiveness.

Data from surveys and interviews were used to determine whether the model is consistent with the data collected. If consistent, the model can be used for further

research; if the data does not fit, then the model is false.



**Figure 3-1: Theoretical model for hypotheses testing**

### 3.4 Sample and Sampling:

The sampling strategy chosen for the study is a mixture of purposive and convenience sampling. Purposive sampling is based on selecting a sample which includes selecting a site and participants who can provide rich information and insights to the research question that cannot be provided by a random sample (Teddle & Yu, 2007; Devers & Frankel, 2000; Marshall, 1996). Convenience sampling is used when ease of access is a consideration and participants are willing (Teddle & Yu, 2007; Marshall, 1996).

The study chose a federal government agency in Australia. This government agency has recently implemented an innovation and uses multiple virtual teams spread across seven locations. Users of the innovation are part of multiple virtual teams. Teams are made up of members who are split across various states making the team virtual.

Virtual teams are split across multiple states. In a particular location (offices are Harbindar Sangha

Student Number: C3153562

located in capital cities of each state), there are at least a minimum of two users who are part of a virtual team (ensuring that no member is working alone). A location has multiple virtual teams working on different tasks reporting to separate organisational structures. Each virtual team can be characterised as geographically dispersed. The researcher works at this Federal Government agency providing easy access.

Organisational consent was sought from Chief Information Officer and the consent letter is attached in Appendix B. The Deputy CIO then sent an email to all Technology Services staff with the Participant information sheet requesting all staff to support the research. All staffs within the division were sent a link/URL for the online survey.

Answering the survey was considered as implied consent. The response rate for the survey was 51%. The response rate was nearly equal across the three branches of the division.

Nine interviewees were chosen for semi-structured interviews using purposive sampling, as it was not practical to interview a lot of respondents (Barriball & While, 1994). Four interviewees were chosen from the implementation team, four interviewees were users of the innovation and one was the sponsor of the innovation from the senior management team of the Technology Services Division. Semi-structured interviews assist, getting detailed answers about attitudes, beliefs, perceptions, opinions and motives of complex and sensitive issues by enabling interaction and rapport between interviewer and interviewee. Semi-structured interviews enable the interviewer flexibility to seek more information to clarify ambiguous answers (Barriball & While, 1994). Interviewees were sent a consent form and participant information sheet. The Participant information sheet and consent



form for interviewees is attached in the Appendix B. The response rate for interviews was 100%.

Respondents are members of virtual teams within the Technology Services Division of a Federal Government agency in Australia. The name of the agency and the interviewed staff has been replaced with pseudonyms to ensure confidentiality and comply with Human Ethics principles in research. The Technology Services division has 350 staff in seven locations in Australia. Virtual teams within this government agency are used to allow members from different locations to work together on specific projects and sometimes for ongoing work.

Interviewees were selected from two groups. The first group consisted of innovation project implementation team. The second group consisted of users of the innovation. Both the groups had virtual members.

### 3.5 Data collection:

#### 3.5.1 Survey

The respondents were all Technology Division staff, familiar with technology and had access to the Internet making online survey as one of the options for the questionnaire.

An online survey was chosen as it is fast, low cost and easy to get the questionnaire to the participants spread over a wide geographical area and easy for data collection (Evans & Mathur, 2005; Duffy & Smith, 2005). Participants were emailed a link to the survey. The survey was hosted on a professional private third party survey provider

called “survey monkey” accessible by the link

<https://www.surveymonkey.com/s/virtualinnov8>. No email addresses or identifying

information was collected by the survey provider ensuring privacy and confidentiality of the respondents.

Online surveys are convenient for the participant, allowing them to answer the questionnaire at a time of their convenience. Online surveys allow ease of analysis by tabulating the responses in multiple formats. Online surveys cost less as they are easy to prepare. Questions in an online survey can be set to require completion before moving onto next question and the visibility/filtering of certain sections/ questions can be enabled depending on the options chosen by the respondent (Evans & Mathur, 2005).

The survey consisted of six sections. The sections included demographic questions, trust section, presence section, group identity section, implementation team effectiveness and product/innovation effectiveness. There were forty eight questions in the questionnaire. The survey was self-administered with instructions at the beginning of each section. The survey would present team effectiveness questions only if the respondent selected the option that they were part of the implementation team.

The survey took a maximum of 30 minutes of each respondent’s time and once they had finished the survey, the participants had to click on the submit button to complete the survey. The survey was open for four weeks and a follow-up reminder was sent after two weeks.

### 3.5.2 Semi-Structured interviews

Interviews are used to gather detailed data about insights, feelings and opinions that cannot be obtained by quantitative measures alone. Interviewers need to be non-judgemental, non-threatening and ensure confidentiality of the interviewees.

Interview questions can be of five different types a) Questions which seek information about experience, actions and behaviour. b) Questions about opinions and values of people c) Questions seeking information about facts d) Questions about sensory experiences e) demographic questions. What and how questions provide rich information. Sensitive questions should be asked late in the interview, after there is trust developed between the interviewer and interviewee (Hove & Anda, 2005).

As part of the planning process, the interviewer needs to prepare an interview schedule. The interview schedule needs to be exploratory to elicit abstract concepts as well as standard to enable comparisons between respondents. The interview schedule should cover areas of interest and relevance (Barriball & While, 1994). The semi-structured interviews covered five broad topics of trust, group identity, virtual teams, and innovation effectiveness. Key members of the implementation team and some select users were interviewed individually to test the validity of the quantitative results obtained from analysing the survey data as well as provide additional information and explanation about the topics of interest. Interviewees were selected uniformly from those active in each of the creativity and innovation phases. The researcher conducted the semi-structured interviews. All the nine interviews were audio recorded to avoid loss of data, facilitate the validity and aid the accurate analysis of data.

The interview questions were general statements (Noor, 2008). The statements covered the concepts of trust, group identity, presence, innovation effectiveness for users and an additional statement on implementation team effectiveness for the implementation team.

### 3.5.3 Instrument:

The survey instrument is constructed by collection of instruments based on the previous published research of Andersons Team Climate Inventory (1998), Heere (2005), Biocca (2003), Bailenson et al. (2005), Witmer and Singer (1998), Henderson and Lee (1992). It contains 48 items. Apart from a section seeking demographic information, items concentrate on the five constructs being measured: “trust”, “presence”, “group-identity” “team-effectiveness (in the context of innovation success)” and “product innovation(innovation effectiveness)”. A copy of the survey is attached in the appendix. Each of the constructs is explained below.

### 3.5.4 Presence measures

Social presence is awareness of another person mediated by technology, ranging from superficial to deep awareness, psychological and behavioural engagement between the virtual team members. The awareness of the other is defined as co-presence and is dependent on the amount of attention that a person devotes to the virtual environment created by technology (Witmer & Singer, 1994). Some technology creates more presence than others (Biocca, Harms & Gregg, 2001). More presence will lead to more mutual understanding. More mutual understanding will help in task execution if there is interdependence (Biocca, Harms & Gregg, 2001).

Sense of presence is attributed to the feeling of reality or realness (Schubert, Friedman and Regenbrecht, 1999). Measures of presence are based on social psychological theories of interpersonal communication that measure involvement, intimacy and immediacy (Short, Williams and Christie, 1976). The specific focus of the measure of presence in this research is to ask users to judge their experience based on the subjective quality of telecommunication (Burgoon & Hale 1987), the properties of representations (reality/fidelity compared to real world) of other beings that elicit social response from users-viewers and the users involvement (Witmer and Singer, 1994; Bailenson, Swinith, Persky, Dimov and Blascovich, 2005).

There are 11 items dealing with presence. Two questions measure co-presence, five questions measure the sensory engagement via technology to create presence, two questions measure mutual understanding and two questions measure behavioural interdependence.

### 3.5.5 Group Identity measures

Group identity is an individual's psychological identification, attachment and sense of belonging to the group based on shared beliefs and interests with other group members (McClain, Johnson Carew, Walton Jr and Watts, 2009). Self-categorization, sense of interdependence, social embeddedness, and attachment are constructs important for group identity (Heere, James, Yoshida & Scremin, 2011). Assignment of an individual to a group also leads to development of Group Identity (McClain, Johnson Carew, Walton Jr and Watts, 2009). Integration with the group and attraction to group members leads to group cohesion increasing identification with group (Carron, Widmeyer & Brawley, 1985). Group identity will be measured by attraction to group; Harbindar Sangha

belonging to group, self-categorization, interdependence and frequency of interaction.

These items are replicated from a previous instruments developed by Heere (2005) and Carron et al. (1985). There are seven questions to measure group identity; one question for group cohesion, one question for attachment/attraction towards the group, one question for self-evaluation, one question for interdependence and one question for interaction.

### 3.5.6 Trust measures

All trust involves taking risk, expecting that the other will not take advantage. Trust usually is between an individual and another individual at an interpersonal level, between an individual and the team or between an individual and an organisation (Costa & Anderson, 2011). Workplace cooperation and interdependence is based on specific types of trust. Trust in the workplace is situation and target specific. Trust at work is about reliability (keeping promises and commitments, credible, honest), dependability (will help when needed), emotional trust (no criticism or embarrassment) and keeping personal confidences (Johnson-George and Swap, 1982). Team climate inventory measures the factors required by teams for innovation (Anderson & West, 1998). Participative safety depends on a team climate of non-threatening personal trust between an individual and team. Participative safety leads to information sharing (Anderson & West, 1998).

This study is interested in studying the effects of trust between an individual and his team in the context of innovation. Questions from Anderson's & West's, Team Climate inventory instrument (1998) were chosen. There are nine items about trust in the survey.

### 3.5.7 Implementation Team effectiveness measures

The implementation team is responsible for the innovation implementation and ensuring acceptance of the innovation by the users. The effectiveness of the team is measured by task performance and team member satisfaction. Task performance is based on work accuracy, work completed on time and cost (Sundstrom, De Meuse, & Futrell, 1990). Member satisfaction is measured by team member's experience (Neuman and Wright, 1999; Piccoli, Powell and Ives, 2004).

The acceptance of new innovation is influenced by the relationship between the implementation team and the users. The influence relationship depends on interactions and trust between the implementation team and users. Effective innovation implementation is thus a collaborative process between the implementation team and users (Henderson & Lee, 1992). There will be fourteen items to measure team effectiveness; these items will include task performance, member satisfaction and interactions with users.

### 3.5.8 Innovation Effectiveness measures

Firm performance is positively linked with innovation performance. Successful innovations satisfy two conditions, they are novel and useful. The usefulness of the innovation product as viewed by the users is product efficacy (Alegre, Lapiedra & Chiva, 2006). Innovation efficacy is defined as the usefulness of the innovation.

Two questions on innovation effectiveness measuring product efficacy from the instrument developed by Alegre et al. (2006) are used – whether the new product is useful and better than the old product and product extension- does the product provide extra features than the old one.

A five point Likert scale is used. The original instruments chose Likert scales because of its ability to extract information, compatibility with the computer email survey, ease of construction, administration and cost-effectiveness.

### 3.6 Analysis

Surveys were emailed to 350 staff of Technology Services Division. 202 people responded (58% response rate). Nine key people were invited to take part in semi-structured interviews and all nine consented to be interviewed. The survey results were coded. During the coding process it was found that 24 responses were incomplete and discarded, leaving 178 complete responses (51%) for analysis. In the presence section of the questionnaire, there were three items in the presence section that required reverse coding. There were two other questions in the presence section that had a choice of N/A, if the person and the team were local. These responses were coded as if the person was local with a value of zero. The Trust section had a question that required reverse coding.

Boone and Boone (2012) advise that Likert scale data should be analysed using an interval measurement scale. They advise to create a Likert scale by calculating a composite score (sum or mean) from four or more type Likert-type items. They recommend descriptive statistics for interval scale items including the mean for central tendency and standard deviations for variability. Additional data analysis procedures appropriate for interval scale items would include the Pearson's  $r$ ,  $t$ -test, ANOVA, and regression procedures.

For each respondent, the coded values for all items for a construct were added to give a score for that construct.



The items in the construct need to be analysed to check whether the construct can be represented as one variable or as multiple variables before relationships between various variables can be analysed. Factor analysis is used to identify any latent variables.

The analysis was carried out in four steps

1. Univariate analysis. The aim of this analysis is to understand each variable as an entity and symmetrize it for further analysis. Descriptive statistics techniques were used for visual analysis of the structure of each variable including the dependent variable. The distribution, mean, standard deviation and median were analysed for each variable. Any outliers which are not part of the distribution were noted and removed from the case for separate analysis. If the distribution is not normal, the variable would be re-expressed to make it normal. Cronbach's alpha was calculated to test the reliability of the constructs. Cronbach's Alpha was used to measure internal reliability. Cronbach's Alpha checks the extent to which people respond consistently to items that are used to measure a particular variable. (Bryman & Bell, 2011; De Veaux , Velleman, & Bock, 2012). The questions are considered valid if they measure the constructs accurately (Bryman & Bell, 2011; Hammersley, 1987)

The study uses questions for constructs from instruments used in previous published research and depends on them for the validity. The measures of presence, group-identity and trust were taken from previous studies Andersons TCI (1998), Heere (2005), Biocca (2003), Bailenson et al. (2005), Witmer and Singer (1998), Henderson and Lee (1992).

2. Bivariate analysis. The aim of bivariate analysis is to understand the relationships between variables. Correlation measures the strength of association and relationship between two variables and regression predicts the dependent variable from independent variables. Tests of confidence show whether the results can be applied to a general population (Cohen, Cohen, West & Aiken, 2013). Pearson's Correlation coefficients were calculated. Correlated variables are tested for linear relationships using regression linear fit model.  $R^2$ , comparison of Lack of fit- sum of squares and total error informs whether the linear model is appropriate. P value & Anova F ratio determines whether the null hypotheses can be rejected. Interaction effects of variables on each other were investigated.

3. Multivariate analysis. The aim of this analysis is to understand groups of variables as models. Multivariate analysis is an extension of bivariate analysis. Innovation effectiveness in virtual teams is an endogenous variable i.e. its variance is caused by other variables in the model as well as extraneous variables. Trust, Presence and Group identity are exogenous or predetermined variables. Pedhauzer (1997) states that causal relationships between the independent exogenous variables need not be analysed for the sake of the model.

Multiple regression analysis can be used with any kind of independent data and with any kind of relationships, for prediction purposes. Multiple regression analysis helps with measuring the complete relationship of the independent and dependent variable, its partial relationships and helps with hypotheses testing (Cohen, Cohen, West & Aiken, 2013). Using correlations from the

bivariate analysis above, stepwise linear regression is carried out between dependent and independent variables to build a model. Independent variables are entered into the model depending on the correlation values obtained from the univariate analysis above, making this a hierarchical linear regression analysis. As per Cohen et al. (2013), the researcher should use his knowledge of the environment and the model to select the causal variables sequence. The data was analysed using multiple regression analysis to find potential predictors of innovation success in the virtual team case study environment. p-values determine whether null value can be rejected and Anova F ratio determines whether the model can be generalised.

The first seven Hypotheses and their null hypotheses listed below were tested using correlation. Linear regression models were built and tested for adequacy and null hypotheses rejection tested using p values and ANOVA F statistic value greater than 3.1 (critical value for significance of 0.05 for null hypotheses rejection).

H1a: Trust in virtual teams affects innovation effectiveness

H0: Trust in virtual teams has no effect on innovation effectiveness

H1b: Presence affects innovation effectiveness

H0: Presence has no effect on innovation effectiveness

H1c: Group Identity in virtual teams affects innovation effectiveness

H0: Group Identity in virtual teams has no effect on innovation effectiveness.

H2a: Interaction of Presence and Group Identity affects innovation effectiveness.

H0: Interaction of Presence and Group Identity has no effect on innovation effectiveness.

H2b: Interaction of Presence and Trust affects innovation effectiveness.

H0: Interaction of Presence and Trust has no effect on innovation effectiveness.

H2c: Interaction of Group Identity and Trust affects innovation effectiveness.

H0: Interaction of Group Identity and Trust has no effect on innovation effectiveness.

H2d: Interaction of Group Identity, Presence and Trust affects innovation effectiveness.

H0: Interaction of Group Identity, Presence and Trust has no effect on innovation effectiveness.

H3a: Implementation team effectiveness affects innovation effectiveness.

The first seven hypotheses are investigated both quantitatively and qualitatively, the last hypotheses was tested only qualitatively.

4. Interview analysis: The audio recorded interviews were transcribed and the raw data was analysed and categorised/coded using the various themes of trust, presence, group identity, implementation team effectiveness and innovation effectiveness as units. The themes were analysed for patterns and relationships so that inferences can be drawn to support/verify the quantitative results. As this research is being conducted using a specific innovation case within a given organisation, there is ready access for follow up interviews with selected respondents to validate or otherwise the results obtained from the quantitative analysis. Respondents were selected from those participating in each stage of the innovation processes (Figure 1). The interviews addressed each of the

hypotheses, looking to draw out commentary, using open questions that might add to the validity or otherwise of the quantitative results achieved

Quotes used from interviews were validated by the interviewees to ensure interpretive validity (Maxwell, 1992).

### 3.7 Validity

Three types of validity were tested in this study. The validity tests included content validity for the construct, internal reliability and external reliability. Content validity of the survey was checked by running a pilot with five staff.

#### 3.7.1 Construct validity

Multiple sources of evidence assists in construct validation and reduce intrinsic bias (Creswell 2007, Yin 2009).

The items for each construct were chosen from previous published research, giving it content validity. Data was collected by surveys and semi-structured interviews .The quotes used from interviews was verified by the interviewees giving it interpretive validity.

#### 3.7.2 Internal validity

Internal validity can be ascertained by correlations and regression analysis for quantitative data, checking whether the linear model is adequate and the null hypotheses can be rejected. Pattern matching and explanations from interview data can be used to increase internal validity (Yin, 2009).

### 3.7.3 External Validity

External validity relates to whether the findings of this study can be generalised to other organisations. Various researchers have stated that generalisation is not recommended for case study research, whereas others have stated that case study research is good for theoretical generalisations (Eisenhardt, 1989; Yin, 2009; Blaike, 2010).

### 3.7.4 Reliability

Cronbach's alpha is used to measure inter item consistency. A measure is considered reliable if it has a value of 0.7 or greater.

### 3.8 Ethical Implications

The study involves an online questionnaire and interviews; hence issues of consent, privacy and confidentiality are addressed by seeking approval from the Human Research Ethics Committee of the University of Newcastle. The approval was provided by Human Research Ethics committee and the approval number is H-2013-0239. Organisational consent is necessary and was obtained from the organisation. The participant information letter explained the voluntary nature of participation and the option to withdraw at any time. The consent from participants is implied when the completed questionnaire is returned. The survey information collected was analysed at an aggregate level, ensuring non-identification of individuals in reports. The data is stored on the password secured researcher's laptop. The soft copy of the survey data will be stored in University of Newcastle and erased five years after successful completion of the dissertation. There are no risk and safety issues involved in this research.

## 4 Data Analysis and Findings

This chapter aims to find answers to the problem questions by analysing the data from surveys and semi-structured interviews. The goal of data collection was to find the factors that affect innovation effectiveness in virtual teams, especially the team constructs of trust, group identity and presence, along with implementation team effectiveness on innovation effectiveness.

### 4.1 Methodology

Two different research techniques were chosen to collect research data. Quantitative surveys were chosen to collect responses about the constructs. Semi-structured interviews were used to collect more in depth information about constructs. The survey was constructed by using questions from previous studies. A pilot survey was run with a group of five people to refine the questions/items in the survey.

The survey explored the areas of trust, presence, group identity, implementation team effectiveness and innovation effectiveness (product innovation and product extension – new features) for the whole Technology Services Division consisting of 350 employees. Team Effectiveness constructs was only measured for the implementation team which consisted of 26 people. The complete survey is attached in Appendix A.

Survey questions used a five point Likert scale ranging from “strongly disagree” to “Strongly agree” for the Independent variables and “Much worse” to “Much better” for Innovation effectiveness.

A pilot survey was conducted in the month of September 2013, with five staff to check that the survey was easy to understand, the questions branched correctly, data



capture was as expected and there were no access issues. The feedback from the pilot survey was incorporated and a dry run conducted again with the same five staff.

The survey was conducted from 28<sup>th</sup> October 2013 to 30<sup>th</sup> November 2013. Microsoft Excel 2010 and JMP11 software was used for the analysis.

Semi-structured interviews were conducted with key people to explore the various constructs in depth. The people interviewed included the Executive sponsor of the innovation program, Project Managers, Technical Implementation manager and key users.

For survey data, the analysis was conducted in five steps. In the first step, data was cleaned by removing incomplete surveys and codes assigned. In the second step, univariate analysis was conducted on each variable. The distribution of each variable was checked. This was followed by comparison of variables using the demographic information. This was followed by bivariate analysis of dependent and independent variables. Finally multivariate analysis was conducted using stepwise regression.

## 4.2 Results

### 4.2.1 Response rate

Surveys were emailed to 350 staff of Technology Services Division. 202 people responded (58% response rate).

Nine key people were invited to take part in semi-structured interviews and all nine consented to be interviewed.

### 4.3 Quantitative Analysis

#### 4.3.1 Step 1: Data Preparation

202 people responded to the surveys. The surveys were checked for completeness.

Surveys with some missing data were discarded. **178** surveys were complete and used for analysis (51% response rate). **N in univariate, bivariate and multivariate analysis below is 178**

The questions used a 5 point Likert scale.

Survey items responses for independent variables were coded with the values shown in the Table 4-1 below

Item Response	Code
Strongly Disagree	1
Disagree	2
Neither agree nor Disagree	3
Agree	4
Strongly Agree	5
N/A ( for Presence construct)	0

**Table 4-1: Independent variables coding**

Survey items responses for the dependent variable were coded with the values shown in Table 4-2 below

Much worse	1
Somewhat worse	2
About the same	3
Somewhat better	4
Much better	5

**Table 4-2: Dependent variables coding**

The survey had 4 negatively worded questions. One question was negatively worded in the trust construct and three questions in Presence construct were negatively worded. The code values for these questions were reversed prior to analysis.

The Presence construct in addition had a response of N/A for people who did not work virtually. N/A was given a code of zero, so as to not influence the Presence measure.

There were a total of 178 respondents. The Survey consisted of seven questions on demographics, nine questions on trust, seven questions on Group Identity, 11 questions on Presence, 12 questions on Team effectiveness and 2 questions on product innovation. The questions (items) for each construct were added to create a Likert scale for each construct.

#### **4.3.2 Step 2 Univariate analyses.**

The goal of this step is to understand each variable. This is done by plotting the distribution of each variable and checking its normality. Normality is a condition that needs to be checked for a lot of statistical tests and if the distribution is not normal, it needs to be re-expressed, so that the distribution is normal before some statistical tests are carried out (De Veaux, Velleman & Bock, 2010).

The Table 4-3 below lists descriptive statistics for the Dependent Variable Innovation effectiveness, the Independent variables of Trust, Group Identity and Presence.

#### **Descriptive Statistics**

<b>Construct</b>	<b>Mean</b>	<b>Std. Dev</b>	<b>Median</b>	<b>Distribution</b>
Trust	3.66	0.46	3.75	Normal
Presence	2.77	0.43	2.8	Normal
Group Identity	3.86	0.57	4	Normal
Innovation effectiveness	2.94	1.1	3	Normal

**Table 4-3: Descriptive statistics**

The distributions of Trust, presence, group identity and Innovation effectiveness are normal. The mean and median of all the variables are also very close to each other.

#### **4.3.2.1 Reliability tests**

Internal reliability tests measures the consistency of responses. Cronbach's  $\alpha$  test is used to test the internal reliability of the constructs. A value of 0.7 or greater is needed for internal reliability.

### Reliability tests for Constructs

Table 4 -4 below tabulates the Cronbach's  $\alpha$  test for the variables

Construct	Cronbach 's $\alpha$	Valid and Reliable (Cronbach 's $\alpha > 0.7$ )
Trust	0.8757	Yes
Presence	0.7595	Yes
Group Identity	0.8423	Yes
Innovation effectiveness	0.8614	Yes

**Table 4-4: Cronbach's  $\alpha$  reliability tests**

Cronbach's tests for Trust, Presence, Group Identity, Team effectiveness and Innovation effectiveness are all greater than 0.7, indicating that the questions for each construct are valid and the constructs reliable.

After checking the reliability of the constructs, Factor analysis is used to identify any latent variables.

#### 4.3.2.2 Factor Analysis

Factor analysis checks the items in a construct whether they all belong to one variable or multiple hidden underlying variables. Factor analysis was used to extract principal factors using varimax rotation. Eigen value > 1 was used as a threshold. On analysis, it was found that;

Trust has a single factor.

Group Identity has a single factor.

Presence has 3 factors. Bivariate and Multivariate tests were run on the 3 factors of presence to test for potential impact.

Presence factor analyses are shown in Table 4-5 below.

Presence factors	Eigen values
Presence 1 ( six items)	3.93
Presence( 2 items)	1.522
Presence ( 3 items)	1.09

**Table 4-5 : Presence factors**

Presence1 was composed of six questions; Presence 2 was composed of 2 questions and Presence3 of 3 questions.

The three presence factors were tested in the models below, all three presence factors reported the same results for hypotheses test. Presence1 being composed of six questions was chosen to represent Presence in the analysis. The tests of different factors effect are attached in Appendix C. Innovation effectiveness has 1 factor.

#### 4.3.2.3 Analysis and comparisons of individual construct

The data was partitioned using the demographic information of tenure in teams and the branches that the respondents worked in, to analyse and compare the constructs as below.

Trust, Presence, Group Identity (GID) and Innovation effectiveness were classified as shown in the table below. Responses were classified as High, if the respondents' response was "strongly agree" and "Agree". Strongly agree and Agree were coded as 5 and 4 respectively, so a response was classified as High if it had a value greater than 3. "Neither agree nor disagree" was coded as 3 and classified as medium. A response of "disagree or strongly disagree" was coded as 2 or 1 and classified as low for the variables. These responses were then analysed to investigate the differences based on tenure and branches and are listed below.

Classification of responses (by aggregating the responses into three for comparison purposes)

Response	Classification	Coded Value
Strongly Agree and Agree	High	5 or 4
Neither agree nor disagree	Medium	3
Disagree or Strongly disagree	Low	2 or 1

**Table 4-6: Aggregations of Responses into three levels**

#### 4.3.2.3.1 Comparison based on Tenure

Response	No. of respondents Tenure > 5 years	No. of respondents Tenure= 1 to 5 years	No. of respondents Tenure <=1 year	Percentage
High	23	79	35	89.54 %
Medium	3	3	3	5.89 %
Low	0	3	2	3.08%

**Table 4-7: Trust with tenure**

**Majority of the respondents reported that intra team trust was very high regardless of tenure**

Response	No. of respondents Tenure > 5 years	No. of respondents Tenure 1 to 5 years	No. of respondents Tenure <=1 year	Percentage
High	26	79	36	87.03 %
Medium	0	2	0	1.23 %
Low	0	4	4	4.93 %

**Table 4-8: Group Identity based on tenure**

**Majority of the respondents reported that Group ID was high regardless of tenure, except that Group ID was slightly lower for new people.**



Response	No. of respondents Tenure > 5 years	No. of respondents Tenure 1 to 5 years	No. of respondents Tenure <=1 year	Percentage
High	17	51	26	65.27 %
Medium	3	10	4	11.81 %
Low	6	17	10	22.91 %

**Table 4-9: Presence based on tenure**

**Majority of the respondents reported that presence was high regardless of tenure, suggesting that other factors rather than tenure might be at play affecting presence.**

Response	No. of respondents Tenure > 5 years	No. of respondents Tenure 1 to 5 years	No. of respondents Tenure <=1 year	Percentage
High	7	37	20	41.83 %
Medium	5	20	7	20.92 %
Low	14	28	15	37.25 %

**Table 4-10: Innovation effectiveness ratings**

**41.83% of all respondents found the innovation to be effective and 37.25% of the respondents found the innovation to be not as effective compared with the old system. 20.92% found the innovation did not add additional value.**

Response	% of respondents by tenure	% of respondents by tenure
	Tenure greater than or equal to 5 years	Tenure less than or equal to 1 year
High	26.92	50
Medium	19.23	17.5
Low	56.85	37.5

**Table 4-11: Innovation effectiveness based on tenure**

**Innovation effectiveness showed a big difference based on tenure. Newer members found the innovation more effect. The percentage of short tenure respondents that found innovation effective were twice compared to long tenured team members.**

#### 4.3.2.3.2 Comparison of constructs based on branches

Branch names abbreviation used in tables below.

TA → Technology Applications

TID → Technology Infrastructure

TED → Technology Engagement and Design

<b>Respondent Count in Branches</b>	<b>Trust High</b>	<b>Trust Medium</b>	<b>Trust Low</b>
TA (n = 70)	67	2	1
TI (n = 65)	55	8	2
TED (n =27)	24	1	2
<b>Percent</b>	<b>%</b>	<b>%</b>	<b>%</b>
TA	95.71	2.86	1.43
TI	84.62	12.31	3.08
TED	88.89	3.7	7.41

**Table 4-12: Trust comparison based on branches**

<b>Respondent Count in Branches</b>	<b>Group Identity High</b>	<b>Group Identity Medium</b>	<b>Group Identity Low</b>
TA (n = 70)	64	2	4
TI (n = 65)	60	1	4
TED (n = 27)	26	0	1
<b>Percent</b>	<b>%</b>	<b>%</b>	<b>%</b>
TA	91.43	2.86	5.71
TI	92.31	1.54	6.15
TED	96.3	0	3.7

**Table 4-13: Group Identity in various branches**

<b>Respondent Count in Branches</b>	<b>Presence High</b>	<b>Presence Medium</b>	<b>Presence Low</b>
TA (n =70)	42	2	26
TI (n = 65)	42	8	15
TED (n =27)	18	3	6
<b>Percent</b>	<b>%</b>	<b>%</b>	<b>%</b>
TA	60	2.86	37.14
TI	64.62	12.31	23.08
TED	66.67	11.11	22.22

**Table 4-14: Presence in various branches**

<b>Respondent Count in Branches</b>	<b>Innov eff. High</b>	<b>Innov eff. Medium</b>	<b>Innov eff. Low</b>
TA (n = 70)	24	20	26
TI (n = 65)	24	9	32
TED (n =27)	17	5	5
<b>Percent</b>	<b>%</b>	<b>%</b>	<b>%</b>
TA	34.29	28.57	37.14
TI	36.92	13.85	49.23
TED	62.96	18.52	18.52

**Table 4-15 : Innovation effectiveness in branches**

**It was found that Trust, Group Identity and Presence were high for all three branches. Innovation was considered effective by 63% of TED (Technology Engagement and Design) respondents, compared to 37% for the Technology Infrastructure branch and 34% for the Technology Applications branch.**

In the next step, relationships between variables will be analysed using bivariate analysis techniques, to check if they affect each other and innovation effectiveness.

### 4.3.3 Step 3 Bivariate analyses:

The goal of this step is to understand the relationship between variables. Co-relations between each construct were calculated to check for relationships between variables. Bivariate linear models were constructed between each pair of variables. The models were analysed using Lack of linear fit statistics for the model. Anova and F statistic were used to test the null hypotheses.

<b>Correlations</b>	<b>Trust</b>	<b>Group Identity</b>	<b>Presence</b>	<b>Innovation effectiveness</b>
Trust	1.0000	0.7470	0.1426	0.3108
Group Identity	0.7470	1.0000	0.0129	0.3474
Presence	0.1426	0.0129	1.0000	0.0376
Innovation effectiveness	0.3108	0.3474	0.0376	1.0000

**Table 4-16: Correlations**

Trust is positively associated with Group Identity (correlation coefficient is 0.7470) and moderately associated with Innovation effectiveness (0.3108). Group Identity is positively associated with Innovation effectiveness. The correlation coefficient for Group Identity association with Innovation effectiveness is higher than the correlation coefficient of trust association with Innovation effectiveness correlation coefficient is 0.3474 compared with 0.3108 Presence is mildly associated with innovation effectiveness.

Bivariate Linear models were built based on the hypotheses H1a, H1b and H1c described in chapter 2. Each of the independent variable's effect on the independent variable was tested. The hypotheses are listed again and results are summarised in the table below.

H1a: Trust in virtual teams affects innovation effectiveness

H0: Trust in virtual teams has no effect on innovation effectiveness

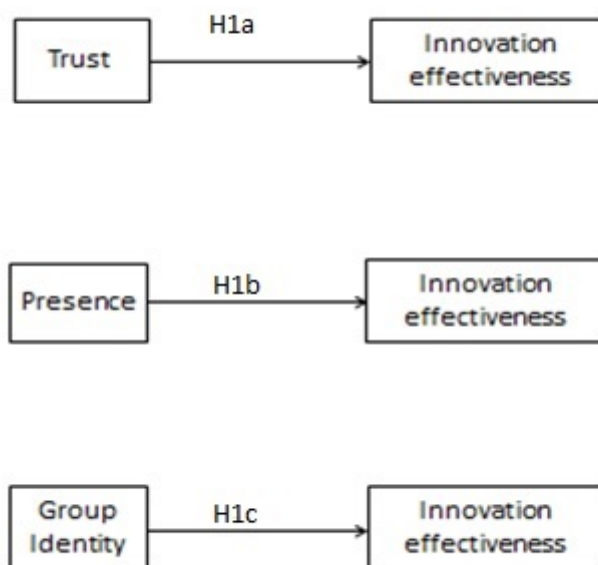
H1b: Presence affects innovation effectiveness

H0: Presence has no effect on innovation effectiveness

H1c: Group Identity in virtual teams affects innovation effectiveness

H0: Group Identity in virtual teams has no effect on innovation effectiveness.

Bivariate linear models shown in the figure below will be tested using linear regression and ANOVA tests.



**Figure 4-1: Bivariate linear models for H1a, H1b, H1c**

## Model 1: Effect of trust on Innovation effectiveness (H1a)

Variables	Innovation effectiveness vs Trust
R square	0.096
F ratio	18.6
Trust coefficient	0.131 (p value < 0.0001)**
Null hypothesis rejection	Yes

Table 4-17 : Innovation effectiveness and Trust

\*\* p < 0.0001

9% ( $R^2$ ) of the variation in innovation effectiveness is accounted by change in trust. In the ANOVA analysis above, F statistic is 18 much higher than the recommended 3.1 (at a significance level of 0.05), the p value for parameter estimate for trust is less than 0.0001 suggesting evidence against the null hypothesis i.e. Product Innovation is linearly dependent on trust.



Model 2: Effect of Presence1 on Innovation effectiveness (H1b)

Variables	Innovation effectiveness vs Presence
R square	0.001246
F ratio	0.1984
Presence coefficient	0.022 (p value = 0.65)
Null hypothesis rejection	No

**Table 4-18: Innovation effectiveness and Presence**

0.12% of the variation in innovation effectiveness is accounted by change in Presence.

In the ANOVA analysis above, the F statistic is 0.1984 much lower than 3.1

recommended and p value is 0.65 much higher than 0.1, suggesting evidence that the

null hypothesis cannot be rejected= i.e. Innovation effectiveness is not linearly

dependent on Presence.

Model 3: Effect of Group Identity on Innovation effectiveness (H1c)

Variables	Innovation effectiveness by Group Identity
R <sup>2</sup>	0.121
F Ratio	23.89
Group ID coefficient	0.17 (p value = 0.0001)**
Null hypothesis rejection	Yes

Table 4-19: Innovation effectiveness and Group Identity

\*\*p < 0.05

12 % (R<sup>2</sup>) of the variation in innovation effectiveness is accounted by change in Group ID. In the ANOVA analysis above, The F ratio is 23.89 much higher than recommended 3.1 recommended for significance at 0.05 level, and the p value is 0.0001; providing evidence that null hypothesis needs to be rejected. i.e. Innovation effectiveness is dependent on Group Identity.

**It can be concluded from above that trust and group identity are two constructs that affect Innovation effectiveness. In the next step Stepwise regression will be run to find if there is any linear relationship between Group Identity, Trust and Innovation and if the null hypotheses can be rejected.**

#### 4.3.4 Multivariate analysis

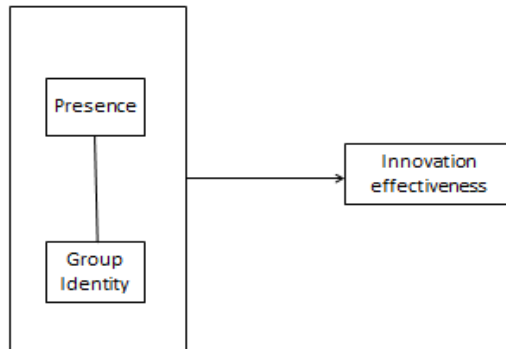
The goal of this step is to investigate the relationship between Group Identity, Trust and Innovation effectiveness and interaction of presence, trust and group identity effects. p value and Anova F statistic will be used to reject/not reject the null hypotheses. De Vaux et al. (2010) advise to use F statistic for more than one variable and t statistic for one variable. For a significance of 0.05, a F statistic greater than 3.1 is required to generalise the model to the wider population.

The variables of Trust and Group Identity are highly correlated. For Multivariate (2 or more independent variables) analysis, VIF was calculated for the coefficients. (VIF values greater than 10 have collinearity). If any VIF was found to be greater than 10, then the problems of multicollinearity will be dealt with forced stepwise regression, which allow the selection of variables and their order (especially since Trust and Group Identity were highly correlated). Stepwise regression variables were decided based on the correlation coefficient. Very low correlation coefficient for presence with other variables were tested in stepwise regression model, but found that they contributed very little. Independent Variables were ordered with Group Identity first as it had the highest effect. Other sequences were tried but did not yield significant differences in the model. Causality occurs from earlier to later in a hierarchical stepwise model. All variables were entered into the model to check for their contributions.

Multivariate regression analyses were run using the models built with the hypotheses.

### Regression analysis H2a: Interaction of Presence and Group Identity affects innovation effectiveness.

Model 4: The interaction of Presence and Group Identity's its effect on Innovation effectiveness H2a



**Figure 4-2: Interaction of Presence and Group Identity**

Model 4: Innovation effectiveness vs Presence and Group Identity

Variables	Main effects	Interaction effects of Presence and Group Identity
R <sup>2</sup>	0.14	0.14
F ratio	12.86	8.52
Presence Estimates	0.0017 (p =0.71)	0.017 (p = 0.71)
Group ID parameter estimates	0.17 (p <0.0001)**	0.17 (p<0.001)**
Presence*Group Identity		-0.0006 (p =0.94)
VIF	Presence = 1.00049 Group Id= 1.00049	Presence =1 Group ID = 1.05 Pres1*GID =1.05
Null hypothesis rejection	No	No

**Table 4-20: Interaction of Presence and Group Identity**

\* p value significant at 10 % level (p < 0.1)

\*\*p value significant at 5 % level ( $p < 0.05$ )

The main effects test (test run with the two Independent variables effect on dependent variable without the interaction effect added) for presence and group identity gave an F value of 12.86, the p value for group identity was less than 0.0001, but the p value for presence was 0.71 much higher than 0.1 providing evidence presence did not contribute to innovation effectiveness.

The analysis of the interaction effects of factor of presence with group identity on innovation effectiveness shows that the p value is much higher than 0.10, suggesting that the null hypotheses cannot be rejected. i.e. there are no interaction effects of presence with group identity on innovation effectiveness. Hypotheses H2a is not supported.

### Regression analysis H2b: Interaction of Presence and Trust affects innovation effectiveness

Model 5 : The interaction of Presence and Trust and its effect on Innovation effectiveness H2b

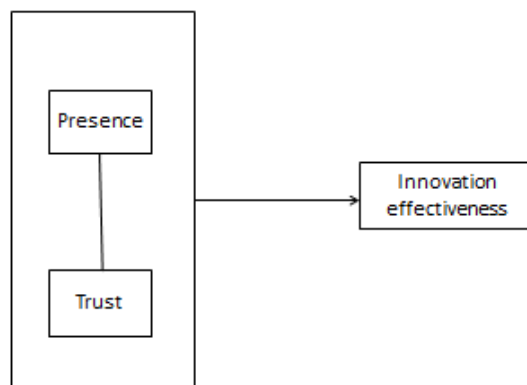


Figure 4-3: Interaction of Presence and Trust

Model 5: Innovation effectiveness vs Trust and Presence

Variables	Main effects with presence	Interaction effects of Presence and Trust
R <sup>2</sup>	0.103	0.11
F ratio	9.09	6.6
Trust parameter estimates	0.128 (p < 0.0001)**	0.12 (p < 0.0001)**
Presence parameter estimates	-0.0066 (p=0.89)	-0.013 (p=0.77)
Trust*Presence		-0.01 (p = 0.20)
VIF	Trust = 1.02 Presence = 1.02	Presence = 1.03 Trust = 1.02 Pres1*Trust = 1.05
Null hypothesis rejection	No	No

**Table 4-21: Interaction of Trust and Presence**

\* p value significant at 10 % level (p < 0.1)

\*\*p value significant at 5 % level (p < 0.05)

The main effects test for presence and trust gave an F value of 9.09 , the p value for trust was less than 0.0001, but the p value for presence was 0.89 much higher than 0.1 providing that presence provided no additive effects trust's contribution to innovation effectiveness.

The analysis of the interaction effects of the factor of presence with trust on innovation effectiveness shows that the p value is much higher than 0.10, suggesting

that the null hypotheses cannot be rejected i.e. there are no interaction effects of presence with trust on innovation effectiveness. Hypotheses H2b is not supported.

### Regression analysis H2c: Interaction of Group Identity and Trust affects innovation effectiveness

Model 6: The interaction of Trust and Group Identity's effect on Innovation effectiveness H2c

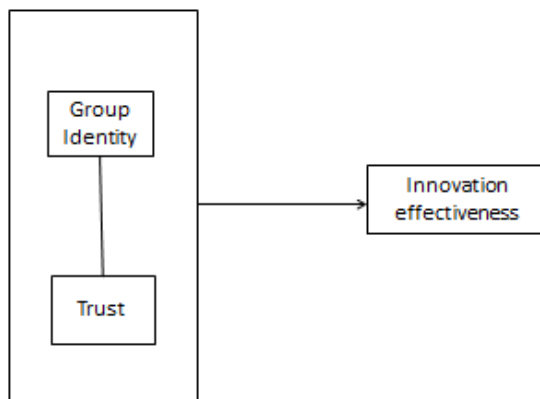


Figure 4-4: Interaction of Group Identity and Trust

Model 6: Innovation effectiveness vs Trust and Group Identity (main effects)

Variables	Main effects	Interaction effects
R <sup>2</sup>	0.126	0.13
F ratio	12.54	8.65
Trust parameter estimates	0.048 (p =0.27)	0.03 ( p = 0.55)
Group ID parameter estimates	0.128 (p =0.0157)*	0.11 (p =0.04)**
Trust*Group Identity		-0.02 ( p =0.34)
VIF	2.26	Trust = 2.64 Group ID = 2.49 Trust*Group ID= 2.04
Null hypothesis rejection	No	No

Table 4-22: Interaction of Trust and Group Identity

\* p value significant at 10 % level ( $p < 0.1$ )

\*\*p value significant at 5 % level ( $p < 0.05$ )

The main effects of Group Identity and trust explain 12.6 % of the variation of Innovation effectiveness. The ANOVA analysis gives an F statistic of 12.54 higher than the recommended 3.1, but the p value for trust parameter is 0.27 much higher than 0.1 estimate suggesting evidence that trust does not add anything to group id's contribution to innovation effectiveness. The VIF is less than 10 suggesting that there is no collinearity between Trust and Group Identity. Adding the interaction effects of Trust and Group Identity to the model increases the  $R^2$  to 13% i.e. 13% of the variation in innovation effectiveness is accounted by change in Trust and Group ID and the interaction of Trust and Group Identity. This is a 0.4% increase from the main effects of Group Identity and Trust. In the ANOVA analysis above gives an F statistic of 8.65, higher than the recommended 3.1, but the p value for the interaction effects of Trust and presence is 0.34 providing evidence that null hypothesis cannot be rejected i.e. Innovation effectiveness is not linearly dependent on Group Identity and the interaction effects of Trust and Group ID.



## Regression analysis H2d: Interaction of Group Identity, Presence and Trust affects innovation effectiveness

Model 7 : The interaction of Presence, Trust and Group identity's effect on Innovation effectiveness : **H2d**

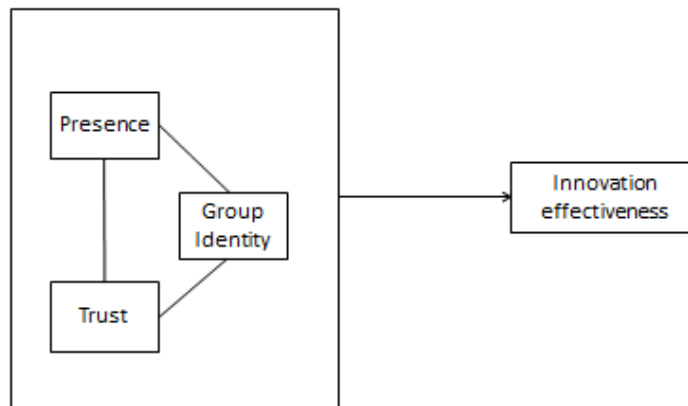


Figure 4-5: Interaction of Presence, Group Identity and Trust

Model 7 – Innovation effectiveness vs Trust, Group Identity & presence (main effects & interaction effects)

Variables	Main effects o	Model 7 (Interaction effects)
R <sup>2</sup>	0.142	0.179
F ratio	8.67	4.79
Trust parameter estimates	0.030 ( p value =0.52)	-0.012 (p value = 0.81)
Group ID parameter estimates	0.146 (p value = 0.0084)**	0.143 ( p value = 0.0130)**
Presence parameter estimates	0.011 (p value = 0.81)	0.025 ( p value = 0.61)
Trust*Group ID coefficient		-0.004 (p value = 0.1051)
Trust*Presence coefficient		-0.025 (p value =0.036)**
Presence*Group ID		-0.010 (p = 0.46)
Trust*GroupID*Presence coefficient		-0.0013 (p = 0.09)*
VIF	Presence VIF = 1.04 Trust VIF = 2.59 Group ID VIF = 2.54	Trust = 3.20, Group Id = 2.80, Presence = 1.13. GroupId*Presence = 1.97, Trust*GroupId = 2.21, Trust*Presence=2.14, Trust*Presence*Group Id = 1.84
Null hypothesis rejection	No	Yes

**Table 4-23: Interaction of Group Identity, Trust and Presence**

\*\*p value significant at 5 % (p value < 0.05), \*p value significance at 10% (<0.1)

The direct effects of trust, group identity and presence on innovation effectiveness were investigated by using stepwise regression and the R<sup>2</sup> was found to be 0.142.

Interaction effects of presence, trust and group identity on product innovation/innovation effectiveness were investigated, the co-relation coefficient  $R^2$  increased to 0.179 from 0.142. The Anova F statistic is high, but the p values for all interaction parameter estimates was very high except for the interaction of trust and presence (p value = 0.036); and the interaction parameter of trust, presence and group identity (p value = 0.09) indicating that there are some interaction effects and null hypotheses need to be rejected. Multiple regression analysis with all independent variables and their interaction effects results in the main predictor as Group Identity with some addition from the interaction of trust and presence; and some contribution from trust, presence and group id to innovation effectiveness.

#### 4.3.5 Hypotheses results

The results of the analysis and hypotheses testing are listed below

Hypotheses	Supported
H1a: Trust in virtual teams affects innovation effectiveness	Yes
H1b: Presence affects innovation effectiveness	No
H1c: Group Identity in virtual teams affects innovation effectiveness	Yes
H2a: Interaction of Presence and Group Identity affects innovation effectiveness	No
H2b: Interaction of Presence and Trust affects innovation effectiveness	No
H2c: Interaction of Group Identity and Trust affects innovation effectiveness	No
H2d: Interaction of Group Identity, Presence and Trust affects innovation effectiveness	Yes

**Table 4-24: Results of Hypotheses testing**

#### 4.4 Semi-structured Interviews

The interviews were transcribed and analysed for patterns/themes corresponding to the constructs of interest.

The nine semi-structured interviews were with two groups. One group was the innovation implementation group and the other group were the users. The concepts of Virtual Teams/Presence, Trust, Group Identity and Innovation effectiveness were discussed.

List of Interviewees and the codes assigned to them

	Interviewees	Codes
1.	Program Sponsor	#Implementer1
2.	Technical Implementation Manager	#Implementer2
3.	Project Manager Phase 1	#Implementer3
4.	Project Manager Phase 2	#Implementer4
5.	Project Manager Phase 3	#Implementer5
6.	User1	#User1
7.	User 2	#User2
8.	User 3	#User3
9.	User4	#User4

#### 4.4.1 Virtual teams/Presence

Most members of the virtual teams at the Federal Government agency knew the other members and had worked at the organisation for more than two years. Virtual teams were split into two or more locations. Each location would have at least two members co-located in an office with a local manager providing pastoral care. The issue with virtual teams and teams in general was inter and intra team communication. The innovation program sponsor (#Implementer1) stated that "Location was not a key issue. It was easy for two units in Central office to not be on the same page. Virtual teams with established relationships are easy to get off the ground. The program manager was new to the organisation. The program manager had some knowledge of virtual teams and tried to build personal rapport. This helped as it is difficult for new members to build rapport with virtual teams" (#Implementer1). The project manager of the third phase of the innovation program (#Implementer5) stated the same "Working virtual, does not cause issues as long as people communicate, the main thing is people coming out of the box and communicating, requires extra effort" (#Implementer5). The project manager of the second phase #Implementer4 supported the above views and he stated "Virtuality did not affect getting ideas from state offices. We had enough Face-to-Face time (get together) and we can clarify messages on the phone. Issues that came up were based on personality conflicts rather than geographical distance. The organisation is used to working with virtual teams. Virtuality, did not cause any issues with engagement" (#Implementer4). One of the key users' #User4 who works remotely supported the view that tenure in the organisation helped working virtually and he stated that "Working virtually is not something that is naturally repeatable. New people can't come in and hit the ground running. This

causes communication breakdowns. In our organisation's culture in particular, you have to be a few years in the organisation before people can become familiar in how to do things and how things get done. Working virtually creates more gaps and has an impact on this learning curve. It is harder to build rapport with stakeholders, when all your meetings, are done via video conference" (#User4).

Additionally the technical implementation manager #Implementer2 added that there were good processes and technology in place for virtual teams to work. Virtual team members were made to meet face to face at frequent intervals to help team effectiveness. He stated that "Virtual teams work with solid processes in place, right technology in place, and they complement each other. A little bit of face-to-face time is required and bringing people together in Canberra periodically was important.

Technology is not at the point where physical proximity or physical interactions can be replaced. The casual banter back and forth is hard to replace. Face to Face helps pick up hidden subtle cues that are not verbalised. Visual tells a lot more than what is told verbally. Video conferencing tells you something, but does not pick very subtle expressions. A mixture of collaboration tools was used. Instant messaging tools like Sametime was used more than Video conferencing or telephone as it allows for more informal communication and is interactive. Screen sharing helped bridge the geographical gap, enabling the local team member to demonstrate the issues or the things that need to be implemented. In state offices, you cannot monitor what remote people are doing and stronger management practices are required here than for local staff. A conscious effort is required to have conversations with remote staff once or twice a day. Weekly/fortnightly meetings need to be conducted with a structured

agenda” (#Implementer2). This view was supported by statements from another two key users, #User1 and #User2. #User2 stated that “Technology in terms of videoconferencing and phone conferencing helps. The work processes have to be matured, so that we can achieve the deliverables required. Last year we did not know the processes, so could not get much value out of it. This year, the processes have matured and work better” (#User2).

#User1 stated that “Whilst doing a project it is good to catch up in person. Webcams are good, but cannot capture 100% of the expressions. The technology is quite effective. The majority of people adapt to the technology and the culture of a virtual team. However virtual teams can have issues when people do not want to change or use technology”.

Project managers for the first phase and second phase expressed a caveat for working virtually especially for detailed technical work. They stated that the technical implementation team, the main users (the Service desk) should be located close together with them, as it helps resolve nitty gritty technical problems quickly. The project manager for phase one (#Implementer3) stated that “Being co-located with the technical team helps and I struggle when they are not. Videoconferencing was useful for larger planning and checking progress. I find it much easier to show the technical collocated team the interface, the errors I get and things are resolved in a matter of seconds, rather than picking up a phone or instant messaging. Nitty gritty detail work with virtual teams wastes a lot of time. For larger broader things like planning, and scheduling, virtual teams work. I can summarize my thoughts in email, get the remote

team member's measured response and we can collectively work through it. Co-located for me is sitting next to me" (#Implementer3).

The project manager for phase two stated that "after the implementation was underway, co-locating the project manager with the Service desk was an improvement, although the majority of staff was in Canberra. There was a wall between the two towers (wings) of the building. The Service Centre and the implementation team were in two different towers. There was not enough engagement between the north tower and south tower" (#Implementer4).

Key managers commented that they had the knowledge and processes to manage virtual team members. The technical implementation manager #Implementer2 stated that "Only certain types of people and personalities can work in virtual teams. Those include self-starters, independent workers and people who do not need to be micromanaged. Some people cannot be trusted to work remotely unsupervised. If there is no choice, then pastoral care needed to supervise them to ensure that these remote people are delivering; otherwise it may cause resentment in other team members. These people need to be pulled up if there are issues. Setting deadlines, having informal chats, creating a team environment where no one can hide helps virtual team members deliver. If trust is not there, it creates more work for others, deadlines are missed, and people have to focus on others' work and overall quality drops" (#Implementer2).

The project manager for phase 1 #Implementer3 commented "In terms of project teams being virtual, they all had a good work ethic, were good workers and I trusted



them and they delivered. The people who complain are those who do not make the effort to stay in touch. We worked really well”(#Implementer3).

**The quantitative analysis shows that the 3 factors in presence had little effect on innovation effectiveness and this is supported by the statements from the interviewees that virtuality was not an issue. The implementation team was centrally co-located with the project manager. Though Presence was not an issue, users commented that if they had someone local providing training and support, that would have helped innovation effectiveness. There were trust issues and overhead for managers re remote workers. Project managers also found colocated teams more efficient to resolve technical issues.**

#### 4.4.2 Implementation team effectiveness

Team effectiveness depends on all team members working together to achieve organisational objectives. Co-ordination and communication are key processes required to achieve team effectiveness (Picollo, Powell & Ives, 2000).

**A lot of richness in detail and extra information was gleaned from the semi-structured interviews, which the survey could not cover. The various sub themes are listed below.**

The key sub themes recognised from the interviews for Implementation team effectiveness were: a) Communication processes, b) Project Management c) Expectation Management d) Vision & Benefits communication, e) Stakeholder management, f) Training g) Engagement h) Vision and benefits communication i) Stakeholder management j) Requirements gathering and k) Resourcing & Top management support.

These sub themes are discussed below.

##### 4.4.2.1 Communication Processes

Informal interactions between team members were well organised using instant messaging. The Technical Implementation manager #Implementer2 stated that “Group meetings in Sametime (Instant messaging/chat tool) allow for informal chatting and develops stronger rapport as they know each other face-to-face, so group meetings in Sametime improves team dynamics, allowing replication of social interaction in virtual teams” (#Implementer2) .

Formal Virtual Meetings need better procedures and etiquette, they were not well organised. #User3 stated that “In a videoconference, you have to jump in to state your point. Some people do not know how to run videoconference meetings and miss remote people. Videoconference works for question and answer, but does not work if you want to explore something “. #User4 stated that “Virtual team meeting etiquette was not there, People talk over each other. The meeting chairperson runs it like everyone is in the room. Because of that there is a communication gap. When the innovation project came in, those gaps still existed”.

To get all team members to contribute their fair share required extra management overhead. #User2 stated that “Some virtual team members can slack off (pull wool over your eyes). There is a need to specify the work (task) and deadlines. These cause double the work for the managers. The manager needs to have periodic discussions and specify deliverables each week”

#### 4.4.2.2 *Project Management*

Project management techniques, clear schedules and deadlines are formal managerial control mechanisms for virtual teams. Self-direction is an informal form of control for virtual team workers (Picollo, Powell & Ives, 2000). These control mechanisms aid implementation team effectiveness.

The team met the target of implementation date and budget. The technical implementation #Implementer2 stated that “Deadlines were tight. Deadlines were not impacted as we had the right processes and structures in place. Vendor contractors working remotely knew what to deliver. Virtual teams had no impact on quality and deliverables”.

The technical implementation manager #Implementer 2 stated that “There were conflicting objectives between the Business owner and Technology Services Division. I disagree with the sequence of deliverables. They could have been different. To our detriment, Configuration management, the core process was neglected. The incorrect sequence process implementation was due to political pressure”(#Implementer2). “Business owner got the best that they can get out of the tool. The focus was on meeting business needs, in the initial roll out and next to no focus on the IT side needs. There was no focus on bringing Service Desk and other IT staff on board on how to use the system. Incident and Request Management was implemented first for business. Technology Services would have benefited more if we implemented Configuration management first” (#Implementer5).

The clear sense of direction was also hindered by a lack of proper governance processes. The program sponsor #Implementer1 stated that “Governance processes and responsibilities were not clear as there were a number of participants across multiple organizational structures across multiple physical locations “.

The quality of work was also affected by the change of project managers. Each phase had a new project manager. # User4 stated that he observed that “The Project Managers (PM) was changed between phases. It appeared to me that there was no proper handover. People are moved around without thinking about the consequences to the project, this includes resources working on the project not just the PM. Knowledge is lost as a consequence and the new PM needs to learn about the project and re-establish relationships with stakeholders, resulting in wasted time and resources” (#User4).

#### *4.4.2.3 Expectation Management*

Innovation implementation is ineffective because of the way the information about the innovation is disseminated to its users. The users expect that the implementers will interact and work with them as partners to customise the new innovation/system to their needs (Henderson & Darcy, 2008).

User expectations are based on their needs, experience with the previous other product/service replaced and communication. The comparison with previous product/services can lead to unrealistic expectations. User resistance is based on expectations not being met and expectations can be classified as system oriented, people oriented and interaction oriented. System orientation expectation is ease of use and performance. People orientation is background, traits etc. and interaction based is loss of power and changing job structure (Klaus & Blanton, 2010). User resistance and satisfaction depends on whether their expectations are met. It is imperative for the service provider/implementer to manage user dissatisfaction due to unrealistic expectations. Interaction and communication with the users about the benefits of the new product/service is the recommended strategy to manage user expectations (Millson-Martula & Menon, 1995).

Expectations of the users were not met and benefits were not clearly explained to users leading to dissatisfaction with the innovation in phase one. The project manager of phase 1 commented that "It was a difficult project to sell as people could not see what benefit they were getting compared to the current product (nothing wrong with the current product)" #Implementer2.

The program sponsor #Implementer1 commented that “The new solution affected a large number of people and the way they did their work. Expectations were that the new solution would support the old work processes. To align expectations, we should be clear about the extent of business process that needs to be reengineered and changed. The new solution was a Commercial of the Shelf (COTS) system with standard out of the box components of business process. People have to learn the new ways of doing things and there may be some steps back, the benefits are easy maintainability, extension of the solution, rather than the day to day operation. We were not clear to the users about this. A longer pilot would not have helped as they wanted X and we were delivering Y and they could not see the benefits. If people understand the broader benefit, people are happy to take the extra steps to achieve those broader benefits. Corporate goals were not in scope and added later. The expectations should have been reset. With different expectations from different teams, expectations were not aligned and not all expectations were met, leading to a mixture of views regarding its success.” The project manager for Phase three #Implementer5 commented “The new system was a way of recording incidents; IT did not get any extra added value out of the new system. IT Service Desk could not see any value in it as there was no effort put into getting their perspective and explaining the benefits. Some people did not see the value of integrated processes, some people did not like the new solution, and some people saw too much effort and little benefit. Some people saw it only offering part of the solution that they needed”.

The user’s expectations were based on comparison of the new innovation with previous experience of innovations implemented. The project manager for phase three

# Implementer5 commented that “Elements of Technology Services Division had already seen COTS being brought in and only half implemented. This had built up the cynical perception that we will implement only part of the solution. We did not do anything to allay those fears, causing distrust”.

#### *4.4.2.4 Vision and Benefits communication*

The vision of an integrated system was not communicated to the users properly. Users were not informed of the benefits of the new product innovation being implemented. The program sponsor #Implementer1 commented “In retrospect, communication could have been better. We could have done more to help staff understand the vision at the start. During the implementation time, there were a number of changes afoot. We were introducing new technology which we did not have knowledge of. With 20/20 hindsight we should have done more to explain the vision”.

The project manager for phase two commented that “Technology Infrastructure platform groups had systems which worked for them, they did not see what the problem was, why was a new product being brought in. The new product offered integration between processes. Platform areas did not get on board with it. The general feeling was that we could fix the old applications. Technology Services was an IBM Lotus Notes shop, causing resistance. This was the first application pushing out some IBM Lotus Notes applications. People had a strong level of comfort and familiarity with notes, causing resistance. When the drawbacks were discussed their response was that we should keep developing the old notes applications. The attitude has softened and acceptance has increased. Adding the missing screenshot functionality has helped. People are more accepting that this is the new organisation

direction. The ongoing cost of maintaining custom solutions, was not understood by staff" (#Implementer 3).

Two key users commented that the vision and benefits were not sold; "Letting people know that we are trying to save costs and have the bigger picture in mind helps. There were presentations and flyers to share the vision that we are trying to save costs, be efficient. There were issues, but having the bigger picture in mind helped the implementation. Overall it was good " (#User1). "In the initial sell, it was not sold as an integrated system. Separate processes were sold. Maintenance of the old system was cheaper compared to the capital cost for the new system was part of the resistance; they could not see the benefit. Integration should have been sold better; it may have offset some of the resistance. The team should have a clear vision. I got 3 or 4 different messages. Only at the end the messages were aligned between Exec, middle management and operational staff" (#User4).

#### *4.4.2.5 Engagement*

Communication is information sharing. Engagement is psychological and emotional relationship that an employee has with the organisation or job and it helps increase personal commitment. Engagement is achieved by involving people in decisions and designing solutions. Engagement needs interactive communication between parties. Engagement works in increasing commitment by satisfying people's need for recognition and growth (Andrew & Sofian, 2011).

The view from users and the implementation team was that users were not sufficiently engaged. The technical implementation manager #Implementer2 stated that "There should have been a marketing campaign, selling the benefits of the new system and



regular updates to get staff ready for the upcoming changes. Feedback received later suggested that there was not enough engagement. We need to find how staff can be better engaged rather than just providing information via meetings”. The project manager for phase 3 #Implementer5 put it this way “The main issue was selling the vision and the way it was going to be achieved. Selling of the package on how these requirements were going to be met was not done. Selling of the implementation phases required that presentation and meetings with stakeholders. The focus instead was to get it implemented”.

The project manager for phase two #Implementer4 commented that “The project scope expanded and it involved other divisions, presenting a whole set of new challenges, making it difficult to engage with all stakeholders. We had never engaged outside the division. Engagement was lacking with the Service Desk regarding the reasons for change in phase one. Service Desk had a tool that worked for them and they had their ways of working. They had a new tool forced on them that did not fit their way of working. Communicating that the project was not about the tool, but about a new way of working was not done. This created a lot of resistance. These were some of the engagement issues with Technology Applications. The infrastructure platform teams didn’t really feel that they were involved in phase one. Involving them with the Post Implementation review with the Consultant improved their engagement. Providing solutions to some problems also increased the engagement from platform groups. Lack of engagement with support areas generally made it difficult for the project ” (#Implementer 4).

There was information sharing by the implementation team, but no engagement. One of the key user's #User3 commented "The remote implementation team did not demonstrate the use of the tool very well. They relied on Videoconferencing, which has a fixed size of screen, with a limited time for the meeting as there is a lot of demand for the Videoconference room. This leads to some issues not being addressed. When an innovation is implemented, you want to ask a lot of questions". The project manager for phase one indicated that there was information sharing, but engagement was lacking due to the nature of technology. "The nature of Videoconference meant that people in the States could not see what was being shown in Canberra".

#### *4.4.2.6 Stakeholder Management*

Poor communication with internal stakeholders is a major cause of inefficiency. Ideal communication is synchronous and two way communication. Fewer people with Face to Face communication are ideal for synchronous communication (Welch & Jackson, 2007).

The project had a lot of stakeholders with some virtual stakeholders. The technical implementation manager #Implementer2 commented that "A lot of stakeholders made communication difficult. Corporate Services was in South Australia.

Communication was not good between Service Owners and technical implementers.

There were issues with communication in the 2<sup>nd</sup> phase, as the Technical Implementation manager for phase two was new to the organisation and was based in Sydney and felt that he could have worked better if he was collocated in Canberra".

Perception was that the innovation project was Business focussed, with the Technology Services Division voice was not being heard (#Implementer5).

#### 4.4.2.7 Training

Most innovations are successful, but fail in the implementation process. This is due to lack of skilled, consistent use by its users. The factors that influence success/failure of innovation implementation include quality training, support on as needed basis and ease of use (Klein & Knight, 2005).

The training provided to the users was not tailored to the organisation business processes. The project manager for phase 3 #Implementer5 commented “Training was out of the box and had no relevance to the business process (how we do things) within Technology Services” (#Implementer5).

The users were expected to do self-learning. One of the key user’s #User1 commented “There is apprehension on how to use new systems. It was a big change and had a big impact. Training would help in this area. Having personal training, e-learning mixture is great. Training is ok to get a feel for it. Having real examples is better than theoretical examples. Being part of the champions board helped resolve our issues. Training by using the system is valuable. A short guide on how we used to do it, and this is how we do it now would have been helpful. Support via person present or screen sharing would also help”.

Another user, # User#2 commented that the new system is complex to use and customised training supporting the organisation business processes rather than standard training would have helped “Training would have helped. Multiple steps involved in the processes till the problem is resolved”.

The project manager for phase 1, #Implementer3 commented that virtual training was difficult to conduct. He commented “Training was difficult logistically in the States”.

#### 4.4.2.8 *Requirements gathering*

Crowston & Kammerer state that shared understanding of customer needs & requirements contributes to group performance. Requirements analyses are a key coordinating mechanism for implementing a system that is easy to use for customers. Getting customer input and involving them in the design process are coordinating mechanisms used in requirement analysis. Incomplete, changing and unclear requirements are the main factors for failure of large software projects. Complete and clear requirements make successful implementation easy. A single person cannot manage requirements gathering for large software projects as they need knowledge from many domains. Multiple members with different domain expertise collect requirements and these requirements need to be integrated and understood by the implementation team. Co-ordination is managing dependencies between multiple members doing independent tasks. Overcoming coordination problems requires extra work from members (Crowston & Kammerer, 1998).

The cause of incomplete requirements was lack of knowledge about the software and changing/conflicting requirements. The implementation team did not gather and analyse the requirements clearly and the requirements also changed. All the key users stated that prior to phase one implementation, user requirements and needs were not analysed and met. The project manager for phase 3 #Implementer5 commented “We did not know the set of requirements when we did the Request for tender (RFT). The innovation program was driven by multiple different requirements

which were not really conducive. As we started writing the Request for Tender, the focus changed from Technology Services using Industry best practices, to business requirements. Business needed Request and Knowledge management first. Our focus changed for managing change within Technology Services Division. The selection of the Commercial off the Shelf (COTS) System did not meet requirements of either side. It was a poor compromise. It is questionable whether the new system is better than the old system". One of the key users' #User4 commented "The implementation team need to understand that when a system is replaced, process and people are affected. Innovation is rarely a technology project. We spend less time on these issues".

Not spending enough time on requirements gathering was a common theme from the users. One of the key users #User3 commented "Not getting the requirements right, maybe a consequence lack of time. Second phase allowed screen dumps paste. I still get comments from clients that they cannot do what they were able to do. The method of assigning tickets to resolvers is not perfect".

#### ***4.4.2.9 Resourcing and Top Management Support:***

Innovation creates change in the way people work. Top leadership support to the innovation is vital and needs to be visible to staff. Top leadership needs to protect, and support the innovation process with resources to make the innovation implementation successful (Barsh, Capozzi & Davidson, 2008).

The project manager for phase 2 #Implementer4 commented that "There was not enough ongoing support from the Senior Executive to make the improvements that we wanted to make. The lack of support and the combination of expanded scope took the focus away from the improvements needed for the Technology Services Division. This

also impacted the engagement that we had with all stakeholders. We did not get resources that we needed and were limited in terms of funding available to get external vendor Consultants. Top down support for the vision and achievements that were going to be made were not visible. There needs to be highly visible support from the Executive for such a major change to be accepted by everyone” (Implementer#4).

#### *4.4.2.10 Coordination*

Coordination is required between team members to achieve team goals.

Communication helps build the shared awareness to achieve coordination. Building shared understanding between new distributed team members is more difficult in innovation contexts, as the team members are uncertain. The team members have to build their own knowledge and share it with other members by communicating and interacting with other team members. Working with stakeholders from other teams or new team members involves the additional overhead of building shared understanding (Rosen, Salas, Letsky & Warner, 2008).

There was communication overhead in effective coordination between virtual stakeholders from different teams. The program sponsor #Implementer1 commented that “Working in Virtual teams has some commonality in dimension when you work with disparate teams within the same location. The common dimensions are of additional communications, building relationships, trust between parties, and shared vision between parties. We saw all of those emerging in this project. In general the use of travel of virtual team members for Face to Face meetings, phones, and emails helped manage them along. The team managed to keep stakeholders on-board during the process”.

The project manager for phase three concurred that coordination with stakeholders was required, #Implementer5 commented that” Success depended on getting all stakeholders on board. We could have done a better job in getting stakeholders on board”.

**There was not a clear sense of direction in the project as there were conflicting objectives and this resulted in implementation which did not satisfy the needs of the Technology services (quality of the work) in phase one. The users regarded the innovation as ineffective. They found the new system as deficient. There were issues with communication, project management, expectation management, engagement with users, stakeholder management, training, support, requirements gathering and resourcing. Users commented that customised training and local support would have helped implementation be more effective. The need for local support suggests that Presence affects innovation effectiveness.**

#### 4.4.3 Trust:

Trust issues lead to management overhead in managing virtual teams. The implementation team had issues of trust with the vendors working remotely. The project manager #Implementer3 for phase 1 stated that “Vendor Contractors worked remotely out of NSW office. It is hard to know their work hours as you are signing their time cards. You have to trust that they did the reasonable thing when they have dinners, same for flights and accommodation (trust that the expenses were the cheapest). Management of distributed teams distract me from the project. There is an overhead when there is no trust and I am less effective in doing my job. I have to

check, that contractors worked the number of hours, that they said that they did ” (#Implementer3).

#User2 supported the above view regarding overheads and lack of trust “Informal networking is needed with other sections to resolve issues. This leads to lack of trust.”

A key user supported the above view. User#1 commented “Trust is key, if you trust the people to do their work, you do not have to chase them for constant updates”.

Tenure of team members cause trust issues. The project manager for phase2

#Implementer4 commented “New people to the virtual team cause issues of trust. A new person could not see what the other person was doing in a remote office, caused conflict. People having worked longer know about all the work that is being done by different team members, leads to trust as you know that the other person is working on and not slacking off. The newer staff did not have the awareness of all the other work that staff members were doing led to conflict” (Implementer4). **Quantitative univariate analysis reported a 3% difference in trust due to tenure.**

#User1 observed that “There was trust amongst team members” (#User1). The quantitative results support the high levels of trust.

#### **4.4.3.1 Inter-team trust issues**

The semi-structured interviews revealed inter-team trust issues which were not covered by the survey. Inter-team trust issues result from non-delivery of expectations. The program sponsor #Implementer1 commented “Unaligned expectations and unfulfilled expectations, led to frustration affecting trust” (#Implementer1).



Group Identity affected inter-team trust. “There were trust issues between teams because of unnatural competition between branches in the Technology Services Division. The innovation project was seen as an Infrastructure project; there was scepticism and resistance as a result” (#User4). #User1 had a contrary view. He stated “There was trust amongst team members” (#User1).

Lack of interaction between the implementation team and other teams caused a lack of trust. #User3 commented “Trust is important in teams; the team implementing the innovation does not have much to do with the group, so trust is not developed with them” (#User3).

**The intra team trust quantitative results were supported by the interviewees. In addition, additional inter-team trust issues affecting innovation effectiveness were discussed in the interviews.**

#### 4.4.4 Group Identity

There was strong identification by employees with the sections and branches that they were part of. The new innovation was seen as a threat to their way of working and there was resistance. This view was echoed by the technical implementation manager, the project manager for phase 1 and phase 2. The technical implementation manager #Implementer2 commented “There was a lot of criticism from Technology Applications. Technology Applications generally were negative and did not want to move away from the Notes environment. They felt that it was a step down from the old system. Creating knowledge documents from comments meant extra work and responsibility”. The project manager of phase 1, #Implementer3 also said the same thing “People that really lived in the old system did not want to change. There was

bonding due to their dislike of the change". The project manager for phase2, #Implementer4 commented that "On the Technology Applications side there was a lot of resistance, to the tool, and also for the standard processes approach, they believed the innovation was for infrastructure, did not fit the software development processes, and was not the direction that they want to head in. The commercial off the shelf (COTS) product was replacing a custom tool that they had built and invested their careers. Their Intellectual property was being wiped out. The organisation had set a general direction of replacing custom built applications with COTS products. This being the first application bore the brunt of the frustration with the developers ".

Collective identity is defined as identity shared by people who have common views and values. These views and values provide a common evaluative platform. These shared views and values are derived from common background. These members come together to achieve certain goals (Kantner, 2006). The program sponsor #Implementer1 stated, "Different groups, subgroups band together around certain shared views as per their group, other times they would align with members outside their group with people who shared their views ".

**The results of the quantitative analysis show that Group Identity influenced the innovation implementation more than presence and this view is supported by the comment from the project manager for phase 2 #Implementer4 "The extra people involved are more a factor of what they are part of rather than virtual teams ".**

#### 4.4.5 Innovation effectiveness:

Innovation implementation is complex, as the new system needs to integrate with existing systems, changes in work processes, automation of certain tasks (Jayanthi & Sinha, 1998).

Two factors impact the implementation effectiveness; innovation climate and innovation-values fit. Innovation climate is the expectation, support and rewards by the organisation for using the innovation. Innovation-values fit affects user commitment to use the innovation. Users will be committed to using the innovation if it fits with their values. An Innovation is considered fit when the system supports the task requirements valued by the users (Dong, Neufield & Higgins, 2008).

There were groups that did not see the new system fitting in with their values of easy to use and functionally rich. The project manager for phase 3 #Implementer5 commented “There was major resistance because people thought that it was functionally deficient compared to the old system. Technology Applications Branch accepted it because they had no choice. Technology Applications thought it was archaic; layout was bad and functionally deficient. The organisation had pampered staff to cater to every perceived need rather than buying off the shelf. If these perceived needs are not met, then users are dissatisfied. We need to review what perceived needs are important”

One of the key users #User3 from Technology Applications Branch supported the above view She commented “Compared to the old system, the new system has reduced functionality, clients cannot check whether someone else had reported the problem (filed a ticket). If multiple tickets filed for the same problem, how to link

them was not shown in training. The product has been designed for Infrastructure and not for Technology Applications. The configuration has no Application assets and the implementation team were not interested in putting it into the new system. Not all features implemented; have gone backwards. Clients cannot assign the urgency to the task. I hate the new Change Management, takes me twice as long. The number of steps is too long; goes onto multiple screens. The solution is not intuitive, not easy to use. People get used to what they use. The implementation team needs some people who are familiar with the old workflow so that the good things can be carried forward”.

#User4 also commented about the lack of innovation-values fit, i.e. system was not easy to use and functionally deficient compared to the old system. “When a new system comes in, it needs to deliver like functionality and should be more intuitive and easier to use. The workflow in the old Notes environment was way better than in the new System. The ability to integrate would have been easier. Because notes and mail use the same environment, notifications were better. This may not have been a fair comparison as a result, but was nonetheless a requirement”.

#User3 believed that there was no support from the organisation either i.e. the innovation climate was not supportive. She commented “Issue could be no allocation to ongoing maintenance if structures are changed. If you are introducing a product that changes culture, that needs to be addressed, it was not addressed. Face to Face has helped me, not virtual training. Should have had some focus on training to get better learning outcome to make it more real and interactive later on. No incentive

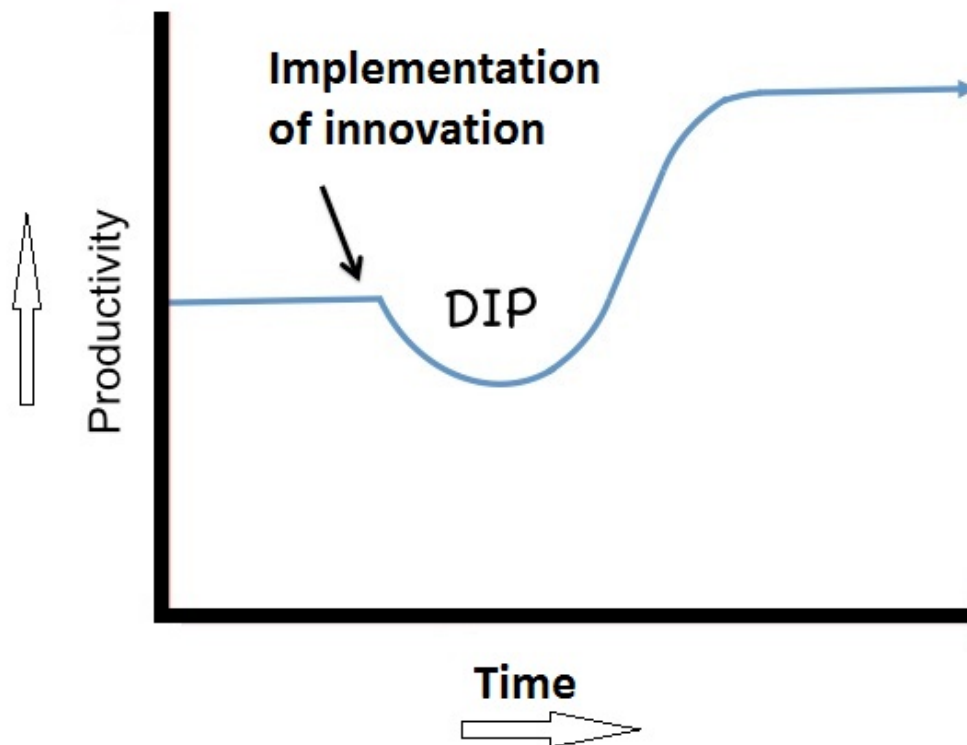
given to applications staff to move, all that was done was to give them an extra task to do. If you want people to change, you need to give them something to change”.

#User4 also felt that there was no innovation-values fit. He commented that “For Applications they had good systems in place, they saw the replacement system as less effective. The transition to the new system was not well established. Their expectation was 1 to 1 functionality in the new system”.

#User1 commented that “Not everything seems intuitive as it was in the past. You have to learn the new system to use new features. Previously the process was simple; just create a ticket and pass it to the Service Desk”.

#### *4.4.5.1 Change adoption view*

The innovation implementation is rated as moderately successful. The program sponsor #Implementer1 states that “Project did achieve its key objectives. It was implemented within budget and time. It achieved a number of outcomes; it was middle of the road success. There were other projects which engendered more support as benefits were explained clearly for those and people were more aligned. Other projects failed to deliver and were criticised”.



**Figure 4-6: Innovation implementation with time**

The productivity of the organisation had a dip immediately after the implementation and followed the typical change implementation curve as depicted above.

The program sponsor #Implementer1 stated “The solution has been accepted as way of working after two years. The system is being used in different ways and is integrated into the way people work. The overall change facilitated the move to a central contact point, and gone further now with organisational change of a centralised single Service Desk as the consequence of it. Learning curve, adaptation and depth of accepting something different were present in this project”.

The typical change adoption view was echoed by the Technical Implementation manager #Implementer2 as well. He stated “The implementation was a success

(because it did not fail). The solution is much better than the old system. Two of the processes are good and third one can be improved. Most people are used to it after the first phase. The general cycle for users is to hate the new system initially and then get used to it. People do not like change and then get used it. There is a marked change in people's perception between then and now". The project manager for phase- 1 #Implementer3 stated similar views on change adoption "Remote users were in shock when the old system was switched off. More antagonism in Canberra as users who were used to the old system are Face to Face, they are compelled to yell at you, new people did not complain. Their rate of processing was much higher than people who were 10 to 15 years in the organisation. We faced passive resistance. We had some people who would not follow the new process. Newer people at the lower level, just followed the process, they were creating Knowledge documents. Old people would not. The richness of Knowledge was not increasing and this created a cycle where new knowledge documents could not be found. Being pressed for time, we transferred old Knowledge documents without checking whether they were correct or not (searching the knowledgebase would get an incorrect document). We did not have the best choice of staff for this effort. It would be better if we had better engaged staff. Corporate Services knowledge had been maintained better. They had more resources and transferred their knowledge documents. Users accepted the change after year and half. People have become reliant on the new system. There is a drop in efficiency when a new system is introduced as they learn and then as acceptance gets in, system efficiency increases".

One of the key user #User1 also supported the change adoption cycle view. He stated that “There was a bit of apprehension when the new solution was introduced. Knowledge documents need to be setup, but as Knowledge documents were created, it became more useful. I can get the answers when I want them from Knowledge Management. A centralised system is empowering and efficient “.

#### *4.4.5.2 Extension and efficacy of the innovation*

The new system added more features (extension) and was more efficient than the old system as it integrated and implemented Industry best processes, though the speed/ease of use is not as good as the old system. The project manager for phase 1 #Implementer3 stated “This is way better than the old custom built system. The new system has a proper database; it is integrated with other automation sources. The new system database can be a sink using other information databases. It links with the Asset management system; that could not be done with the old system. Speed of use is not as good as the old system. There is more visibility across work, time taken to resolve incidents. Overdue work is visible which was hard to do before. This visibility has allowed us to stop and think about our processes; only incremental work could be done on the old system as it was built over a bad base. Old system had mandatory fields which people filled without understanding. The new system built on the way we want to work. Integration was lacking, hampering decision making. Ops Staff cannot see the benefits, so difficult to sell; but team leader and above can see the benefits of decision making and joined up workflow”.

User#1 commented “New tool has great many features. It would cost a fortune to develop such features in-house and maintain it. The new tool keeps the history and



co-relates incidents and helps find root cause, though it is not visible when you first use it. In the initial stage you do not see the benefits. The new solution extended management and analysis of the incidents. The biggest feature is Knowledge Management; it helps save time for me and the person providing support.

Implementation was effective. Some of the issues were perceived issues as people liked the old system. The new system was integrated with old systems. People were consulted and informed. We persisted till people started using it “.

Business using the system was an addition over the old system. User#4 commented “We got Business using Services which was an improvement from Technology Services Division using it alone. Metrics were not available in the old system as they were not redesigned to cater for this. Approvals were easier to perform in the old system than in the Commercial Off-The-Shelf (COTS) product. The workflow needs some work in the new system“.

There were other extensions and efficiencies that the innovation provided. #User 4 commented that “The good thing in Solution, people are using it as a single entry point for Services. It has started to build the knowledge documents in the long run. Majority of the Lotus Notes based knowledge has been migrated as well. In the new system, one does not have to go to layers of documents to find the document. It allows one to drill down and go back to the main menu. However, it takes a lot longer to do screenshots effectively. The quality of screenshots in the old systems was better for testing and supporting production. Services allow people to hold multiple roles and change roles without system changes or assistance from an administrator. Most Lotus Notes systems do not cater for multiple roles. Trust helped in the implementation as

we trusted each other that we had commitment to this and as a group we decided to support the implementation. It was difficult in the beginning; success was not visible till towards the end”.

#### *4.4.5.3 Not all features are implemented*

All the benefits of the innovation have not accrued to the organisation as all the features were not implemented and funding was not available for later stages. The technical manager for implementation #Implementer2 commented “We have not implemented a lot of features that are extension over the old system. Configuration management is not implemented”.

The project manager for phase 2 #Implementer4 echoed the view and commented “Change Management is the same as before with improvement in assessing of risk, but linking of change to configuration and links to services has not been achieved. It has been a hard slog. Incidents leading to changes feature is not utilised to the extent it could. Improved knowledge management was not being utilised. Downsizing happening at the same time did not help. Project was a success overall. There are certain things not utilised that should be used, but the project did not push us backward. There are other organization changes like the move away from phone support and the amalgamation of multiple Service desks into a Single Service Desk, has led to a drop of support for operational platform groups, which is more of factor than the implementation of the new toolset. Improvement in Problem Management, correlation and linking of Incidents are not particularly visible to the organisation, but there is savings in ongoing Notes development that people do not see in their day to day job “

“The push for users to search Knowledge before calling the Service Desk has pushed Knowledge Management to improve. We are getting good value out of Knowledge management. The process was not communicated clearly “(#Implementer4).

One of the key users #User2 commented that “The process is of analysing incidents and focussing effort on the root cause has not started. Product is successfully implemented, but I do not know whether all features are being utilised as analysis not done on metrics to identify problems or process areas “(#User2).

Implementer 3 stated that “Things missing are approval workflow. Internal resourcing for the program pulled out and put on other things. It is a vast improvement over the previous system ” (#Implementer3).

“A lot of old systems still not decommissioned as we did not implement all features completely. The new system has not realized all the benefits and outcomes that the project envisaged ” (#Implementer5).

#User2 concurred that the new system required more improvement work which has stopped due to lack of support from the organisation. He stated “There are still lots of improvement required and the improvement process should not stop” (#User2).

#### 4.4.6 Summary of Structured interviews

**The interviews supported the quantitative results of low-moderate innovation effectiveness. The interviews highlighted that innovation effectiveness was low-moderate as the extensions of the product innovation was not visible or not installed and users did not know (were not clearly communicated) the integration of processes in the new product innovation (efficacy features of the innovation).**

**In addition the interviewees volunteered many more reasons for the lack of high effectiveness of innovation. These included lack of innovation-values fit, innovation climate which prevented from all the features being implemented and continuous improvements not supported. These factors are all responsibility of the implementation team effectiveness.**

**Hypothesis 3a – Implementation team effectiveness affects innovation effectiveness was thus supported**

#### **4.5 Summary of Findings and Conclusion**

This chapter analysed the empirical results as well as qualitative results and provided answers for the research questions.

Data was cleaned and coded in the first step, followed by univariate analysis to check the distributions of the variables. All the variables had normal distributions. This was followed by bivariate analysis to check for the correlations among variables and the reliability of the items used to measure the constructs. The data suggests that Group Identity, Trust and Presence were generally high in this organisation.

The Innovation implementation was found effective by 44% of the surveyed staff, 21% of the surveyed staff found it to be the same as the system it was replacing and 35% of the staff found it less effective than the previous system. Twice as many percentage of new members (<1 year tenure) found the innovation effective compared to long tenured members (> 5 years). This was supported by the comment from one of the interviewees #Implementer3 “More antagonism in Canberra as users who were used to the old system are Face to Face, they are compelled to yell at you, new people did

not complain. Their rate of processing was much higher than people who were 10 to 15 years in the organisation”.

Bivariate models were built for the first three hypotheses. This analysis found that trust had a positive impact on innovation effectiveness; group identity had a positive impact on innovation effectiveness. Presence had no impact on innovation effectiveness. Interviews validated these findings.

Multivariate analyses were then conducted to test the hypotheses that had two or more independent variables. The multivariate regression model confirmed that presence had no impact on innovation effectiveness. The results of the first seven hypotheses are listed below.

H1a: Trust in virtual teams affects innovation effectiveness. This hypothesis was supported by empirical results. The surveys measured intra team trust. Quantitative results from univariate analysis show that intra team (within the team) trust was more than 89% regardless of team tenure or branch. Bivariate analysis results found that, Trust was correlated with Innovation effectiveness. Hypotheses H1a measures the effect of trust alone on innovation effectiveness and is supported by the literature. The results obtained for the relationship between trust and innovation agree with Andersons’ TCI participative safety measures in studies by Hülshager, Anderson & Salgado (2009) (Hülshager, Anderson & Salgado, 2009). The intra team trust quantitative results were supported by the interviewees. Semi-structured interviews provided additional details about Inter team trust as this was not measured by the survey. Semi structured interviews analysis showed that there was low levels of inter team trust.

H1b: Presence affects innovation effectiveness. This hypothesis was not supported by empirical results. Descriptive statistics analysis reported that 65% of all respondents reported high presence, regardless of tenure and branch. 35% of staff reported low presence. The presence reported in quantitative analysis was intra team presence. Hence even though presence reported was high, it did not translate into high innovation effectiveness. Semi-structured interviews revealed that co-location of the training and support staff in the weeks after the implementation, was important for the users to be effective at using the innovation and as the training and support was remote, led to innovation effectiveness being low. Literature review supports the need for local presence for transfer of tacit knowledge (Aydogan, 2008). The support for presence hypotheses results is also provided by some studies, though other studies dispute it and further research is needed (Rallet & Torre, 1999; Aydogan, 2008).

H1c: Group Identity in virtual teams affects innovation effectiveness. This hypothesis was supported by empirical results. The results are also supported by literature. A study conducted by Wang, Ying and Klein (2006) confirmed that group cohesion and identity are positively related to innovations implementation (Wang, Ying & Klein, 2006). Innovation was rated effective by twice the number of staffs that were new to their teams than staff who had been with their teams for five years or more.

Regression analysis showed that innovation effectiveness was dependent on Group Identity. 90% of new group members reported a high level of group identity compared to 100% of long tenured group members. This is only a slight difference in Group identification level between new and long tenured team members, contrary to intuitive view that new members would have low group identification. The reasons

that might explain new team members finding the innovation effective can be that newer members want to survive in their jobs and want to impress the management. New members are also not habituated into the old ways of doing things. This is an area that needs to be researched further in future studies.

H2a: Interaction of Presence and Group Identity affects innovation effectiveness. This hypothesis was not supported by the empirical results i.e. the interaction of Group Identity and presence factors has no effect on Innovation effectiveness. The level of group identification in this case study is very high possibly due to long tenured virtual teams, hence presence has no effect on group identity's contribution to innovation effectiveness.

H2b: Interaction of Presence and Trust affects innovation effectiveness. This hypothesis was not supported by the empirical results. Trust and the interaction of presence factors had no effect on innovation effectiveness. The level of trust between team members is very high in this case study, possibly due to long tenured teams. The survey questions measured intra team trust and did not measure inter team trust between user teams and the remote implementation team, hence presence has no effect on trust's contribution to innovation effectiveness.

H2c: Interaction of Group Identity and Trust affects innovation effectiveness. This hypothesis was not supported by the empirical results. Group Identity and the interaction of Group identity and trust had no effect on innovation effectiveness. The survey questions measured intra team trust and not inter team trust. Majority of the members reported high levels of intra team trust and Group identity. If inter team trust was measured, the effect of group identity and the interaction effects of group

identity may have affected innovation effectiveness differently. Further research is needed on effect of inter team trust between implementation team and users on innovation.

H2d: Interaction of Group Identity, Presence and Trust affects innovation

effectiveness. This hypothesis was supported by the empirical results with Group Identity being the main predictor. The parameter estimates for both the interaction effects are negative and, are very small indicating that though they have an inverse relationship with innovation effectiveness, their effect is very low and can be ignored.

Hypothesis H2d testing shows that Group Identity is the main predictor for innovation effectiveness in long tenured virtual teams and teams with high levels of intra team trust. Group Identity had more effect on innovation effectiveness than presence and this view is supported by the comment from the project manager for phase 2

#Implementer4 “The extra people involved are more a factor of what they are part of rather than virtual teams “.

Though the data was collected from surveys to check the effect of implementation team effectiveness on innovation effectiveness, the data was not analysed using quantitative techniques as there were only 26 respondents in the implementation team. Semi-structured interviews were conducted to analyse the implementation team effectiveness on innovation effectiveness as well as validate the quantitative findings.

Analysis of semi-structured interview supported the hypothesis “H3a: Implementation team effectiveness impacts innovation effectiveness”. Semi-structured interviews highlighted a number of areas in the domain of implementation team effectiveness



that contributed to the low-moderate innovation effectiveness. These factors are listed below. These include a lack of a clear sense of direction in the project; conflicting objectives resulting in an implementation which did not satisfy the needs of the Technology services (quality of the work) in phase one. Some of the users found the innovation as ineffective. Some users did not see the new system fitting in with their values of easy to use and found it functionally deficient compared to the old system. The functional deficiencies did not enable the users to deliver good customer service which is one of their values. User feedback regarding improvements to the innovation was not implemented due to lack of resourcing. Users viewed the organisation climate as not supportive of the innovation.

Semi structured interviews also revealed issues with communication, project management, expectation management, engagement with users, stakeholder management, training, support, requirements gathering and resourcing.

Semi structured interviews revealed that vision and benefits were not communicated to users. Univariate analysis validated this, by reporting that the percentage of group of users reporting innovation as effective, from the branch dealing with strategy was much higher compared to other branches. Sharing of vision and strategy leads to shared goals building. This finding suggests that to increase innovation effectiveness in organisations, managers need to develop strategies to increase employee identification with the organisation in addition to their identification with their work group.

Semi structured interviews provided information that virtual presence had a negative effect on innovation effectiveness, as users did not find remote training and remote

support after innovation implementation effective for learning and use of the new innovation.

The interviews supported the quantitative results of low-moderate innovation effectiveness. The interviews supported the extension and efficacy features of the innovation

In summary, for organisations with high intra team trust and long tenured virtual teams, Group Identity and implementation team effectiveness are the predictors for innovation effectiveness.

This chapter detailed the results of the quantitative and qualitative research. The next and final chapter of this thesis provides a summary of the thesis, implications, limitations of the results and some recommendations for future research.

*“Learning and Innovation go hand in hand” – C. William Pollard (2010)*

## **5 Discussion, Conclusion and Contributions**

### **5.1 Introduction**

This final chapter discusses the findings from Chapter 4. Although the effects of presence, trust, group identity and implementation team effectiveness on innovation effectiveness in virtual teams have been studied separately, the effects of presence, trust, group identity and implementation team effectiveness on innovation effectiveness together have remained unexplored. In an organisational setting all these factors do not exist in isolation and are at play together, during an innovation implementation. The aim of the study was to find the effects of all these factors together on innovation effectiveness in virtual teams.

The chapter starts with reviewing the reasons and motivations for the research, followed by findings, limitations, contributions to practice, followed by areas for further research and conclusions.

### **5.2 Research sub questions**

The main research question was “What is the effect of group identity, trust, presence and implementation team effectiveness on innovation effectiveness in virtual teams?”

This question was split into three research sub questions as below.

RQ1: What is the relationship between Trust, Presence, Group Identity and Innovation effectiveness?

RQ2: Do Presence, Trust and Group Identity interact with each other to affect innovation effectiveness?

RQ3: Does Implementation team effectiveness affect innovation effectiveness?

### 5.3 Summary of major findings

This section summarises the findings from this study. This research shows the effects of Presence, Group Identity, Trust and Implementation team effectiveness on innovation effectiveness in virtual teams. The three research sub questions in the section above were split into eight hypotheses. The hypotheses and the results are listed below.

H1a: Trust in virtual teams affects innovation effectiveness (supported)

H1b: Presence affects innovation effectiveness (not supported)

H1c: Group Identity in virtual teams affects innovation effectiveness (supported)

H2a: Interaction of Presence and Group Identity affects innovation effectiveness (not supported)

H2b: Interaction of Presence and Trust affects innovation effectiveness (not supported)

H2c: Interaction of Group Identity and Trust affects innovation effectiveness (not supported)

H2d: Interaction of Group Identity, Presence and Trust affects innovation effectiveness (supported). The contributions of the interaction effects were small, leaving Group Identity as the main predictor.

H3a: Implementation team effectiveness affects innovation effectiveness (supported).

The Innovation implementation was found effective by 44% of the surveyed staff, 21% of the surveyed staff found it to be the same as the system it was replacing and 35% of the staff found it less effective than the previous system. The effect of various factors on innovation effectiveness in virtual teams, found by this study are summarised below.

### **5.3.1 Effect of trust on innovation effectiveness**

Intra team (within the team) trust was found to be more than 85% regardless of team tenure or branch. Trust was found to be correlated with Innovation effectiveness.

There was low levels of inter team (between teams) trust. The literature supports the effect of trust alone on innovation effectiveness. Hülshager, Anderson and Salgado (2009) found similar results for the relationship between trust and innovation using Andersons' TCI participative safety measures (Hülshager, Anderson & Salgado, 2009).

### **5.3.2 Effect of presence on innovation effectiveness**

Findings showed that Presence alone had no effect on innovation effectiveness. 65% of all respondents reported high presence, regardless of tenure and branch. 35% of staff reported low presence. The presence reported in quantitative analysis was intra team presence. Hence even though presence reported was high, it did not translate into high innovation effectiveness. Information from semi-structured interviews showed that Presence had an effect on innovation effectiveness. For example, training and support necessary for innovation acceptance were negatively affected by virtual teams/presence. Co-location of the training and support staff in the weeks after the implementation was important for the users to be effective at using the innovation.

However, the training and support was remote, which led to innovation effectiveness being low. The literature supports the need for local presence for the transfer of tacit knowledge like training and support of an innovation, (Rallet & Torre, 1999; Aydogan, 2008). The support for the presence hypotheses results is also provided organisations like Google and Yahoo (Warkentin, Sayeed, & Hightower, 1997; Guynn, 2013). Further research is needed on the effect of presence on innovation effectiveness.

### **5.3.3 Effect of group identity on innovation effectiveness**

Results of the research showed that group identity affected innovation effectiveness. The results are supported by the literature. A study conducted by Wang, Ying and Klein (2006) confirmed that group cohesion and identity are positively related to innovations implementation.

### **5.3.4 Combined and interactions effect of presence, group identity and trust on innovation effectiveness**

Findings show that interaction effects were significant when all three factors of Group Identity, Presence and Trust interacted with each other to affect innovation effectiveness. Group Identity was the main predictor for innovation effectiveness; contributions for the interactions of Trust, Presence and Group Identity were small leaving Group Identity as the main predictor, followed by Trust. The virtual teams in this case study comprised of members having long tenure and teams with high levels of intra team trust. The literature states that identification with the group enables enhanced social interaction among members. Nonaka (1990) states that; enhanced social interaction among group members enables sharing of solutions to problems, improving innovation acceptance and effectiveness. Identification with the group

enables group cohesion, which promotes participation and learning the new innovation (Wang, Ying, Jiang, Klein, 2006). In this case, the implementation team and the users saw each other as the out group (not part of their group) due to high levels of group identity, leading to lower levels of interaction and information exchange; leading to lower levels of innovation effectiveness.

### 5.3.5 Effect of implementation team effectiveness on innovation effectiveness

The research found that vision and benefits were not communicated to users. This was further supported by a higher percentage of users from the strategy branch (who were aware of the vision and benefits), reporting the innovation as effective, compared to other branches. Sharing of vision and strategy leads to shared goals and building organisational identity (Rogers & Lea, 2006), proving that shared organisational group identity leads to higher innovation effectiveness. This leads to the conclusion that to increase innovation effectiveness in organisations, managers must develop strategies to increase employee identification with the organisation in addition to their identification with their work group.

The research found that some key processes needed to be implemented and improved. Fixed period videoconferencing did not allow time for interaction between the remote implementation team and virtual users, adding to a lack of engagement. The implementation team needed to have more interaction and discussion with the users to manage their expectations. This is supported by the literature. User engagement will increase if the systems are easy to use, and users are involved during requirements gathering and in design of the system (O'Brien & Toms, 2008).

The users who did not find the innovation effective was due to lack of fit with their values – innovation values fit and lack of supportive climate – innovation climate fit.

There were users that did not see the new system fitting in with their values of easy to use and found it functionally deficient compared to the old system. The functional deficiencies did not enable the users to deliver good customer service, which is one of their values. Though the new system integrated all the different IT processes, added more features and is more efficient than the old system, it is not as easy to use as the old system.

The research also found that all the features and processes of the innovation were not implemented, as funding and resources were not available during the later phases.

Users viewed the organisation climate as not supportive of the innovation.

The research found that reasons for ineffective innovation implementation were factors that are part of the Upper Echelon theory; Resource Based View and Process theories. Best practices in project management include most of these factors. These factors were; sense of direction, Expectation Management, Vision and Benefits communication, Stakeholder Management, Training, Engagement, Requirements gathering and Resourcing, and Top management support.

In summary, this case study found that group identity and implementation team effectiveness were the main factors affecting innovation effectiveness.

## 5.4 Limitations

This study was conducted on an innovation implementation in a technology services division in a single federal government agency. The effect of specific variables of trust,



group identity, presence and implementation team effectiveness on innovation effectiveness in virtual teams was investigated using surveys and semi-structured interviews. To limit respondent burden, the surveys did not include all questions of interest in each of the variables. The survey questions did not include questions on inter- team trust between the implementation team and users. The interviews provided rich detail and highlighted other factors that affected innovation team effectiveness, ameliorating and alleviating the concerns regarding the lack of some questions in the survey.

Though the case study investigated the implementation of an innovation to integrate IT processes using Commercial off the shelf software, to replace multiple bespoke systems supporting different business processes, the findings could be generalised to other organisations implementing technical innovations.

The organisation studied has been using virtual teams for some time, so the quantitative findings regarding the effect of presence on innovation effectiveness may not be applicable to organisations with new virtual teams, though the findings from semi-structured interviews regarding presence are applicable to virtual teams.

The case study investigated the innovation effectiveness in a federal government organisational context and the findings may be different in other private sector contexts.

In spite of all the above limitations, the variables of group identity, presence, trust and implementation team effectiveness and innovation effectiveness are general and apply to all types of organisations. The findings from this study may help managers in

effective implementations of innovations and future researchers in studying innovation effectiveness.

## 5.5 Contributions

The effectiveness of innovation implementation in virtual teams is dependent on a lot factors. Previous studies have focussed on these factors individually as they form part of different theories, namely Organisational Behaviour theories, Project Management theories, Upper Echelon theory, Resource Based View and Process Based theories. The main contribution of this research is holistic guidance to practitioners based on the findings from this study; which investigated the various factors from different theories affecting innovation effectiveness in virtual teams. The study found that factors from various theories impact each other to support innovation effectiveness. The contributions are summarised below:

1. The finding that group identity as one of the main predictors of innovation effectiveness in virtual teams. The concept of group identity includes the identification with the team, but also with the organisation. The finding that the sharing of vision and benefits helps innovation effectiveness in virtual teams can benefit management practitioners. Sharing of vision and benefits of an innovation leads to building of shared organisational identity. This finding shows that Group identity (from organisational behaviour theory) is built up by factors from upper echelon theory required to support innovation effectiveness.
2. The importance of the provision of customised training and local support for virtual teams immediately after the implementation of the innovation. Local support allows users' interaction with the support persons enabling users to

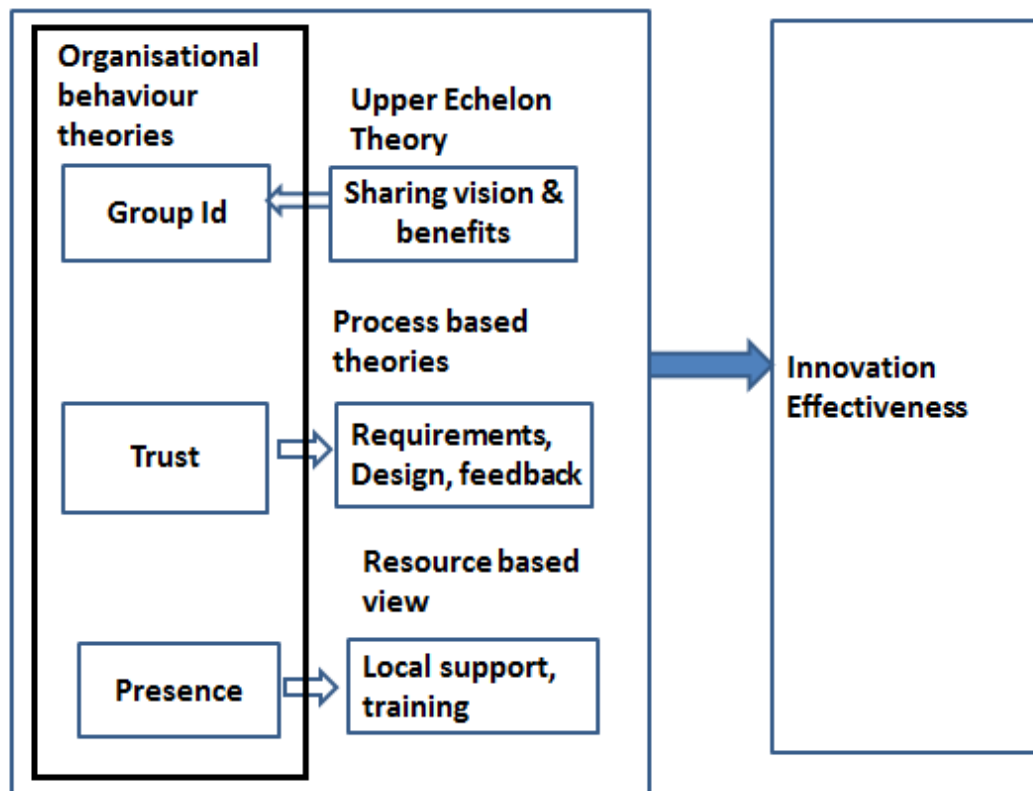
access the support person's tacit knowledge of the innovation. This helps in developing the skills of the user in using the innovation, making it more effective. Though the findings showed that Presence in long tenured virtual teams, did not directly affect innovation effectiveness; Presence is important for building the resource skills (training and local support) needed for innovation effectiveness. Thus Presence (from organisational behaviour theory) affects Knowledge sharing from Resource based view theory, needed for innovation effectiveness.

3. The reinforcement of the importance of engaging users in the innovation implementation. This is all the more important because for an innovation implementation to be effective, it has to fit with the user's values. Engaging users in the requirements gathering, design and prototype ensures that the users provide feedback about the usefulness of the innovation. It also helps in the management of expectations, leading to an improved innovation that delivers benefit to the user, making the innovation effective. Requirements gathering, involvement in design and user feedback interactions between the implementation team and users requires trust. The research thus recommends that managers implementing innovations in virtual teams should use techniques to build trust between the implementation team and virtual users. Another contribution from this study is the linking of trust (from organisational behaviour theory) to requirements gathering and feedback; factors that affect innovation effectiveness (these factors are part of process based theory).

The above contributions show that for effective innovation implementations in virtual teams, managers and practitioners need to know the innovation values of the users, so

that the implemented innovations match the innovation values of the users; or the managers need to devise strategies to change these values. Managers and practitioners also need to ensure that the organisational climate is supportive of the innovation by ensuring proper resourcing for improvements suggested by user feedback, customised training that is tailored for the organisation's business processes and local support for users immediately after innovation implementation.

Sharing vision and benefits a part of Upper Echelon theory, helps build group identity. Customised training and local user support to share knowledge, a part of the Resource Based View, is dependent on face to face presence after the innovation implementation. Engaging users for requirements gathering and feedback is part of the Process theories that includes Project Management, and is dependent on trust. The relationships between various factors drawn from these different theories are summarised in the figure below.



**Figure 5-1 : Various factors and its impact on innovation effectiveness in virtual teams**

This study's contribution can be summarised as finding the specific factors from these various theories that affect innovation effectiveness in virtual teams, which may guide practitioners to implement innovations more effectively. Overall the study's contributions may be generalised to organisations with a similar history of virtual teams.

The study achieved its aim of finding the effects of presence, trust, group identity and implementation team effectiveness on innovation effectiveness in virtual teams. In the course of research some areas that need further research were identified and these areas are listed below.

## 5.6 Areas for further research

The research raised some questions that require further research. The answers to these questions might help increase innovation effectiveness.

1. This study found that people with low tenure were twice as likely to find the innovation effective, compared to long tenure employees. This area needs further research.
2. The study measured Intra team trust. The Intra team trust was high in this study and affected innovation effectiveness. Research needs to be conducted for the effects of inter team trust between the implementation team and the users on innovation effectiveness.
3. The study was conducted in an organisation which had used virtual teams for a long time and presence was found to have no significant effects either alone or in interaction with trust and group identity, on innovation effectiveness.  
  
Research needs to be conducted on an organisation that has recently started using virtual teams, to identify whether presence becomes more significant for organisations new to virtual teaming.
4. Interviews found that the user expectations were not managed. More research is needed to guide practitioners in managing user expectations for innovation effectiveness.
5. Users also reported that the implementation team failed to engage the users adequately. Research is needed to guide the practitioners on methods to engage users remotely in virtual teams.

- a. What kind of technology can help?
  - b. What processes can support virtual user engagement?
  - c. Does strong intra-group identity work against building stronger inter-group engagement?
6. More research is needed to study levels of Trust, Group Identity and its effect on innovation effectiveness in private organisations.
  7. Further research on the effect of implementation team effectiveness on innovation effectiveness in context of radical innovations that change major business processes is needed.

## 5.7 Conclusion

The study investigated the effects of Trust, Group Identity, Presence and Implementation team effectiveness on Innovation effectiveness in virtual teams. The results for the relationship between presence and innovation effectiveness were different from hypothesised expectations. The study found that group identity, and implementation team effectiveness were the main predictors in long tenured virtual teams, with high levels of intra team trust.

The study provides practical guidance to managers and practitioners that effective innovation implementations depend on group identity, innovation values fit, innovation climate, customised local training and support and the application of good project management practices.

In conclusion, at a higher level the analysis, the strategic choices, motivation, resourcing, the ease of use, right business processes and good project management

practices were necessary for innovation effectiveness in virtual teams. The study concludes that a synthesis of various concepts from the theories on virtual teams, Project Management theories, Organisational Behaviour, Resource Based View, Upper Echelon Theory and Process theory determines innovation effectiveness and suggests new avenues for research.



## 6 References

- Acar, S., Runco, M.A. (2012), *Creative Abilities: Divergent Thinking*; Handbook of organizational creativity
- Adarves-Yorno, I., Postmes, T., & Haslam, S. A. (2007). Creative innovation or crazy irrelevance? The contribution of group norms and social identity to creative behaviour. *Journal of Experimental Social Psychology*, 43(3), 410-416.
- ADVICE, P. (2000). Study design in qualitative research—2: Sampling and data collection strategies. *Education for health*, 13(2), 263-271.
- Alavi, M., & Tiwana, A. (2002). Knowledge integration in virtual teams: The potential role of KMS. *Journal of the American Society for Information Science and Technology*, 53(12), 1029-1037.
- Alegre, J., Lapiedra, R., & Chiva, R. (2006). A measurement scale for product innovation performance. *European Journal of Innovation Management*, 9(4), 333-346.
- Alencar, S.M.L.de, (2012), *Creativity in organizations: Facilitators and Inhibitors*, Handbook of Organizational Creativity and Invention HarperCollins, New York
- Anderson, N. R., & West, M. A. (1998). Measuring climate for work group innovation: development and validation of the team climate inventory. *Journal of organizational behaviour*, 19(3), 235-258
- Andres, H. P. (2002). A comparison of face-to-face and virtual software development teams. *Team Performance Management*, 8(1/2), 39-48.

Andrew, O. C., & Sofian, S. (2011). Engaging People who Drive Execution and Organizational Performance. *American Journal of Economics and Business Administration*, 3(3), 569-575.

Arias, E., Eden, H., Fischer, G., Gorman, A., & Scharff, E. (2000). Transcending the individual human mind—creating shared understanding through collaborative design. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 7(1), 84-113.

Aydogan, N. (2008). Tacit Knowledge Transfer, Geographical Proximity, and Inter-Firm Contracts: The Silicon Valley Case. In *Social Capital and Business Development in High-Technology Clusters* (pp. 15-37). Springer US.

Bailenson, J.N., Swinth, K., Hoyt, C., Persky, S., Dimov, A., Blascovich, J. (2005). The Independent and Interactive Effects of Embodied Agent Appearance and Behaviour on Self-Report, Cognitive, and Behavioral Markers of Copresence in Immersive Virtual Environments. *Presence: Teleoperators and virtual environment*, 14(4), 379-393.

Bardi, A., & Goodwin, R. (2011). The dual route to value change: Individual processes and cultural moderators. *Journal of Cross-Cultural Psychology*, 42(2), 271-287.

Barsh, J., Capozzi, M. M., & Davidson, J. (2008), Leadership and innovation. *McKinsey quarterly*, 1, 36.

Beise, C. M. (2004, April). IT project management and virtual teams. In *Proceedings of the 2004 SIGMIS conference on Computer personnel research: Careers, culture, and ethics in a networked environment* (pp. 129-133). ACM.

Bell, B. S., & Kozlowski, S. W. (2002). A typology of virtual teams implications for effective leadership. *Group & Organization Management*, 27(1), 14-49.

Biocca, F., Harms, C., & Burgoon, J. K. (2003). Toward a more robust theory and measure of social presence: Review and suggested criteria. *Presence: Teleoperators & virtual environments*, 12(5), 456-480.

Biocca, F., Harms, C., & Gregg, J. (2001, May). The networked minds measure of social presence: Pilot test of the factor structure and concurrent validity. In 4th annual International Workshop on Presence, Philadelphia, PA.

Blalock, H. M. (Ed.). (1985). *Causal models in the social sciences*. Transaction Publishers.

Blaike, N. (2010), *Design Social Research*, Cambridge: Polity Press.

Boone, H. N., & Boone, D. A. (2012). Analyzing likert data. *Journal of Extension*, 50(2), 2TOT2.

Bourne, L., & Walker, D. H. (2005). Visualising and mapping stakeholder influence. *Management Decision*, 43(5), 649-660.

Brotons-Mas, J. R., O'Mara, S., & Sanchez-Vives, M. V. (2006). Neural Processing of Spatial Information: What We Know about Place Cells and What They Can Tell Us about Presence. [Article]. *Presence: Teleoperators & Virtual Environments*, 15(5), 485-499.

Bryman, A., & Bell, E. (2011). *Business Research Methods (Third Edition)*. New York: Oxford University Press.

Burgoon, J. K., & Hale, J. L. (1987). Validation and measurement of the fundamental themes of relational communication. *Communications Monographs*, 54(1), 19-41.

Carland, J., Carland, J. W., & Stewart, W. H. (1996). Seeing what's not there: The enigma of entrepreneurship. *Journal of Small Business Strategy*, 7(1), 1-20.

Carron, A. V., Widmeyer, W. N., & Brawley, L. R. (1985). The development of an instrument to assess cohesion in sport teams: The Group Environment Questionnaire. *Journal of sport psychology*, 7(3).

Chertoff, D. B., Schatz, S. L., McDaniel, R., & Bowers, C. A. (2008). Improving Presence Theory Through Experiential Design. [Article]. *Presence: Teleoperators & Virtual Environments*, 17(4), 405-413.

Chesbrough, HW., & Teece, D.J., (2002), Organizing for Innovation: When is virtual virtuous, *Harvard Business Review*.

Chow, W. S., & Chan, L. S. (2008). Social network, social trust and shared goals in organizational knowledge sharing. *Information & Management*, 45(7), 458-465.

Christensen, C. M., & Anthony, S. D. (2004). Seeing what's next: Using the theories of innovation to predict industry change. *Harvard Business Press*.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2013). *Applied multiple regression/correlation analysis for the behavioral sciences*. Routledge.

Cooke-Davies, T. (2002). The “real” success factors on projects. *International journal of project management*, 20(3), 185-190.

Coppola, N. W., Hiltz, S. R., & Rotter, N. G. (2004). Building trust in virtual teams. *Professional Communication, IEEE Transactions on*, 47(2), 95-104.

Courvoisier, D., & Etter, J.F. (2008). Using Item Response Theory to Study the Convergent and Discriminant Validity of Three Questionnaires Measuring Cigarette Dependence. *Psychology of Addictive Behaviors*, 22(3), 391-401.

Creswell, J. (2007), *Qualitative Inquiry and Research Design: Choosing among Five Traditions*, Thousand Oaks, CA: Sage Publications.

Creswell, J.W. (2003), *Research Design: Qualitative, Quantitative, and Mixed Method Approaches*, Sage, Thousand Oaks, CA.

Crossan, M. M., & Apaydin, M. (2010). A multi-dimensional framework of organizational innovation: A systematic review of the literature. *Journal of Management Studies*, 47(6), 1154-1191.

Crowston, K. and Kammerer, E.E. (1998), "Coordination and collective mind in software Requirements development", *IBM Systems Journal*, Vol. 37 No. 2, pp. 227-45.

Csikszentmihalyi, M. (1996) *Creativity: Flow and the Psychology of Discovery*

Daft, R.L., & Lengel, R.H. (1986). Organizational Information requirements Media Richness and structural design, *Management Science*, 32(5), 554-571.

Damanpour, F. & Aravind, D. 2012. Organizational Structure and Innovation revisited: From organic to ambidextrous structure, *Handbook of Organizational Creativity*

Davenport, T. H. (2013). *Process innovation: reengineering work through information technology*. Harvard Business Press.

de Leede, J., Kraan, K. O., den Hengst, M., & van Hooff, M. L. (2008). Conditions for innovation behaviour of virtual team members: a 'high-road' for internationally dispersed virtual teams. *The Journal of E-working*, 2(1), 22-46.

De Veaux, R. D., Velleman, P. F., & Bock, D. E. (2012). *Stats: Data and Models* (3rd Edition ). Boston: Addison-Wesley.

DeRosa, D.M., Hantula, D.A., Kock, N., D'arcy, J. (2004). Trust and Leadership in Virtual Teamwork: A Media Naturalness perspective, *Human Resource Management*, 43(2), 219-232

Dong, L., Neufeld, D. J., & Higgins, C. (2008). Testing Klein and Sorra's innovation implementation model: An empirical examination. *Journal of Engineering and Technology Management*, 25(4), 237-255.

Duffy, B., Smith, K., Terhanian, G., & Bremer, J. (2005). Comparing data from online and face-to-face surveys. *International Journal of Market Research*, 47(6), 615.

Dunne, D.D., Dougherty, D. (2012). *Organizing for change, innovation and creativity*, The handbook of organizational creativity

Eisenhardt, K. (1989), "Building Theories from Case Study Research", *Academy of Management Review*, 14(4), 532-550.

Elias, S. (2013). *Origins of human innovation and creativity* (Vol. 16). Elsevier.

Ellemers, N., De Gilder, D., & Haslam, S. A. (2004). Motivating individuals and groups at work: A social identity perspective on leadership and group performance. *Academy of Management Review*, 29(3), 459-478.

Evans, J. R., & Mathur, A. (2005). The value of online surveys. *Internet Research*, 15(2), 195-219.

Ferlie, E., Fitzgerald, L., Wood, M., & Hawkins, C. (2005). The nonspread of innovations: the mediating role of professionals. *Academy of management journal*, 48(1), 117-134.

Flach, J. M., & Holden, J. G. (1998). The Reality of Experience: Gibson's Way. [Article]. *Presence: Teleoperators & Virtual Environments*, 7(1), 90-95.

Forrester, R., & Drexler, A. B. (1999). A model for team-based organization performance. *The academy of management executive*, 13(3), 36-49.

Frambach, R. T., & Schillewaert, N. (2002). Organizational innovation adoption: A multi-level framework of determinants and opportunities for future research. *Journal of Business Research*, 55(2), 163-176.

Friedrich, T. L., Mumford, M. D., Vessey, B., Beeler, C. K., & Eubanks, D. L. (2010). Leading for innovation. *International Studies of Management and Organization*, 40(2), 6-29.

Fuller, J., Bartl, M., Ernst, H.M., (2006), Community Based Innovation, *Electronic Commerce Research*

Gajendran, R. S., & Joshi, A. (2011). INCLUSION AND IDENTIFICATION IN VIRTUAL WORKGROUPS: (WHEN) DOES LEADER-MEMBER VIRTUAL COMMUNICATION MATTER?. Academy of Management Annual Meeting Proceedings, 1-6.

George, A. L., & Bennett, A. (2005). Case studies and theory development in the social sciences. Mit Press.

Gibson, C.B., Gibbs, J.L. (2006), Unpacking the concept of virtuality: The effects of geographic dispersion, electronic dependence, dynamic structure and national diversity on team innovation, Administrative Science quarterly.

Greenberg, P. S., Greenberg, R. H., & Antonucci, Y. L. (2007). Creating and sustaining trust in virtual teams. Business Horizons, 50(4), 325-333.

Guyenn, J. (2013, Feb 27). Mayer feels heat over telecommuting ban, Sydney Morning Herald retrieved online on 10th April 2013 from <http://www.smh.com.au/it-pro/business-it/mayer-feels-heat-over-telecommuting-ban-20130227-2f4rj.html#ixzz2M3FRAsTw>

Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. Academy of management review, 9(2), 193-206.

Hamel, G., & Prahalad, C. K. (1994). Competing for the future: Breakthrough strategies for seizing control of your industry and creating the markets of tomorrow. Harvard business school press.

Hammersley, M. (1987). Some notes on the terms 'validity' and 'reliability'. British Educational Research Journal, 13(1), 73-81.



Harrison, C., & Hudson, S. E. (2008). Pseudo-3D Video Conferencing with a Generic Webcam. Paper presented at the Multimedia ISM Tenth IEEE International Symposium.

Hartman, F., & Ashrafi, R. (2002). Project management in the information systems and information technologies. *Project Management Journal*, 33(3), 5-15.

Harvey, M. A., & Sanchez-Vives, M. V. (2005). The Binding Problem in Presence Research. [Article]. *Presence: Teleoperators & Virtual Environments*, 14(5), 616-621.

Haslam, S. A., Powell, C., & Turner, J. C. (2000). Social Identity, Self-categorization, and Work Motivation: Rethinking the Contribution of the Group to Positive and Sustainable Organisational Outcomes. [Article]. *Applied Psychology: An International Review*, 49(3), 319.

Haslam, S. A., Ryan, M. K., Postmes, T., Spears, R., Jetten, J., & Webley, P. (2006). Sticking to our guns: Social identity as a basis for the maintenance of commitment to faltering organizational projects. *Journal of Organizational Behavior*, 27(5), 607-628.

Heere, B., & James, J.D., Yoshida, M., & Scremin, G. (2011). The effect of associated group identities on team identity. *Journal of Sport Management*, 25(6), 606-621.

Henderson, C., & Dancy, M. H. (2008). Physics faculty and educational researchers: Divergent expectations as barriers to the diffusion of innovations. *American Journal of Physics*, 76(1), 79-91.

Henderson, J. C., & Lee, S. (1992). Managing I/S design teams: a control theories perspective. *Management Science*, 38(6), 757-777.

Henderson, J. C., & Lee, S. (1992). Managing I/S design teams: a control theories perspective. *Management Science*, 38(6), 757-777.

Hogg, M. A., & Terry, D. I. (2000). Social identity and self-categorization processes in organizational contexts. *Academy of Management Review*, 25(1), 121-140.

Hove, S. E., & Anda, B. (2005, September). Experiences from conducting semi-structured interviews in empirical software engineering research. In *Software Metrics, 2005. 11th IEEE International Symposium* (pp. 10-pp). IEEE.

Hurley, R. F., & Hult, G. T. M. (1998). Innovation, market orientation, and organizational learning: an integration and empirical examination. *The Journal of Marketing*, 42-54.

Hülsheger, U. R., Anderson, N., & Salgado, J. F. (2009). Team-level predictors of innovation at work: a comprehensive meta-analysis spanning three decades of research. *Journal of Applied psychology*, 94(5), 1128.

Igartua, J. I., Garrigós, J. A., & Hervas-Oliver, J. L. (2010). How innovation management techniques support an open innovation strategy. *Research-Technology Management*, 53(3), 41-52.

Jarvenpaa, S. L., Knoll, K., & Leidner, D. E. (1998). Is Anybody out There? Antecedents of Trust in Global Virtual Teams. *Journal of Management Information Systems*

Jarvenpaa, S. L., & Leidner, D. E. (1999). Communication and trust in global virtual teams. *Organization Science*, 3, 791-815.

Jayanthi, S., & Sinha, K. K. (1998). Innovation implementation in high technology manufacturing: A chaos-theoretic empirical analysis. *Journal of Operations Management*, 16(4), 471-494.

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of mixed methods research*, 1(2), 112-133.

Johnson-George, C., & Swap, W. C. (1982). Measurement of specific interpersonal trust: Construction and validation of a scale to assess trust in a specific other. *Journal of Personality and Social Psychology*, 43(6), 1306.

Jonassen, D., Davidson, M., Collins, M., Campbell, J., & Haag, B. B. (1995). Constructivism and computer-mediated communication in distance education. *American journal of distance education*, 9(2), 7-26.

Jones, G. R., & George, J. M. (1998). The experience and evolution of trust: Implications for cooperation and teamwork. . *Academy of Management. The Academy of Management Review*, 23(3), 15.

Kantner, C. (2006). Collective Identity as Shared Ethical Self-Understanding The Case of the Emerging European Identity. *European Journal of Social Theory*, 9(4), 501-523.

Kärreman, D., & Alvesson, M. (2004). Cages in tandem: Management control, social identity, and identification in a knowledge-intensive firm. *Organization*, 11(1), 149-175.

Kauff, P., & Schreer, O. (2002). An immersive 3D video-conferencing system using shared virtual team user environments. Paper presented at the Proceedings of the 4th international conference on Collaborative virtual environments, Bonn, Germany.

Klaus, T., & Blanton, J. E. (2010). User resistance determinants and the psychological contract in enterprise system implementations. *European Journal of Information Systems*, 19(6), 625-636.

Klein, K. J., & Knight, A. P. (2005). Innovation implementation overcoming the challenge. *Current directions in psychological science*, 14(5), 243-246.

Klein, K. J., & Sorra, J. S. (1996). The challenge of innovation implementation. *Academy of Management Review*, 21(4), 1055-1080.

Kock.N. (2005). Media Richness or Media Naturalness? The Evolution of our Biological Communication Apparatus and its influence on our behaviour toward e-communication tools. *IEEE Transactions on Professional Communication*, 48(2), 117-130.

Koskela, L. J., & Howell, G. (2002). The underlying theory of project management is obsolete. In *Proceedings of the PMI Research Conference* (pp. 293-302). PMI.

Kotlarsky, J., & Oshri, I. (2005). Social ties, knowledge sharing and successful collaboration in globally distributed system development projects. *European Journal of Information Systems*, 14(1), 37-48.

Kramer, R. M. (1999). Trust and distrust in organizations: Emerging perspectives, enduring questions. *Annual review of psychology*, 50(1), 569-598.

Kraut, R.E.,Gergle, D., & Fussell, S.R. (2002). The Use of Visual Information in Shared Visual Spaces: Informing the Development of Virtual Co-Presence. *Human-Computer*

Interaction Institute, Paper 60 Retrieved on 30 Nov 2012 from

<http://repository.cmu.edu/hcii/60>

Lander, M. C., Purvis, R. L., McCray, G. E., & Leigh, W. (2004). Trust-building mechanisms utilized in outsourced IS development projects: a case study. *Information & Management*, 41(4), 509-528.

Lee, K. M. (2004). Presence, Explicated. *Communication Theory*, 14(1), 27-50.

Lee, K. M., Yates, D., Clark, J., & El Sawy, O. (2010). Value Creation of Mobile Services Through Presence: Designing Mobile Information and Entertainment Applications with Presence in Mind. [Article]. *Presence: Teleoperators & Virtual Environments*, 19(3), 265-279.

Levin, D. Z., & Cross, R. (2004). The Strength of Weak Ties You Can Trust: The Mediating Role of Trust in Effective Knowledge Transfer. [Article]. *Management Science*, 50(11), 1477-1490.

Lin, H. F. (2007). Knowledge sharing and firm innovation capability: an empirical study. *International Journal of Manpower*, 28(3/4), 315-332.

Linton, J. D., & Walsh, S. T. (2008). A theory of innovation for process-based innovations such as nanotechnology. *Technological Forecasting and Social Change*, 75(5), 583-594.

Lipnack, J., & Stamps, J. (2008). *Virtual teams: People working across boundaries with technology*. Wiley.

Lou, Z., Bouwen, J., Willaert, K., Van Broeck, S., Van den Broeck, M., Zubic, S., . . .

Dams, D. (2012). PresenceScape: Virtual World Mediated Rich Communication.

[Article]. Bell Labs Technical Journal, 16(4), 219-242. doi: 10.1002/bltj.20543

Louise Barriball, K., & While, A. (1994). Collecting Data using a semi-structured

interview: a discussion paper. Journal of advanced nursing, 19(2), 328-335.

Lumpkin, G. T., & Lichtenstein, B. B. (2005). The Role of Organizational Learning in the Opportunity-Recognition Process. Entrepreneurship Theory and Practice, 29(4), 451-472.

Majchrzak, A., Rice, R., Malhotra, A., King, N., & Ba, S. (2000). Technology adaptation: The case of a computer-supported inter-organizational virtual team. MIS Quarterly, 24, 569-600

Marshall, M. N. (1996). Sampling for qualitative research. Family practice, 13(6), 522-526.

Martins, L. L., Gilson, L. L., & Maynard, M. T. (2004). Virtual teams: What do we know and where do we go from here?. Journal of management, 30(6), 805-835.

Maxwell, J. A. (1992). Understanding and validity in qualitative research. Harvard Educational Review, 62(3), 279-300.

May, T. (2001), Social Research Issues, methods and process, Open University Press, Buckingham Third edition.

McAdam, R., Moffett, S., Hazlett, S. A., & Shevlin, M. (2010). Developing a model of innovation implementation for UK SMEs: A path analysis and explanatory case analysis. *International Small Business Journal*, 28(3), 195-214.

McClain, P. D., Johnson Carew, J. D., Walton Jr, E., & Watts, C. S. (2009). Group membership, group identity, and group consciousness: Measures of racial identity in American politics?. *Annual Review of Political Science*, 12, 471-485.

McClain, P. D., Johnson Carew, J. D., Walton Jr, E., & Watts, C. S. (2009). Group membership, group identity, and group consciousness: Measures of racial identity in American politics?. *Annual Review of Political Science*, 12, 471-485.

Metcalf, R. (n.d.). World needs more innovation retrieved online on 26<sup>th</sup> Jan 2015 from [http://www.brainyquote.com/quotes/authors/r/robert\\_metcalf.html](http://www.brainyquote.com/quotes/authors/r/robert_metcalf.html)

Millson-Martula, C., & Menon, V. (1995). Customer expectations: concepts and reality for academic library services. *College & research libraries*, 56(1), 33-47.

Ming-Huei, C., & Ming-Chao, W. (2008). Social networks and a new venture's innovative capability: the role of trust within entrepreneurial teams. [Article]. *R&D Management*, 38(3), 253-264.

Montoya, M. M., Massey, A. P., & Lockwood, N. S. (2011). 3D Collaborative Virtual Environments: Exploring the Link between Collaborative Behaviors and Team Performance. *Decision Sciences*, 42(2), 451-476.

Montoya-Weiss, M. M., Massey, A. P., & Song, M. (2001). Getting it together: Temporal coordination and conflict management in global virtual teams. *Academy of management Journal*, 44(6), 1251-1262.

Moorman, C., & Miner, A. S. (1997). The impact of organizational memory on new product performance and creativity. *Journal of marketing research*, 91-106

Mumford, M.D, Hester, K.S., & Robledo, I.C., (2012), Creativity in Organizations: Importance and Approaches, *Handbook of organizational creativity*

Nemiro, J. E. (2002). The Creative Process in Virtual Teams. *Creativity Research Journal*, 14(1), 69-83.

Newell, S., David, G., & Chand, D. (2007). An analysis of trust among globally distributed work teams in an organizational setting. *Knowledge and Process Management*, 14(3), 158-168.

Nonaka, I. (1990). Redundant, Overlapping Organization: A Japanese Approach to Managing the Innovation Process. *California Management Review*, 32(3).

Noor, K. B. M. (2008). Case Study: A Strategic Research Methodology. *American Journal of Applied Sciences*, 5(11).

Nunez, D. (2003). A connectionist explanation of presence in virtual environments. University of Cape Town.



O'Brien, H. L., & Toms, E. G. (2008). What is user engagement? A conceptual framework for defining user engagement with technology. *Journal of the American Society for Information Science and Technology*, 59(6), 938-955.

Oldham, G.R., & Baer, M. (2012). Creativity and the work context, *Handbook of organizational creativity*

Paletz, S.B.F. (2012). Project Management of Innovative Teams, *Handbook of organizational creativity*.

Parkhe, A. (1993). Messy research, methodological predispositions, and theory development in international joint ventures, *Academy of Management Review*, 18(2), 227-268.

Pedhazur, E. J. (1997). Multiple regression in behavioral research: Explanation and prediction.

Piccoli, G., Powell, A., & Ives, B. (2004). Virtual teams: team control structure, work processes, and team effectiveness. *Information Technology & People*, 17(4), 359-379.

Pinjani, P., & Palvia, P. (2013). Trust and knowledge sharing in diverse global virtual teams. *Information & Management*, 50(4), 144-153.

Plutchik, R. (2001). The nature of emotions: Human emotions have deep evolutionary roots, a fact that may explain their complexity and provide tools for clinical practice, *American Scientist*

Porter, M. E. (2008). *Competitive strategy: Techniques for analyzing industries and competitors*. Simon and Schuster.

Rallet, A., & Torre, A. (1999). Is geographical proximity necessary in the innovation networks in the era of global economy?. *GeoJournal*, 49(4), 373-380.

Reiter-Palmon, R., Wigert, B., & de Vreede, T. (2012), *Team Creativity and Innovation: The Effect of Group Composition, Social Processes, and Cognition*, *Handbook of organizational creativity*.

Relja, R., & Bandalović, G. (2008). The dimension of trust in a virtual working environment. *Management*, 2, 65-80.

Rhoads, M. (2010). Face-to-Face and Computer-Mediated Communication: What Does Theory Tell Us and What Have We Learned so Far?. *Journal of Planning Literature*, 25(2), 111-122

Riva, G. (2009). Is presence a technology issue? Some insights from cognitive sciences. [Article]. *Virtual Reality*, 13(3), 159-169.

Rogers, P., & Lea, M. (2005). Social presence in distributed group environments: The role of social identity. *Behaviour & Information Technology*, 24(2), 151-158.

Rosen, M. A., Fiore, S. M., Salas, E., Letsky, M., & Warner, N. (2008). *Tightly coupling cognition: understanding how communication and awareness drive coordination in teams*. UNIVERSITY OF CENTRAL FLORIDA ORLANDO.

Rusman, E., van Bruggen, J., Sloep, P., & Koper, R. (2010). Fostering trust in virtual project teams: Towards a design framework grounded in a Trustworthiness antecedents (TWAN) schema. *International Journal of Human-Computer Studies*, 68(11), 834-850.

Saonee, S., Manju, A., Suprateek, S., & Kirkeby, S. (2011). The Role of Communication and Trust in Global Virtual Teams: A Social Network Perspective. [Article]. *Journal of Management Information Systems*, 28(1), 273-309.

Sarmiento, J. W., & Stahl, G. (2007). Group creativity in virtual math teams: Interactional mechanisms for referencing, remembering and bridging. Paper presented at the Proceedings of the 6th ACM SIGCHI conference on Creativity & cognition.

Schmidt, C. (2004). The analysis of semi-structured interviews. A companion to qualitative research, 253-258.

Schiller, S. Z., & Mandviwalla, M. (2007). Virtual team research an analysis of theory use and a framework for theory appropriation. *Small group research*, 38(1), 12-59.

Scott, C. R. (2007). Communication and Social Identity Theory: Existing and Potential Connections in Organizational Identification Research. *Communication Studies*, 58(2), 123-138.

Shalley, C. E., Zhou, J., & Oldham, G. R. (2004). The effects of personal and contextual characteristics on creativity: Where should we go from here? *Journal of Management*, 30(6), 933-958.

Shneiderman, B. (2007). Creativity support tools: accelerating discovery and innovation. *Communications of the ACM*, 50(12), 20-32

Simon, H. A. (1954). Spurious Correlation: A Causal Interpretation\*. *Journal of the American Statistical Association*, 49(267), 467-479.

Simonton, D.K. (2012). Fields, Domains and Individuals, *Handbook of organizational creativity*

Singer, T., & Lamm, C. (2009). The social neuroscience of empathy. *Annals of the New York Academy of Sciences*, 1156(1), 81-96.

Slater, M., & Wilbur, S. (1997). A framework for immersive virtual environments (FIVE): Speculations on the role of presence in virtual environments. *Presence: Teleoperators and virtual environments*, 6(6), 603-616.

Soh, C., & Markus, M. L. (1995, December). How IT creates business value: a process theory synthesis. In *ICIS* (pp. 29-41).

Stahl, G. (2005). Group cognition in computer-assisted collaborative learning. *Journal of Computer Assisted Learning*, 21(2), 79-90.

Storper, M., Venables, A.J. (2004). Buzz:Face to Face contact and the Urban economy, *Journal of economic geography*. 4(4), 351-370.

Study shows virtual workforce as an advantage retrieved online on 11th May 2014 from <http://www.brandman.edu/news/study-shows-virtual-work-force-advantage>.

Sundstrom, E., De Meuse, K. P., & Futrell, D. (1990). Work Teams: Applications and Effectiveness. *American Psychologist*, 45(2), 120-133.

Suppes, P. (1970), *A probabilistic theory of causality*, North Holland Pub Co.

Sztompka, P. (1999). *Trust: A sociological theory*. Cambridge University Press.

Tanewski, G. A., Prajogo, D., & Sohal, A. (2003, June). Strategic orientation and innovation performance between family and non-family firms. In *World Conference of the International Council of Small Business*. Monash University.

Tashakkori, A. and Teddlie, C. (1998), *Mixed Methodology: Combining Qualitative and Quantitative Approaches*, Sage, Thousand Oaks, CA.

Tavčar, J., Žavbi, R., Verlinden, J., & Duhovnik, J. (2005). Skills for effective communication and work in global product development teams. *Journal of Engineering Design*, 16(6), 557-576.

Teddlie, C., & Yu, F. (2007). Mixed methods sampling a typology with examples. *Journal of mixed methods research*, 1(1), 77-100.

Tyler, T. R., & Blader, S. L. (2003). The group engagement model: Procedural justice, social identity, and cooperative behaviour. *Personality and social psychology review*, 7(4), 349-361.

Uma D. Jogulu, Jalon Pansiri, (2011). Mixed methods: a research design for management doctoral dissertations, *Management Research Review*, 34(6), 687 -701

Van Knippenberg, D. (2000). Work Motivation and Performance: A Social Identity Perspective. [Article]. *Applied Psychology: An International Review*, 49(3), 357.

Wang, E. T., Ying, T. C., Jiang, J. J., & Klein, G. (2006). Group cohesion in organizational innovation: An empirical examination of ERP implementation. *Information and Software Technology*, 48(4), 235-244.

Warkentin, M. E., & Beranek, P. M. (1999). Training to improve virtual team communication. *Information Systems Journal*, 9(4), 271-289.

Warkentin, M. E., Sayeed, L., & Hightower, R. (1997). Virtual Teams versus Face-to-Face Teams: An Exploratory Study of a Web-based Conference System. *Decision Sciences*, 28(4), 975-996.

Webster, J., & Wong, W. K. P. (2008). Comparing traditional and virtual group forms: identity, communication and trust in naturally occurring project teams. *International Journal of Human Resource Management*, 19(1), 41-62.

Welch, M., & Jackson, P. R. (2007). Rethinking internal communication: a stakeholder approach. *Corporate Communications: An International Journal*, 12(2), 177-198.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic management journal*, 5(2), 171-180.

West, M. A., Sacramento, C. A., & Fay, D. (2006). Creativity and innovation implementation in work groups: The paradoxical role of demands. *Creativity and innovation in organizational teams*, 137-159.

- Whittington, R. (2006). Completing the practice turn in strategy research. *Organization studies*, 27(5), 613-634.
- Winter, G. (2000). A comparative discussion of the notion of validity in qualitative and quantitative research. *The qualitative report*, 4(3), 4.
- Witmer, B. G., & Singer, M. J. (1998). Measuring presence in virtual environments: A presence questionnaire. *Presence*, 7(3), 225-240.
- Woodman, R. W., Sawyer, J. E., & Griffin, R. W. (1993). Toward a theory of organizational creativity. *Academy of Management Review*, 18, 293-321.
- Young, R. R. (2002). Recommended requirements gathering practices. *CrossTalk*, 15(4), 9-12.
- Yin, R.K. (2009), *Case Study Research: Design and Methods*, Thousand Oaks, CA: Sage Publications.
- Zakaria, N., Amelinckx, A., & Wilemon, D. (2004). Working Together Apart? Building a Knowledge-Sharing Culture for Global Virtual Teams. *Creativity and innovation management*, 13(1), 15-29.
- Zornoza, A., Orengo, V., & Pennerroja, V. (2009). Relational capital in Virtual teams: The role played by trust, *Social Science Information*, 48(2), 257-281.

## 7 Appendix A: Survey questionnaire

Survey link: <https://www.surveymonkey.com/s/virtualinnov8>

### 7.1 Survey questions

#### 7.1.1 Demographic Information

What is your role in context of the innovation process? (Circle one as primary role and tick as many other secondary roles)	Ideas Generator	Ideas Evaluator	Developer	Implementer	User
--------------------------------------------------------------------------------------------------------------------------------	-----------------	-----------------	-----------	-------------	------

How long have you been with this team?

01	Less than 3 months
02	3 months to less than 6 months
03	6 months to less than 1 year
04	1 year to less than 3 years
05	More than 3 years



### 7.1.2 Trust questions

Participative safety questions from Anderson's TCI was taken and slightly modified as it measures trust.

		Strongly Agree	Agree	Neither agree nor	Disagree	Strongly Disagree
01	We share information generally in the team rather than keeping it to ourselves	05	04	03	02	01
02	People feel understood and accepted by others	05	04	03	02	01
03	Everyone's view is listened to even if it is in minority	05	04	03	02	01
04	Disagreeing with other's idea is not a rejection of that person	05	04	03	02	01
05	Team members are friendly and easy to approach	05	04	03	02	01
06	I find putting new ideas to team threatening	01	02	03	04	05
07	Other members of your team are supportive	05	04	03	02	01
08	There is feeling of high trust between members of your team	05	04	03	02	01
09	Other members foster an atmosphere of non-threatening cooperation between your team.	05	04	03	02	01

### 7.1.3 Group Identity questions

		Strongly Agree	Agree	Neither agree	Disagree	Strongly Disagree
01	I fit in well with my workgroup.	05	04	03	02	01
02	I like the members of my workgroup	05	04	03	02	01
03	I feel good about the team I belong to ( Heere 2005)	05	04	03	02	01
04	Being part of the team is important to me ( Heere 2005)	05	04	03	02	01
05	When I speak about the team, I use we rather than they ( Heere 2005)	05	04	03	02	01
06	What happens to the team will have an impact on my life (Heere 2005)	05	04	03	02	01
07	I interact with other members on a daily basis (Heere 2005)	05	04	03	02	01

#### 7.1.4 Presence measures using computer mediated communication

		Strongly Agree	Agree	Neither agree nor	Disagree	Strongly Disagree
01	Even when the other was present, I felt alone in the virtual room (Bailenson, Swinth, Persky, Dimov and Blascovich, 2005)	01	02	03	04	05
02	Spending time with the other was not enjoyable (Bailenson, Swinth, Persky, Dimov and Blascovich, 2005)	01	02	03	04	05
03	All your senses were completely engaged (Witmer and Singer, 1994)	05	04	03	02	01
04	The visual aspects of the environment involved me completely (Witmer and Singer, 1994)	05	04	03	02	01
05	The auditory aspects of the environment involved me completely Witmer and Singer, 1994)	05	04	03	02	01
06	My experiences in the virtual environment seem consistent with my real world experiences (Witmer and Singer, 1994)	05	04	03	02	01
07	The quality of visuals interfered or distract from performing assigned or required activities (Witmer and Singer, 1994)	01	02	03	04	05
08	My opinions were clear to other (Biocca, 2003)	05	04	03	02	01
09	Others opinions were clear to me (Biocca, 2003)	05	04	03	02	01
10	I worked with other to complete the task	05	04	03	02	01
11	The other could not act without me	05	04	03	02	01

### 7.1.5 Implementation Team effectiveness questions

		Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly Disagree
03	The team adhered to its schedules	05	04	03	02	01
04	The team adhered to its budgets	05	04	03	02	01
05	The team produced quality work	05	04	03	02	01
06	The team had effective interactions with outside members	05	04	03	02	01
07	The team was able to meet the goals of its project	05	04	03	02	01
08	The team met the goal as quickly as possible	05	04	03	02	01
09	Members contributed fair share	05	04	03	02	01
10	Enjoyed working on virtual team project	05	04	03	02	01
11	Clear sense of direction in the project	05	04	03	02	01
12	Member interactions were well organized	05	04	03	02	01
13	Satisfied with procedures to communicate	05	04	03	02	01
14	Information timely, accurate and useful for effective coordination	05	04	03	02	01

### 7.1.6 Innovation effectiveness questions

#### Product innovation efficacy and extension

01	The Product efficacy is high compared to the old product being phased out	05	04	03	02	01
02	The new product extended the use through improved technology	05	04	03	02	01

## 7.2 Semi-structured interviews

Interviews will be 30 minutes to an hour in duration and will be conducted e

All interviews will be audio recorded. All interviews will be transcribed and analysed.

### 7.2.1 Summary Interview Protocol

Semi-structured focussed interviews with selected personnel using open questions to validate findings

Personnel's role in the innovation process will be noted

Topics include

- Effects of Presence on innovation success

- Effects of Trust on innovation success

- Effects of Group Identity on innovation success

## **8 Appendix B HREC Approval letters**

1. Consent form individual interview
2. Organisation participation statement
3. Participant Interview information statement
4. Participant survey information statement

## Consent Form - Interview

*For further information:*

Dr. Laurie Lock Lee

Co Investigator Harbindar Sangha

Faculty of Business and Law

3<sup>rd</sup> Floor University House

University of Newcastle

+61 407001628

llocklee@gmail.com

[Harbindar.Sangha@newcastle.edu.au](mailto:Harbindar.Sangha@newcastle.edu.au)

[hari.sangha@abs.gov.au](mailto:hari.sangha@abs.gov.au)

## Consent Form for the Research Project:

### Creativity and Innovation in Virtual teams

I agree to participate in the above research project and give my consent freely.

I understand that the project will be conducted as described in the Participant Information Statement, a copy of which I have retained.

I understand that I can withdraw from withdraw from the project until such time as the interview has been transcribed and do not have to give any reason for withdrawing.

During the interview I can ask for the tape to be stopped and edited or erased. I may also review the transcript of the interview and edit my contribution. If I decide to withdraw, all data related to me will be withdrawn and destroyed.

I consent to:

1. Participate in an interview of no more than 30 minutes
2. The interview being recorded onto a digital recorder.

I understand that my personal information will remain confidential.

I have had the opportunity to have questions answered to my satisfaction.

Please tick if you would like a copy of the summary of findings

☐

Once you have signed the letter, please scan and email it to the co-investigator at the ABS email address above.

Print name:

---

Signature:

---

Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

Dr. Laurie Lock Lee

Harbindar S. Sangha

Newcastle Business School

Newcastle Business School

Harbindar Sangha

Student Number: C3153562



Faculty of Business and Law

Faculty of Business and Law

University of Newcastle  
Newcastle

University of

+61 407001628

+ 61 467 715 855

Laurie. [locklee@newcastle.edu.au](mailto:locklee@newcastle.edu.au)  
[Harbindar.Sangha@uon.edu.au](mailto:Harbindar.Sangha@uon.edu.au)

### **Organisation Information Statement for the Research Project:**

#### **Creativity and Innovation in Virtual Teams: Australian Bureau of Statistics (Technology Services Division)**

**13<sup>th</sup> Sept 2013 version 3**

Australian Bureau of Statistics (Technology Services Division) is invited to participate in the above mentioned research project that is being conducted by Dr. Laurie Lock Lee and Mr. Harbindar S. Sangha from the Newcastle Business School at the University of Newcastle, Australia. The research is being carried out as a requirement of Mr Harbindar Sangha's Doctor of Business Administration Degree. Dr. Laurie Lock Lee is Mr. Harbindar Sangha's research supervisor.

#### ***Why is the research being done?***

This research investigates the conditions for innovation success in virtual teams at Australian Bureau of Statistics, Technology Services Division (ABS (TSD)). The project is in response to a deficit of research on the conditions required for innovation success in virtual teams

#### ***What is being asked of the ABS (TSD)?***

We request the consent of the ABS (TSD) to:

1. Survey its full-time employees;
2. Permit the Technology Engagement and Design Branch (TEDB) to email all full-time employees inviting them to participate in the research by completing an anonymous online Survey about their opinions of innovation success related to Harbindar Sangha

Student Number: C3153562

trust, group identity and presence. This will entail the TEDB sending out the Participant Information Statement and survey link via its group email to all employees;

3. Permit the Technology Engagement and Design Branch (TEDB) to email a select few employees to participate in follow up interviews.
4. Permit the researchers to identify the ABS (TSD) in Mr. Harbindar Sangha's dissertation and in related scholarly publications.

The consent of the ABS (TSD) would be subject to full approval of the research project by the University of Newcastle Human Ethics Committee.

***What choice do you have?***

Participation in this research by the ABS (TSD) is entirely voluntary. The decision to participate or not will not affect its relationship with the University of Newcastle in anyway.

***What are the risks and benefits of participating?***

Participation in this study entails neither risk nor direct benefit to the ABS. However, the research findings may assist the ABS in future innovation projects using virtual teams.

***How will privacy be protected?***

ABS will not be identified in the research, employee responses will be anonymous and the data reported in aggregate. The anonymity of employee responses is guaranteed they are not required to provide any identifying information. An electronic copy of the aggregated data will be securely stored on password protected computers accessible only to the researchers except as required by law. The data will be kept for a minimum of five years from the date of approval of the Mr. Harbindar Sangha's dissertation and then destroyed.

***How will the information collected be used?***

The findings of this study will form part of Mr. Harbindar Sangha's Doctor of Business Administration dissertation and may be published in scholarly and professional

journals. ABS will not be identified in the dissertation. ABS will be provided with a summary of results as a pdf document.

***What do you need to do to participate?***

Once this Information Statement has been read and understood, should the ABS wish to provide its consent to the research project as stated above, you are requested to sign the attached form on behalf of the ABS (TSD) so providing informed written consent from ABS (TSD). The Participant Information Statement for employees and copy of the survey are also attached for information.

***Further information***

If you would like more information about this study, please contact Mr. Harbindar Sangha or Dr. Laurence Lock Lee at the above emails or phone numbers. Thank you for considering this invitation.

Yours sincerely,

Dr. Laurie Lock Lee  
Chief Investigator

Mr. Harbindar S. Sangha  
Student Researcher

26<sup>th</sup> August 2013

***Complaints about this research:***

This project has been approved by the University's Human Research Ethics Committee, Approval No. **H-2013-0239** Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email [Human-Ethics@newcastle.edu.au](mailto:Human-Ethics@newcastle.edu.au).

Dr. Laurie Lock Lee

Newcastle Business School  
(Sydney)

Faculty of Business and Law

University of Newcastle

0407 001 628

[Laurie.Locklee@newcastle.edu.au](mailto:Laurie.Locklee@newcastle.edu.au)

Mr Harbindar Sangha

Newcastle Business School

Faculty of Business and Law

University of Newcastle

0467715855

[Harbindar.Sangha@uon.edu.au](mailto:Harbindar.Sangha@uon.edu.au)

### **Participant Information Statement for the Research Project:**

#### **Creativity and Innovation in Virtual teams**

**13<sup>th</sup> Sept 2013 version 3**

You are invited to participate in the above mentioned research project that is being conducted by Dr. Laurie Lock Lee and Mr Harbindar Sangha from the Newcastle Business School at the University of Newcastle. The research is being carried out as a requirement of Mr Harbindar Sangha's Doctor of Business Administration Degree. Dr. Laurie Lock Lee is Mr Harbindar Sangha's research supervisor.

#### **Why is the research being done?**

As communication technology advances and reliance on it increases, Organizations are increasingly using virtual teams to take advantage of expertise not available locally, as well as to reduce costs. There are conflicting views on effectiveness of innovation in Virtual teams with some organizations using virtual teams for innovation and others opposed to it. Virtual teams differ from face to face teams in terms of presence, which impacts trust and group identity needed for team effectiveness in context of innovation. The study aims to research the effect of technology in creating presence and the relationship of presence, trust and group identity on each other and team effectiveness. The aim of this research is to find the impact of technology on presence, trust, group identity and virtual team effectiveness.

Harbindar Sangha

Student Number: C3153562

### **Who can participate in the research?**

You are eligible to participate in this research project if you are a manager of a virtual team within Technology Services Division of ABS.

### **What choice do you have?**

Participation in this research is entirely your choice. Whether or not you decide to participate, your decision will not disadvantage you in any way and will affect your relationship with the Technology Services Division at the Australian Bureau of Statistics. Only those people who give their informed consent will be included in the project. If you decide to participate, you may withdraw from the project until such time as the data from the interviews has been transcribed.

### **What you are being asked to do?**

If you agree to participate in the project, you will be interviewed by one of the researchers. During the interview you will be asked a series of questions about the effectiveness of the virtual teams that you manage. The interview will be recorded on audio tape and during the interview you can ask for the tape to be stopped and edited or erased. The recordings will be transcribed by a transcriptionist who will have signed a confidentiality agreement prior to transcribing. The transcriptions will be then edited to delete or change any identifying information before being sent to you for review and edit if required.

### **How much time will it take?**

The interview will take no longer than thirty minutes to complete.

### **What are the risks and benefits of participating?**

There is minimal, if any, risk to you if you participate in this research. You will not be identifiable in the published output from the research. While we cannot promise any direct benefit to you or your firm, the research aims to better understanding of using virtual teams in innovation process.

### **How will your privacy be protected?**

All information received from you will be strictly confidential. The data will be transcribed by the student researcher who is bound by the confidentiality agreement of the university. The transcripts will be de-identified first by the researcher and then checked by you to ensure there is no identifying information. Code numbers will be used in place of names throughout the research process. The consent forms and transcripts will be kept on the password-protected computers of the researchers. The

recordings will be destroyed once you have verified the transcripts. Only the researchers and their research assistant will have access to the data except as required by law. The de-identified data will be kept in locked storage at the Newcastle Business School for a minimum of five years after the conclusion of the research.

#### **How will the information collected be used?**

The results from this research will be used to inform the use of virtual teams in innovation process and will form part of Mr Harbindar Sangha's Doctor of Business Administration dissertation and may be published in scholarly and professional journals. Although no individual person or firm is identified, some anonymous quotations may be used in reports and scholarly articles. You will be sent a summary of the results in the form of a pdf document, once the project is completed, which is expected to be in April 2014.

#### **What do you need to do to participate?**

Please read and retain this Participant Information Statement and be sure you understand its contents before you consent to participate. If there is anything you do not understand, or you have questions, please contact the researchers at the contact emails and phone numbers given above. Once you have read and understood the statement, if you wish to proceed, please send a return email indicating your willingness to participate in an interview. Once this is received, we will reply to arrange a date, time and location convenient to you for an interview. We have attached a copy of the consent form for your information. You will be invited to sign the consent form immediately prior to the interview taking place.

#### ***Further information***

If you would like further information please contact Dr. Laurie Lock Lee or Harbindar Sangha. Our contact details are listed on the letterhead. Thank you for considering this invitation.

Dr. Laurie Lock Lee  
Chief Investigator

Mr Harbindar Sangha  
Co-Investigator

29<sup>th</sup> April, 2013

#### ***Complaints about this research:***

Harbindar Sangha

Student Number: C3153562

This project has been approved by the University's Human Research Ethics Committee, Approval No. **H-2013-0239**. Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email [Human-Ethics@newcastle.edu.au](mailto:Human-Ethics@newcastle.edu.au).

Dr. Laurie Lock Lee

Newcastle Business School

Faculty of Business and Law

University of Newcastle

0407 001 628

[llocklee@gmail.com](mailto:llocklee@gmail.com)

Mr Harbindar Sangha

Newcastle Business School

Faculty of Business and Law

University of Newcastle

Harbindar.Sangha@uon.edu.au

### **Participant Information Statement for the Research Project:**

#### **Creativity and Innovation in Virtual teams**

Date 13/09/2013

You are invited to participate in the above mentioned research project that is being conducted by Dr. Laurie Lock Lee and Mr Harbindar Sangha as part of his Doctor of Business Administration from the Newcastle Business School at the University of Newcastle.

#### **Why is the research being done?**

As communication technology advances and reliance on it increases, Organizations are increasingly using virtual teams to take advantage of expertise not available locally, as well as to reduce costs. There are conflicting views on effectiveness of innovation in Virtual teams with some organizations using virtual teams for innovation and others opposed to it. Virtual teams differ from face to face teams in terms of presence, which impacts trust and group identity needed for team effectiveness in context of innovation. The study aims to research the effect of technology in creating presence and the relationship of presence, trust and group identity on each other and team effectiveness. The aim of this research is to find the impact of technology on presence, trust, group identity and virtual team effectiveness.



### **Who can participate in the research?**

You are eligible to participate in this research project if you are an employee of the Technology Services Division.

### **What choice do you have?**

Participation in this research is entirely your choice. Only those people who give their implied consent will be included in the project. Whether or not you decide to participate, your decision will not disadvantage you. If you do decide to participate, you may withdraw from the project until such time as the completed survey has been completed, without giving a reason and have the option of withdrawing any data which may identify you. If you decide to withdraw, all data related to you will be withdrawn and destroyed. Your decision whether or not to participate will not disadvantage you in your current or future relationship with the University or Australian Bureau of Statistics.

### **What you are being asked to do?**

If you agree to participate in the project, you will be emailed a survey with questions.

### **How much time will it take?**

The survey questionnaire will take no longer than thirty minutes to complete.

### **What are the risks and benefits of participating?**

There is minimal, if any, risk to you if you participate in this research. You or your firm will not be identifiable in the published output from the research. While we cannot promise any direct benefit to you or your firm, the research aims to better understanding of using virtual teams in the innovation process, which will help virtual team participants, their managers and Australian Bureau of Statistics.

### **How will your privacy be protected?**

All information received from you will be strictly confidential. The surveys will have no identifying information. Code numbers will be used in place of names throughout the research process. The consent forms and survey responses will be kept on the password-protected computers of the researchers. Only the researchers will have access to the data except as required by law. The de-identified data will be kept in locked storage at the Newcastle Business School for a minimum of five years after the conclusion of the research.

### **How will the information collected be used?**

The results from this research will be used to inform the effective use of virtual teams in the innovation process. Although no individual person or firm is identified, some anonymous quotations may be used in reports and scholarly articles. Please contact the research team if you would like a summary of the results once the project is completed, which is expected to be in March 2014.

### **What do you need to do to participate?**

Please read and retain a copy of this Participant Information Statement and be sure you understand its contents before you consent to participate. If there is anything you do not understand, or you have questions, please contact the researchers at the contact emails and phone numbers given above. Once you have read and understood the statement, if you wish to proceed, please send a return email indicating your willingness to participate in the survey. Once this is received, we will email you the survey. We have attached a copy of the consent form for your information. You will be invited to sign the consent form immediately prior to the survey taking place.

### ***Further information***

If you would like further information please contact Dr. Laurie Lock Lee or Harbindar Sangha. Our contact details are listed on the letterhead. Thank you for considering this invitation.

Dr. Laurie Lock Lee  
Chief Investigator

Mr Harbindar Sangha  
Co-Investigator

29<sup>th</sup> April, 2013

### ***Complaints about this research:***

This project has been approved by the University's Human Research Ethics Committee, Approval No. **H-2013-0239** Should you have concerns about your rights as a participant in this research, or you have a complaint about the manner in which the research is conducted, it may be given to the researcher, or, if an independent person is preferred, to the Human Research Ethics Officer, Research Office, The Chancellery, The University of Newcastle, University Drive, Callaghan NSW 2308, Australia, telephone (02) 49216333, email [Human-Ethics@newcastle.edu.au](mailto:Human-Ethics@newcastle.edu.au).

### **Survey**

Link to the survey: <https://www.surveymonkey.com/s/virtualinnov8>

The Survey has a save button, go back button on each page and a submit button at the last page. Please click the submit button once you have completed the survey

## 9 Appendix C Factor Analysis

Model 2: H1b Effect of presence factors on innovation effectiveness

Variables	Innovation effectiveness vs Presence	Innovation effectiveness vs Presence1	Innovation effectiveness vs Presence2	Innovation effectiveness vs Presence3
R square	0.0003	0.001	0.0055	0.012
F ratio	0.043	0.19	0.81	1.9829
Presence coefficient	0.0045 (p value = 0.83)	0.05 (p value = 0.68)	0.51 (p value = 0.36)	0.09 (p value = 0.16)
Null hypothesis rejection (H1b/H0)	No	No	No	No

The table above shows, that the three factors of presence do not have any effect on Innovation effectiveness. The p value are much high and the ANOVA F value too low for the null hypotheses to be rejected.

Model 4 : H2a Group Identity and interaction of presence factors and group identity on innovation effectiveness

Variables	Interaction effects of Presence and Group Identity	Interaction effects of Presence1 and Group Identity	Interaction effects of Presence2 and Group Identity	Interaction effects of Presence3 and Group Identity
R <sup>2</sup>	0.175	0.12	0.14	0.15
F ratio	10.18	8.52	8.81	8.91
Presence estimates	-0.007 ( p = 0.729)	0.017 (p = 0.71)	0.11 (p =0.39)	0.08 (p =0.32)
Group ID parameter estimates	0.19 (p <0.001)*	0.17 (p<0.001)*	0.16 (p <0.001)*	0.16 (p <0.001)*
Presence*Group Identity	0.008 ( p =0.09)**	-0.0006 (p =0.94)	-0.002 (p = 0.87)	0.0006 (p =0.65)
VIF	Presence = 1.23 Group ID = 1.02 Presence*Group ID= 1.26	Presence =1 Group ID = 1.05 Pres1*GID =1.05	Presence2 =1.11 GroupID =1.38 Pres2*GID=1.46	Presence2 =1.04 GroupID =1.33 Pres3*GID=1.34
Null hypothesis rejection	Yes	No	No	No

Decomposing presence into factors resulted in no interaction effects of presence on group identity.

Model 5 H2b: Presence and Trust, main effects and interaction effects

Variables	Main effects (Trust and aggregate presence)	Interaction effects of Presence1 and Trust	Interaction effects of Presence2 and Trust	Interaction effects of Presence3 and Trust
R <sup>2</sup>	0.11	0.11	0.11	0.11
F ratio	8.67	6.6	6.99	6.95
Trust	0.128 (p <0.0001)*	0.12 (p <0.0001)*	0.09 (p =0.010)**	0.09 (p =0.008)*
Presence parameter estimates	-0.0005 (p=0.98)	-0.013 (p=0.77)	0.06 (p=0.63)	0.06 (p =0.48)
Presence*Trust		-0.01 (p =0.20)	-0.018 (p = 0.16)	-0.0018 (p =0.15)
VIF	1.003	Presence =1.03 Trust= 1.02 Pres1*Trust =1.05	Presence2 =1.14 Trust=1.54 Pres2*Trust =1.47	Presence2 =1.03 Trust=1.44 Pres3*Trust= 1.41
Null hypothesis rejection	No	No	No	No

The 3 presence factors had no effect on trust's contribution to innovation effectiveness

Model 7: H2d Presence1 Main effects and interaction effects with all Dependent variables

Variables	Model 7 (Main effects) Presence1 and all DV	Model 7 Interaction effects with Presence1 and all DV
R <sup>2</sup>	0.14	0.27
F ratio	8,67	1.85
Trust parameter estimates	0.03 (p value = 0.52)	-0.02 (p = 0.70)
Group ID parameter estimates	0.14 (p value = 0.084)**	0.12 (p = 0.09)**
Presence1 parameter estimates	0.011 (p value = 0.81)	0.02 (p = 0.72)
Trust*Group ID coefficient		0.02 (p = 0.77)
Trust*Presence coefficient		Trust*Presence1 - 00.38 (p = 0.036)*
Presence*Group ID		0.007 (p = 0.72)
Trust*GroupID*Presence coefficient		0.00005 (p = 0.86)
VIF		GID = 4.46 Trust*Presence1 = 4.68
Null hypothesis rejection	No	No

On checking the interaction and main effects for all three presence factors only presence1 interacted with trust in a significant way (p = 0.036), but the ANOVA F statistic value was lower than 3.1, so the null hypotheses could not be rejected, leaving Group Identity as the only predictor in this model.

H2d was run with other presence factors with similar results