HOW TEAMS PROGRESS THROUGH THE INNOVATION PROCESS

Submitted for the degree of PhD

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Declaration

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Michelle MacMahon

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Summary

The work of any innovation-project team working on an innovation project is a process within a process. The innovation-project team is a group of individuals whom may be working on one of several innovation projects at any one time. Among many other responsibilities and challenges, they must individually and collectively navigate the labyrinth of internal social relations - manage the complexities associated with their structural position within the team, their relationships with others in the team, and their cognitive capacity to recognise and manage themselves, others and tasks in the process. Separately, individual and team level knowledge, skills and abilities are significant to performing innovation-relevant tasks. All the while, the team is engaged in a process with no definitive road-map of the innovation-project but guided by a more-or-less clear conception of the intended outcome.

This study gathered data on nine innovation-project teams, averaging five members, engaged in the complex process involved in pursuing an innovation project. The data from each team was gathered on three separate occasions, roughly two months apart, over a ten-month period. A hypothetical conceptual framework guided the empirical investigation while the choice of abduction as an analytical tool allowed the inclusion of data within and beyond the initial theoretical framework. Following an extensive analysis of the data, the original theory was reconceptualised to find that teams progress through the innovation process by complex and at times non-linear learning processes. Teams cycle between the strategic learning phases of exploration and exploitation within and across stages of the innovation process. Each stage of the innovation process begins with a phase of exploration and ends with a phase of exploitation. Within each of these phases are nested phase related activities that separately display exploration and exploitation learning behaviours. In addition, the dialogue between team members reference either task or relationships. Task relevant dialogue between team members enables progress by team members either disagreeing with a certain thought,
action, or plan and exploring alternative options, or agreeing and exploiting shared knowledge. Relationship relevant dialogue between team members seeks to make a personal judgement either positive or negative.

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Dedicated to Nana
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1. INTRODUCTION

The focus of this research is the innovation process at the team level. It takes a multiple-case study approach using data collected at three time points. The outcome of the empirical study is an elucidation of how teams progress through the innovation process. The data are used to describe how teams engage in relevant activities during the different stages of the innovation process (invention, development, and implementation), how they move from stage to stage and how different phases and activities drive progress within each of these stages. More specifically, within each stage, the analysis focuses on two key phases characterised by the competing yet complementary learning strategies of exploration and exploitation. Within phases, activities and behaviours that influence progression through the innovation process are described. A central device used in the research is an ideal type model of the innovation process, labelled the 3-Diamonds Model (3DM), that is developed and discussed in detail and serves as the theoretical framework to effectively guide the empirical investigation (see, Swedberg, 2018).

1.1. Research Objective

Innovation remains crucial for organizational survival (Kanter, 2010; West & Farr, 1990) and while many of the relevant activities are conducted at team level (e.g., Goyal & Akhilesh, 2007; Richter, Hirst, van Knippenberg, & Baer, 2012) we know little about how teams progress through the innovation process (Paulus, Levine, Brown, Minai, & Doboli, 2010). What we do know is based on research that has taken a variance approach (e.g., Bouncken, Brem, & Krau, 2016; Curral, Forrester, Dawson, & West, 2001) or converted existing individual level and organisation level process models to team level (Amabile & Pratt, 2016; Ramos, Anderson, Peiró, & Zijlstra, 2016). The objective of this study is to investigate the mechanisms that explain how teams progress through the innovation process. In doing so, there are three contributions to knowledge: theoretical; empirical; and practical.
1.1.1. **Theoretical contribution**

A theoretical contribution systematically explains what, why, and how social mechanisms cause the phenomena of interest in the empirical world (Bacharach, 1989; Hedstrom & Swedberg, 1998; Mahoney, 2001; Whetten, 1989). In this study, it is explained how cycling between strategic learning phases of exploration and exploitation enable the team to progress through the innovation process.

This study takes the alternative and rarely travelled process approach to studying the innovation process and links opposing social network structures to “concepts that are central to adaptation, organisational learning, and technical innovation” (Beckman, 2006:741), exploration and exploitation. The literature is awash with quantitative studies that provide conflicting evidence for the strength of relations between opposing social network structures, brokerage and closure, and innovation (e.g., Baer, Evans, Oldham, & Boasso, 2015). Meanwhile, scant qualitative studies show that both brokerage and closure play a role in innovation over the life of the project, for example Ancona and Caldwell (1992) (Kijkuit & Van Den Ende, 2007).

The existing literature on strategic innovation provides rich discussion on the value of exploration and exploitation for organizational innovation and how organizations manage these activities at the strategic level (e.g., Lavie, Stettner, & Tushman, 2010), yet there is a dearth of literature on how they apply at the team level where many innovation-relevant activities in organizations take place (Paulus et al., 2010).

Further, there is a scarcity of research that has examined the challenges of managing the balance between exploration and exploitation. While punctuated equilibrium and ambidexterity are largely discussed as mechanisms for achieving a balance, their feasibility in various contexts remains understudied (Gupta, Smith, &
Shalley, 2006). This study considers both as mechanisms for the team to manage exploration and exploitation for progress.

The analysis elaborates upon extant literature on exploration and exploitation and integrates this with the three-stage model of the innovation process, invention, development, and implementation (Garud, Tuertscher, & Van de Ven, 2013) to produce the 3DM. The 3DM is an ideal type model of the innovation process at team level. It is used to demonstrate the interplay between exploration and exploitation across the innovation process. Specifically, it considers the deliberate sequencing and other attempts to manage these competing yet complementary activities and identifies other team-level concepts and dynamics that interact with these learning strategies and activities to support or hinder innovation progress.

Thereby, the 3DM makes a theoretical contribution to the literature by theorizing how teams progress through the innovation process.

1.1.2. **Empirical contribution**

An empirical contribution produces knowledge based on sensory data subjected to methodological rigor and testing (Bryman & Bell, 2007; Singleton & Straits, 2005). The objective is to answer the call for a process study of real-world, innovation project teams (Paulus & Dzindolet, 2008; West & Farr, 1990) by providing empirical data of the innovation process at team level.

As innovation relevant activities and behaviors are highly visible in team contexts, this renders the analysis of exploration and exploitation more easily observable than organization level processes (Rosenfeld & Servo, 1990). Using the 3DM as the framework for the empirical investigation, data was gathered at three points in time, across the innovation process and across multiple cases. The analytical strategy is abduction and retroduction. The presentation of results is a story about how teams progress through the innovation process building the 3DM for demonstration. Thereby the study
contributes empirical evidence on how teams progress through the innovation process.

1.1.3. Practical contribution
A practical contribution provides guidelines by the researcher for practice (Edmondson & McManus, 2007). The outcome of this study is an explanation of how team progress through the innovation process by describing roles for exploration and exploitation at opportune times within and across the innovation process and other factors that contribute to progress. The theory and empirical evidence, aided by the 3DM, can support practice in at least three ways: planning, diagnosing, and intervening, as described below.

1.1.3.1. Planning
Being aware of the power of strategic learning phases, exploration and exploitation, management can influence and direct purposeful events, so they correspond with progress (Danermark, Ekstrom, Jakobsen, & Karlsson, 2002). It is not assumed that management can predict progress, rather use the 3DM as context to forecast activities, knowledge, skills, and attributes that may be required at certain times to support progress. Before an innovation project begins, management and team members can use the 3DM in two ways: plan what activities, knowledge, skills, and attributes are required by team members for the duration of the project; and, what activities, knowledge, skills and attributes are required by the team from beyond the team at certain stages or phases to facilitate progress. In addition, the 3DM can help plan for essential resources other than those provided directly by people such as, equipment, money, technology, etc.

1.1.3.2. Diagnosing
During the innovation project, if progress is slow or the innovation project team are having to revert to an earlier stage of the process more often than expected, management can use the 3DM as a blueprint to assess the current stage of the innovation process the
innovating entity (such as a team), or innovation project is at. The 3DM reinforces a clear process focus that is in line with procedural research that investigates innovation in organizations (Mørk, Hoholm, & Aanestad, 2006). Therefore, mapping previous progress can help diagnose the strengths and limitations regarding exploration and exploitation related activities and other team behaviours.

1.1.3.3. Intervening
The 3DM also offers a useful framework for developing pragmatic managerial interventions to support the innovation process. If a team, for example, has spent a particularly long period of time exploring options as part of the development stage, the 3DM can help facilitate joint decision-making on closing off further exploration and support the decision to switch to a phase of exploitation. Additional resources or training can be deployed if diagnosis indicates weaknesses in executing the relevant activities, or in switching focus effectively at appropriate times. If teams do not appear to make sufficient progress along the innovation process, the 3DM can help them gain clarity of the next challenge they need to meet to progress. The abstract nature of the 3DM does not offer any immediate solutions but provides a broader perspective within which available expertise can be shared and deployed.

1.2. Research paradigm
The research paradigm reflects the philosophical beliefs of the researcher and influences how research should be conducted and how data are collected and analysed (Crotty, 1998; Danermark et al., 2002). There is the assumption that a reality exists independent of social actors and that social actors are not confined by a particular stage (Ackroyd & Fleetwood, 2000; Crotty, 1998). As a critical realist, it is believed that this independent reality is not immediately observable, unlike the natural sciences, but that does not rule out our ability to investigate the explanatory power in “revealing the mechanisms which connect things and events in causal sequence” (Danermark et al., 2002: 53).
However, the research paradigm is as much practical as it is personal (Bryman & Bell, 2007). Practically, best fit also determines the approach to gathering and analysing data in response to the research question (Edmondson & McManus, 2007). Therefore, investigating how the team progress through the innovation process is answered by participants (Crotty, 1998) in their social and historical practices (Danermark et al., 2002). Data collected using the multiple-case study are analysed by the researcher through the lens of a priori theory in a process of abduction and retroduction (Fisher & Aguinis, 2017; Klag, Langley, 2013; Meyer & Lunnay, 2013). Abduction allows for the analysis of data that falls outside the theoretical framework (Danermark et al., 2002) to explain events and the social processes that may cause events (Pierce, 1934). Retroduction permits the instinctive analysis of data by identifying what must exist, and contextual factors (Danermark et al., 2002) to explain the event therefore reconceptualising theory to “give new meaning to already known phenomena” (Meyer & Lunnay, 2013: 9).

The alternative approach to studies of innovation is positivist research concerning the null-hypothesis significance-testing procedure (NHSTP) (Trafimow, 2003) that is prevalent in the field of innovation research (Crossan & Apaydin, 2010). This approach to social science merely measures the statistical correlation between variables but does not respond to questions of cause and is therefore an unsuitable approach for responding to the research question in this study (Danermark et al., 2002).

1.3. **Definitions of key concepts**

For clarification purposes, key concepts are defined and presented here:

- The innovation process is defined as “the process of inventing, developing, and implementing new ideas” (Garud et al., 2013: 776). The innovation process is discussed further in section 3.1.
➢ Exploration and exploitation are defined as both strategies and activities: Exploration is largely associated with increasing diversity, creating newness, difference, and generating variety (Lavie et al., 2010; McGrath, 2000) via search, discovery, and experimentation (March, 1991). Exploitation is largely associated with refining and using existing knowledge and competencies (Levinthal & March, 1993) and reducing variance (Lavie et al., 2010) via selection and execution (March, 1991). Exploration and exploitation are discussed further in section 3.3.

➢ Time is defined as the “shared, expected patterns of paced activity (Ancona, Goodman, Lawrence, Tushman, 2001: 648). Time is discussed further in section 3.4.4.

➢ Social relations – trans-team and intra-team: Trans-team relationships are those relations that link the whole team or individual team members to entities outside the team for access to non-redundant information (Burt, 2005). Intra-team relationships are those relations between and among the members of a team (Alderfer & Smith, 1982). Social relations are discussed further in section 3.4.6.

1.4. **Thesis structure**

Chapter one introduces the study. Here, the researcher is introduced in making explicit their research philosophy. Research philosophy is as much personal as it is practical (Bryman & Bell, 2007). Personally, our research philosophy reflects how we make sense of the world which in turns provokes certain types of research questions and can inform our approach to empirical investigation. Practically, best fit also determines the approach to gathering and analysing data in response to the research question (Edmondson & McManus, 2007). Chapter one continues by describing the contributions the study makes empirically, theoretically and practically.
Chapter two describes the conception of the study vis-à-vis reading the literature and continues by describing the consequential systematic literature review and findings. Chapter three follows with a presentation of the theory that emerged from the systematic literature view. This theory led to the development of an ideal type model that formed the theoretical framework for the empirical investigation, the 3DM. This chapter continues with the introduction and discussion of the research question.

Chapter four discusses the research design (multiple-case study) and describes methods for gathering and analysing the data. This chapter follows Yin’s (2004) framework for case study research to describe the systematic procedures for conducting this study to ensure best practice. The main source of data are from interview. Data was also collected via non-participant observation. Data was collected on three occasions across a ten-month period using nine cases. The analytical approach is abduction and retroduction.

Chapter five presents the analysis and results. The presentation of results is a story, by chapters, that describe how teams progress through the innovation process. Data are used as evidence to support the story. Chapter six is a discussion about the study including implications for research and practice as well as the limitations of the current study. Chapter seven provides a conclusion of the study.

2. LITERATURE REVIEW

A systematic literature review (SLR) was conducted to gather and examine evidence on how teams progress through the innovation process.

Informed by the SLR and utilising Garud et al., (2013) three stage model of the innovation process, consideration was given to roles for competing yet complementary learning strategies, exploration and exploitation, in the context of the innovation process at team level. As learning activities, exploration and exploitation are influenced by social relations – trans-team and intra-team relations. Theory was
developed, and a research model proposed (3DM) to serve as a theoretical framework for the empirical investigation. The theory development and research model are presented in chapter three but first the SLR process is described and the outcome presented, because of the influence of the SLR on influencing the 3DM and shaping the research question.

2.1. **A systematic literature review**

A systematic literature review is a “systematic, explicit, and reproducible method for identifying, evaluating, and synthesizing the existing body of completed and recorded work produced by researchers, scholars, and practitioners” (Fink, 2005: 3). Originated in the field of medicine, the aim of a SLR is to gather as much evidence as possible about a chosen topic, to expose gaps and uncertainties within the literature, and qualify the final research question (Mertens, 2010; Petticrew & Roberts, 2006; Tranfield, Denyer, & Smart, 2003). Owing to the ‘reproducible’ quality of the SLR a prescribed format was followed which is described in the following section.

2.1.1. **A framework for conducting a SLR**

Petticrew and Roberts (2006) provide a framework for conducting a SLR based on the acronym PICOC that represents, Population, Intervention, Comparison, Outcomes, Context:

a. **Population.** Innovation teams which are broadly defined as groups of people that work together on an innovative project and are jointly responsible for progressing through the innovation process.

b. **Intervention.** The role of social networks, specifically conflicting social relations, to facilitate innovation.

c. **Comparison.** What other than social relations facilitate the process? This question seeks to identify alternative constructs, concepts, variables within the innovation literature.

d. **Outcome.** The outcome is progress along the innovation process within and across different stages of this process.
e. **Context.** An organisational setting, here the innovation team. Such a team was defined as “*a social entity that is goal-directed, inextricably linked to the environment yet with nominal boundaries, and that employ deliberately designed and co-ordinated activities and approaches to achieve their objectives*” (Martin & Fellenz, 2017: 5).

To begin, the authors recommend answering two questions to focus the review. What is the current research question, and why this question?

The initial research question asked of the SLR was - *what role(s) do social relations have in the innovation process?* An early, traditional review of the literature social networking and innovation literatures exposed contradictions in terms of the value of conflicting yet complementary social structural arrangements for innovation, commonly referred to as brokerage or closure. Brokerage defines a weak link between relations and closure defines a strong link between relations (Burt, 2005). For example, Baer, Evans, Oldham and Boasso (2015) found that ‘strong ties’ can have both a positive and negative effect on individual level innovation, and Ancona and Caldwell (1992) found support for team performance when they manage social relations outside the team as well as inside the team. Separately, Kijkuit and van den Ende (2010) found support for innovation when the social network associated with the innovation differed across stages.

The findings of the SLR influenced the research question ‘*how do teams progress through the innovation process?*’. See section 2.3 that discusses the relevance of the SLR for theory development and section 3.7 that discusses the research question.

The systematic approach to the literature review includes: identifying the search criteria; identifying the relevant databases for conducting a search; conducting the search; identifying criteria for inclusion and exclusion; analysis and results of the SLR; and finally reporting the findings or results (Bolderston, 2008; Fink, 2005).
2.1.1.1. Search criteria

The search criteria for finding the most relevant literature associated with innovation and social relations was based on search terms (Marrone, 2010: 913). Search terms were selected based on word frequency from four primary readings: Baer, Evans, Oldham, and Boasso (2015) who did a meta-analysis of the literature on the social network correlates of individual innovation; Phelps, Heidl, and Wadhwa (2012) who did a systematic review and analysis of empirical research published on the topic of knowledge networks; Hemphälä & Magnusson (2012) who did an empirical investigation of types of network structure and types of innovation; and, Garud et al., (2013) who did a literature review of the innovation process.

Phelps et al. (2012) was included for search terms, even though the paper concerns ‘knowledge networks’ and not ‘social networks’, because their framework of the literature on knowledge networks contains similar characteristics as the framework presented by Nahapiet and Ghoshal (1998) on the organisational advantage of social capital. Social capital is a key outcome of social relations for innovation (e.g., Alguezaui & Filieri, 2010). Nahapiet and Ghoshal (1998) seminal paper pioneered research on the advantages intrinsically held by organisations for creating and sharing knowledge owing in part to the structural, cognitive, and relational elements of the people within the organisation. The Phelps et al. (2012) literature review provides a symmetrical relationship between social networks and knowledge networks as far as their review of the knowledge network literature created a framework for the power of networks to distribute knowledge, specifically, based on structural, relational, nodal, and knowledge properties.

Across all four papers the following words appeared most frequently (see Appendix 1.1): ‘networks’ -1,087 times, ‘knowledge’ - 820 times, and ‘innovation’ - 543 times.
Therefore, the search terms for the systematic literature review are - networks, knowledge, and innovation

2.1.1.2. Relevant databases
The four primary authors (Baer, Evans, Oldham, & Boasso, 2015; Garud et al., 2013; Hemphälä & Magnusson, 2012; Phelps et al., 2012) informed which databases and fields were selected for the SLR. Eleven databases were accessed in the following fields - economics, management, psychology, and sociology using variations of the search terms based on returns for that database. Appendix 1.2 (The results from the SLR database initial search) provides copies of the Excel worksheet that stored results from databases searches including variations of search terms for each database.

2.1.1.3. Reducing the search selection for relevant papers
The initial search provided a yield of 16,186 papers. Including limiters, this number fell to 1029 papers. Finally, based on title this number fell further to 362 papers. Appendix 1.3 (Database search reduced) provides a table with the list of databases in column one, and reductions in columns two, three and four.

The reduction in yield from column two ‘search terms and yield’ to column three ‘limiters and yield’ was based on ‘subject selection’ which varied from database to database. For example, in Emerald the terms ‘innovation’ and ‘collaboration’ provided a bigger yield, whereas in Business Source Complete it was better to include ‘innovation in business’ and ‘social networks’. All subject based limiters, e.g., ‘peer reviewed’ are included in Appendix 1.2 (The results from the SLR database initial search).

The reduction in yield from column three ‘limiters and yield’ to column four ‘shortlisted based on title’ was based on refining the literature to respond to the research question (Bolderston, 2008). Since the SLR is concerned with the role of social networks within and across the innovation process in an organisation (Knight, 1967), exclusions included articles which addressed innovations, networks,
or knowledge which may be classified as one or more of the following three categories: those existing independent of the organisation; those existing external to the organisation; or, literature which discuss interventions within the organisation to support innovation. Appendix 1.4 (Categories and sub-categories of literature excluded based on title) has a complete list of categories and sub-categories of excluded literature that include for example, open innovation, customer networks, and knowledge management.

The yield shown in column four ‘shortlisted based on title’ highlighted duplications in the search when selected literature was exported to RefWorks, a reference management system (ProQuest, no date). Further analysis found unique hits represent 80% of the yield or 290 of the 362 articles selected.

2.1.1.4. Selection for inclusion and exclusion based on abstracts

The selected 290 articles were further reduced to 109 when the abstracts revealed that the paper was not specifically concerned with social networks nor the innovation process. Added to the 109 articles were 85 papers already identified during the ‘scoping’ phase to provide a total collection of 194 papers. These 85 papers did appear in the SLR exercise but were excluded at that time because they were not unique to the SLR. To the contrary, the SLR complemented the traditional approach, making the literature review progress more extensive and rigorous.

2.1.1.5. Data extraction

All 194 papers were reviewed using a data extraction template to evaluate the relevance of the article (Bolderston, 2008; Fink, 2005). A standardised form supports the reliability and validity of the review (Fink, 2005), see an example in Appendix 1.5 (SLR, data extraction sheet). The relevance of each paper was recorded in an Excel sheet, see an excerpt in Appendix 1.6 (SLR, brief notes on paper review).
2.1.1.6. Analysis of the SLR
Descriptive statistics of the selected papers was conducted by investigating various trends including: number of authors; publishing trends; trends between journals; and trends about topic. Each of these are discussed below.

2.1.1.7. Trends on number of authors
The selection of 194 papers shortlisted have between 1 and 5 authors. Most of papers have two authors on a paper \((n = 73)\). Almost 100 papers have either 1 author \((n=49)\) or 3 authors \((n=49)\). Eighteen papers have 4 authors, while only three papers have 5 authors. See Appendix 1.7 (SLR, number of authors per paper).

2.1.1.7.1. Publishing trends
An analysis of publishing trends shows a steep and continuous increase in the number of papers published, per decade, on the topic of social relations and the innovation process since the earliest publication in 1950 until the SLR in 2016 (see Appendix 1.8 Publishing trend per decade). For example, there were 9 papers published between 1950 and 1989 compared to 99 papers published between 2010 and 2016. A closer look at the trend in publishing per year (see Appendix 1.9 Year and quantity of papers published) shows that there was a relatively steady number of papers published from 1950 until 1994. It appears that were no papers published in 1995 and 1996. However, 1997 shows a revived interest in the topic followed by an irregular pattern until 2004 when the trend shows a strong increase.

2.1.1.7.2. Journal trends
Altogether, 93 journals and 4 books provided discussion and research on the topic of social relations and the innovation process. Journals that appeared three or more times are listed in Appendix 1.10 (SLR, journal which appear most frequent). The three most frequent journals from this list are: Academy of Management Journal (AMJ) that provided 22 papers; and, Administrative Science Quarterly (ASQ) and Organization Science (OS) which provided 12 papers
each. The publishing trends by these top three journals (AMJ, ASQ, and OS) are provided in Appendix 1.11 (SLR, publishing trends for most cited journals). Collectively these journals have not published more than 5 papers in any one year. 2001, 2005, and 2010 are the only years when all three journals published. Separately, Appendix 1.10 lists other top journals that published in this time period. The Journal of Psychology (JP) published 8 papers and the Journal of Organizational Behavior (JOB) published 7 papers. These journals represent theories and empirical work in the fields of management, strategy, organizational theory, and organizational behaviour and psychology.

2.1.7.3. **Topic trends**

In organising the selected literature for writing the review, the readings were further categorised by topic. Altogether the readings generated thirteen different topics providing both theory and empirical investigations on different aspects of social relations and innovation, see Appendix 1.12 (SLR, final selection of literature by topic). By far the greatest number of articles represent dual or contradictory roles. The literature provides a variety of terms to describe social relations, such as: diverse network, dense network, open network, etc., see Appendix 1.13 (SLR, social networking terms). Social relations appear to be defined by the strength of inherent relationships, that is, weak or strong ties.

Another topic that absorbs a significant bulk of the selected readings is the role of networks in the innovation process. Readings which represent the role of networks for performance is innovation related performance. Much of the literature covering these two dominant topics were published in the last sixteen years, see Appendix 1.12 (SLR, final selection of literature by topic).

2.2. **Reporting the literature**

Innovation is essential for organisational survival (Kanter, 2010). Innovation is a complex social process where opportunities are
derived in gaining new knowledge or refining current knowledge (Baer, Leenders, Oldham, & Vadera, 2010; Ibarra, Kilduff, & Tsai, 2005; Joshi, Pandey, & Han, 2009b; Tsai & Ghoshal, 1998).

Therefore, innovation is also a process. The process of innovation consists of at least three stages, invention, development, and implementation (Garud et al., 2013). Relationships have a role, as a sub-process, within and between these stages (Garud et al., 2013; Van de Ven, 1986) to provide essential knowledge, skills, and resources, and influence others thinking (Amabile, 1988; Jia, Shaw, Tsui, & Park, 2014; Van de Ven, 1986).

The results of the SLR are presented in five sections. To begin, definitions of ‘creativity and innovation’ are provided because these terms are often used to describe stages of the innovation process. Next the innovation process is described and the social nature of innovation. Then the two complementary categories of social relations, brokerage and closure are discussed. Finally, factors that influence social relations and their inherent social capital are described before drawing a conclusion of the SLR.

2.2.1. Creativity and innovation

Creativity and innovation are often used interchangeably (Scott & Bruce, 1994) but mean different things. Creativity can mean at least two things, the capacity of an individual and a stage of the innovation process. As an individual level construct (Amabile, 1988; Van De Ven & Poole, 1995) creativity refers to the character or capacity of an individual to be ‘creative’, for example a proactive personality (Grant & Ashford, 2008) or cognitive preference (Carnabuci & Dioszegi, 2015). Stemming from the right side of our brain, the creative side, it provides us with intuition, non-rational thoughts (Burns, 2008) and an innocence that informs no best way (de Bono, 1995). Separately, creativity defines a phase when novel and appropriate ideas are generated by an entity, be that individual, group or other (Hagedoorn & Cloodt, 2003). Collectively, research that examines individual level creativity has found strong support for the power of social
connections for ideas to reach implementation stage (Cattani & Ferriani, 2008; Uzzi & Dunlap, 2005) implying individual creativity is only part of the innovation process.

Innovation is defined as an outcome: that which emerges from the active combination of people, knowledge, and resources (Obstfeld, 2005); “new products, services, or work practices” (Subramaniam & Youndt, 2005: 451); or an idea that has survived the battle for resources and support (Kanter, 2010). Either way, innovation is the outcome of a process that begins with an idea (Scott & Bruce, 1994; Yuan & Woodman, 2010) and people make the difference, that is, innovation depends on how people respond to an idea, do they work to develop or modify it (Scott & Bruce, 1994) or ignore it?

A whole plethora of relevant terms describe aspects of creativity and innovation, respectively, they include: idea generation and selection, which describes the activity of generating ideas for new products and services and selecting one most suitable for the need (Paulus et al., 2010); divergence and convergence are used in reference to the imaginative nature of an entity to invent something followed by their structured approach to actually producing it (Lewis & Wright, 2012); development and introduction describes the process of developing an idea followed by its implementation (Anderson, 2008); risk and influence invoke the complexities involved in creating disruption in the organization by making changes followed by the ability of the organization to influence others that their idea is innovative (Kanter, 2006, 2010); finally, getting ready to perform and then performing categorise activities in a temporal order with the former reflecting the time an entity needs to explore alternative avenues, gather new data and additional resources before completing the task (Gersick, 1988).

2.2.2. The innovation process

Innovation is also considered a process (Obstfeld, 2005) defined here as, “the process of generating new ideas for organizational products, procedures, processes, and service offerings, of testing, developing,
and refining these ideas for future use, and of implementing them” (Baer et al., 2015: 3). This definition is fully aligned with the three-stage conception of the innovation process (Garud et al., 2013) and is the definition that is used in this research.

The three distinguishable stages are identified as: invention, development, and implementation (Amabile, 1988; Garud et al., 2013; Hagedoorn & Cloodt, 2003). The nature and order of these stages are discussed below, as well as the complexities involved that often lead to non-linear progress.

**2.2.2.1. Stage one: invention**

Invention may be driven by the push of technology or the pull of necessity both creating a demand that aims to motivate employees, teams, or organisations to make time and resources available for invention (Garud et al., 2013). Invention is also the first stage of the innovation process, where ideas emerge or are presented (Amabile, 1988; Hagedoorn & Cloodt, 2003). Ideas may emerge from an individual, group, or other entity as the product of creativity (Fleming, Mingo, & Chen, 2007). This is stage that requires time and insight (Amabile, 1988; Garud et al., 2013) which is a challenge considering the demands put upon workers in many organisations to balance commerce with creativity (DeFillippi, Grabher, & Jones, 2007). Alternatively, ideas may also emerge from a secondary source, that is, an idea from one context is imported to another context referred to as “creative arbitrage” (Fleming et al., 2007: 467).

Creative arbitrage highlights the role of networks in the innovation process as information is shared across relations (Burt, 2004).

The presentation of ideas refers to the task or assignment of an idea by another person, for example, a manager (Amabile, 1988). The presentation of an idea does not guarantee its acceptance (Amabile, 1988) meaning individuals or teams require the necessary cognitive and absorptive capability (Amabile, 1988; Garud et al., 2013) to move an idea forward and herein lies the complexities of the innovation
process. Cognitive capacity refers to the creative ability or motivation to work against or question current rules, the confidence to get it wrong, and the desire to want to ‘play’ creatively (von Oech, 1986). In a team environment, cognitive capacity is unlikely to be evenly distributed which implies a level of conflict in moving an idea forward. Absorptive capacity is the ability of an entity to identify new knowledge, discern how this knowledge complements existing knowledge, and combine knowledge (Fleming et al., 2007; Jia et al., 2014; Lavie et al., 2010). Therefore, absorptive capacity requires proactivity, challenging the entity to engage with the external environment to improve learning and performance (Lavie et al., 2010; Levinthal & March, 1993).

Translating ideas to a currency requires people to engage with others (Van de Ven, 1986) either formally or informally (Reagans & Zuckerman, 2008; Zhou, Shin, Brass, Choi, & Zhang, 2009). As such, it is within the labyrinth of social relations where information flows and knowledge is shared enabling invention (Baer, 2012; March, 1991; Zhou et al., 2009).

**2.2.2.2. Stage two: development**

Development is the second stage of the innovation process where ideas are assumed accepted since it is within this stage that ideas are elaborated (Garud et al., 2013), made explicit or even warranted being labelled a ‘project’ (Amabile 1988; Garud et al., 2013). For the development of ideas, they need both critical evaluation (Hansen, Mors, & Lovás, 2005) and resources (Faraj & Yan, 2009).

Critical evaluation may come from a variety of sources, perhaps it is for this reason that ideas are often assigned to product development teams implying development is a team level concept (Hansen et al., 2005). The challenge for product development teams is to establish a culture that has enough confidence to allow information to flow inwards across its boundary yet also resistant to external distractions (Faraj & Yan, 2009; Yorks, Neuman, Kowalski, & Kowalski, 2007).
They need to have the ability to recognise the trade-off associated with either being overly cohesive or overly diverse (Hsu & Lim, 2014; Obstfeld, 2005). An overly cohesive team is a team that is highly synchronised to the extent that they think alike, they agree on everything, there is no critical thinking, therefore no room for change (Fliaster & Spiess, 2008). Alternatively, an overly diverse team is a team that does not share the views of others, members are working to their own individual agenda to the extent that members are focused on different things (Reagans & Zuckerman, 2008; Stettner & Lavie, 2014).

Ideas need resources to demonstrate on some level 'proof of concept' (Garud et al., 2013), for example, sketches or models (Hagedoorn & Cloo, 2003) that may require time, energy, equipment, knowledge, or technology. The resources demand for development may exceed those available to any one person, team, organisation, or even community (Garud et al., 2013). For this reason, product development teams often include members who act as external ambassadors for the team and scout around for additional but necessary resources and support for their idea (Faraj & Yan, 2009). These additional resources are often the result of a personal network, their position within the network and the negotiating power and influence this provides (Han, Han, & Brass, 2014; Hansen et al., 2005; Perry-smith, 2006). However, by nature, teams are not typically receptive to members’ boundary spanning because this activity can conflict with the members role within the team, contribute to information overload, and generate extra work for others within the team (Marrone, 2010; Schippers, 2014). Therefore, an entity working to develop an idea needs to be able to balance the extent to which it exploits available resources while simultaneously attracting additional resources.

### 2.2.2.3. Stage three: implementation

Implementation is the third stage in the innovation process where products, processes, or services are deemed ready for deployment to the market or user setting (Garud et al., 2013; Van de Ven, 1986)
leveraging the outcome as innovation (Obstfeld, 2005).
Implementation is also a process, a process of actually getting the product to market which includes, for example, production, marketing, sales, training, etc., occurring additional resources, that is, time and money (Baer, 2012). Implementation is dependent on a number of personal and contextual factors (Baer et al., 2015). Contextual factors include, for example, production capacity and economic conditions (micro and macro) (Garud et al., 2013) suggesting implementation is sometimes beyond the scope of the developer (Hagedoorn & Cloo, 2003). Personal factors include, for example, the ability or capacity of person or team to have their development endorsed by significant others for market use (Sauer, Lynn, & Podolny, 2012), suggesting implementation is the result of personal networks (Uzzi & Dunlap, 2005). Status represents quality or assurance in times of uncertainty (Ertug & Castellucci, 2013; Leigh, 2012; Pearce, 2011) and new products, processes, services, often represent risk (Yuan & Woodman, 2010), therefore personal status can alleviate concerns and create opportunities. Implementation represents the point at which the person, team, or organisation recognises the return on investment of resources (Hagedoorn & Cloo, 2003).

The innovation process is not linear, there is no telling how long an idea will remain in a stage before it progresses to the next stage or reverts to a previous stage. The next stage may qualify the idea as invalid and so the progress will begin again. Even as far as the implementation stage, there is no telling if an idea will make it to market, for example, a pilot product may dictate additional development before the product is finally approved. All the while, social relations are at play sourcing money, technologies, and knowledge as well as introductions to key personnel to ensure an idea or product achieves market recognition.
2.2.3. The social/relational element of innovation

Each of the three stages of the innovation process contain at least four elements, they are: evolution that defines the determinants of innovation; temporal that reflects the element of time; culture that determines the drivers of innovation; and relational that represent the social element (Garud et al., 2013). The discussion will focus only on the relational element of innovation as is the purpose of this review.

The relational element of innovation is captured by many studies of innovation, not least the social networking literature, highlights the relevance of appropriate knowledge (e.g., know what, know how, know who), skill (e.g., political and task related) and attributes (e.g. motivation) for innovation (Amabile & Pratt, 2016; Jia et al., 2014; Van de Ven, 1986), see Table 1. Where or when these are missing or lacking, an entity has the option to sources these from beyond the boundary of self, team or organisation by building relations with an/other entity(s) thereby capturing the social element of innovation.

Interactions with others is considered a large part of everyday work (Kilduff & Brass, 2010a), especially with complex and often highly interdependent tasks such as innovation. Relevant interactions that form part of the innovation process may include face-to-face interpersonal interactions (Coleman, 1988; Hsu & Lim, 2014), and may cross team (de Vries, Walter, Van der Vegt, & Essens, 2014), or organisational boundaries (Brass, Galaskiewicz, Greve, & Tsai, 2004).

For this reason, organisations have adapted a more integrated organisational structure (Mintzberg & Van der Heyden, 1999) to facilitate the necessity of flexibility and growing project work in the continuous mission to achieve competitive advantage (Bapuji & Crossan, 2005; Hollenbeck & Jamieson, 2015). Flexibility enables an organisation to respond to environmental demands (Hansen et al., 2005; Aparna Joshi et al., 2009). Organisations which achieve this incorporate a learning culture that is the driver for change (Choo,

There are several factors that facilitate this learning culture, including a balance of exploitation and exploration (Hirst, van Knippenberg, Zhou, Zhu, & Tsai, 2015; Perry-smith, 2006). March (1991), describes ‘closed systems’ and opposing ‘open systems’, with each having unique advantages to a point. A ‘closed system’ is one where group membership is stable with limited knowledge being shared among members. Within a closed system, group members narrow their focus, reduce variability, consolidate efforts and exploit what they have at this time (March, 1991).

| Amabile, T.M., 1988. A model of creativity and innovation in organizations. | - Motivation – personal reason to innovate, also influenced by the environment  
- Political skill e.g. to “break mental set during problem solving”  
- Task related knowledge or talent |
|---|---|
| Jia, Shaw, Tsui, Park, 2014. A social-structural perspective on employee-organization relationships and team creativity. | - Ability to create and exploit dense communication networks  
- Motivation at team level (value expectancy) and individual level (personal value) |
| Van de Ven, 1986. Central problems in the management of innovation. | - Managing attention - encouraging people to think about new ideas, needs, opportunities  
- Currency - the social and political dynamics of innovation  
- Managing the proliferation of ideas, people, transactions  
- Leadership – creating an infrastructure conducive to innovation |
- Relational – social element  
- Temporal - timings are different for different interested parties  
- Cultural – different drivers |

Table 1| Factors which influence innovation
Alternatively, an ‘open system’ is where group membership changes on a regular basis with limited opportunity to share knowledge creating greater variance for exploring new possibilities. Too much exploitation can create suboptimal bit stable performance, too much exploration can lead to many experiments but little innovation. Separately, Yorks, Neuman, Kowalski, & Kowalski, 2007) found a team, that is both ‘bounded and porous’ is able to create a collaborative space to enhance learning. ‘Porous’ refers to social entity opening for data gathering, ‘bounded’ refers to the social entity closing for analysis. This socially created space facilitates personal and group reflection so people can think differently (Hsu & Lim, 2014), consider new possibilities (Bushe & Marshak, 2015) and improve innovation (Subramaniam & Youndt, 2005). This web of social relations generates a form of social capital that has the potential to facilitate certain actions by those involved (Coleman, 1988).

2.2.4. Social and intellectual capital

Social network structures influence social and intellectual capital (Burt, 1997; Nahapiet & Ghoshal, 1998). In this context social capital is defined as a “set of social resources embedded in relationships” (Tsai & Ghoshal, 1998: 464) that provides an opportunity for members to “learn, create, and acquire useful knowledge” and resources (Carmeli, 2007: 33). Intellectual capital is accumulated knowledge available to the organisation based on multiple levels of information exchange and combination (Nahapiet & Ghoshal, 1998). This knowledge includes workers’ experience as well as theoretical knowledge, at individual and aggregated level (Burt, 2004; Subramaniam & Youndt, 2005). A social entity working on developing or implementing an idea may not have all the necessary knowledge required to move the idea through the stages of the innovation process in which case it may be prudent to span the boundaries of the entity for the required information (Amabile, 1988; Kanter, 2006; Wolff, Moser, & Grau, 2008).
Social capital and intellectual capital are both a key asset for any organisation (Subramaniam & Youndt, 2005; Zhou et al., 2009) because they are an antecedent to innovation (Nahapiet & Ghoshal, 1998). Social capital can create and transfer knowledge (Nahapiet & Ghoshal, 1998) while intellectual capital is the outcome of this process, the aggregation of workers’ knowledge, skills, and attributes (Subramaniam & Youndt, 2005).

Therefore, a social network perspective highlights the importance of social relations for the innovation process, a premise that has received significant empirical evidence (Baer et al., 2015; Brass et al., 2004; Burt et al., 2013; de Vries et al., 2014; Fleming & Waguespack, 2007; Granovetter, 1973; Jia et al., 2014; Summers, Humphrey, & Ferris, 2012). Despite this support there is limited research that employs a social network perspective for examining the role of social relations within and across the innovation process (Baer, 2012; Hsu, Wang, & Tzeng, 2007; Scott & Bruce, 1994). The social network literature uses several terms to identify individuals and their position within a social network, and terms which also describe links between individuals - for the benefit of the reader, a glossary of terms is provided in Appendix 1.12 (Social networking terms); they include, broker, boundary spanner, gate-keeper, and strong ties.

Social capital is based on an entity’s structural, cognitive, and relational position within a social network (Nahapiet & Ghoshal, 1998; Oh, Labianca, & Myung-Ho, 2006) which are briefly discussed below to appreciate their relevance for innovation (Bapuji & Crossan, 2005; Tsai & Ghoshal, 1998). I then discuss in more detail the three forms of social resources distinguished by social network analysis: obligations and expectations, information channels, and social norms (Coleman, 1988; Mahoney, 2004). A closer look at each of these social resources helps to demonstrate why and how social relations can play a significant role in the innovation process.
2.2.4.1. Structural determinants of social capital

Social actors form relationships with each other, thus creating a social network that describes the relations between social actors by identifying ties between them as well as the strength of those ties (Borgatti, Mehra, Brass, & Labianca, 2009). Social structure represents the flow of information between actors to the extent that an actor’s structural position will determine the quality and quantity of information available to them (Burt, 2004; Ibarra et al., 2005; Kleinbaum & Stuart, 2013; Reagans & Zuckerman, 2008; Sauder et al., 2012). From such a structural perspective, analysis focuses on the position of an actor within the structure to determine advantage in terms of information and potential power and influence (Balkundi, Kilduff, & Harrison, 2011; Brown & Baer, 2015; Burt, 2004; Perry-smith, 2006).

2.2.4.2. Cognitive determinants of social capital

There are two main cognitive perspectives in the social network literature. The first is an individual level construct that considers the social actor’s perception of their social network, referred to as cognitive social structure (Brands, 2013). Our cognitive social structure determines who we perceive is within our network and therefore what value is available to us (Brands, 2013; Kilduff & Krackhardt, 2008). A second cognitive perspective adopts a group level approach that considers the shared vision of members within a social entity (Tsai & Ghoshal, 1998). A shared vision of the group’s goals and purpose can support group collaboration and lead to improved performance (Lester, 2013; Nahapiet & Ghoshal, 1998; Tsai & Ghoshal, 1998).

2.2.4.3. Relational determinants of social capital

The capacity of social actors to build relations with other social actors depend on several factors at multiple levels. At an individual level these factors may be based on personality (Grant & Ashford, 2008), for example, some people’s proactive nature supports their reaching out to make contact with another (Thomas, Whitman, &
Viswesvaran, 2010), and homophily (Joshi, 2006) that suggests people generally feel more comfortable building relationships with others from a similar background or with whom they believe they have something in common with. At team level, leadership has a significance influence (Fleming & Waguespack, 2007; Hogg, van Knippenberg, & Rast, 2012). For example, a leader can create an effective coalition between groups when managing the relational element by recognising different groups’ identity (Hogg et al., 2012). Finally, at organisational level, relations are determined by organisational climate (Edmondson, 2003), for example, psychological safety. Psychological safety concerns how people collaborate (Collins & Smith, 2006) as it “describes perceptions of the consequences of taking interpersonal risks” (Edmondson & Lei, 2014: 30), in contexts such as a workplace.

2.2.5. **Forms of social capital**

All three aspects of social interactions, structural, cognitive, and relational, provide utility value (Kilduff & Brass, 2010a) because they are the means for social actors (an individual, group or organisation, etc.) to obtain social resources. However, certain forms of social capital are more appropriate than others depending on the situation and circumstances (Coleman, 1988). There are three distinguishable forms of social capital which, if capitalised upon, are thought to create organisational advantage through developing intellectual and human capital (Bapuji & Crossan, 2005; Nahapiet & Ghoshal, 1998): obligations and expectations; information channels; and norms.

2.2.5.1. **Obligations and expectations**

When social actors converge they begin to shape and form relationships and a level of trust upon which actors respond to one another (Coleman, 1988; Kahn, 1990; Lewin, 1951). Trust, therefore, creates perceived obligations and expectations which govern the actions of members within the social network (Coleman, 1988). Members of the network recognise what their and others’ obligations are because, often, they intentionally engage in the relationship for
the benefit of what they believe others can provide. Equally, members are aware of what they can trade, that is, what they consider other actors value in their membership of the network (Coleman, 1988). If obligations and expectations are not delivered or received this can change the dynamics of the network through influencing the structural, relational, and cognitive dimensions (Tsai & Ghoshal, 1998). In this context reciprocity is a measure of the relationship (Fleming & Waguespack, 2007; Mahoney, 2004; Reagans & McEvily, 2003; Tortoriello & Krackhardt, 2010; Zou & Ingram, 2013), a means by which parties’ exchange information or/and share resources for one another’s benefit.

2.2.5.2. Informational channels
The dispersion of information happens at individual level (Bapuji & Crossan, 2005; von Krogh, Nonaka, & Rechsteiner, 2012). Information can be primary, for example, task advice or information which will help someone do their job better, and strategic information such political information about the organisation or information concerning the hierarchy of the organisation; information can also be secondary, that is, information that is not directly related to a person’s job, for example, information about another job in another organisation (Wolff et al., 2008). In the context of innovation, relevant information includes new ideas, know-how (e.g., information about relevant processes and procedures), know-what (e.g., knowledge about facts or about limited or relevant resources), and know-who (e.g., information about individuals who may hold or have access to relevant information), etc., (Bushe & Marshak, 2015; Butler, 1999; Gong, Cheung, Wang, & Huang, 2012). Such information can be very powerful to the extent that it facilitates or hinders cognitive or behavioural change (Ibarra et al., 2005). Similarly, such information can be shared and combined and thus form a rich source of new knowledge that can aid innovation (Collins & Smith, 2006; Kanter, 2006; Nahapiet & Ghoshal, 1998; von Krogh et al., 2012).
2.2.5.3. Norms

There are many factors at multiple levels that influence norms including the broader macro environment, organisational level, group level (Dacin, 1997) and individual level (Pettigrew, 1998). Norms create a code which mimics individuals’ beliefs about their environment (Cyert, Dill, & March, 1955), this code has the power to influence the structure and behaviour of a social entity (Dacin, 1997). Norms and behaviours are inextricably linked, being influenced by norms and influencing norms continuously ‘crafts’ a code that is temporarily acceptable (Sørensen, 2002).

To summarise, social relations generate obligations and expectations, information channels, and norms that influence actions and behaviours of social entities which has consequences for their work.

2.2.6. Complementary social relational structures

Research on social networking in and across organisations has burgeoned in recent years in part due to the advantages offered by network constructs for understanding and researching organisational innovation (Brown & Baer, 2015; Coleman, 1988; Fleming & Waguespack, 2007; Hsu et al., 2007; Ibarra et al., 2005; Kilduff & Krackhardt, 2008; Nahapiet & Ghoshal, 1998). From this perspective, the literature largely describes two distinguishable forms of social network structures, brokerage and closure. Both are likely to have complex roles in the innovation process (Ibarra et al., 2005; Janhonen & Johanson, 2011; Reagans & McEvily, 2003; Tsai & Ghoshal, 1998) which will be further explored theoretically below.

2.2.6.1. Brokerage

Brokerage is defined as the act of building bridges between social entities (i.e., individuals, groups, etc.) to transfer different opinions or practices, or non-redundant information, that can inform new thinking or action to support invention (Baer, 2012; Burt, 1997; Carnabuci & Dioszegi, 2015; Coleman, 1988). In the 1970s researchers began to explore how individuals bridge connections or structural holes to
build networks and create new advantages (Granovetter, 1973), and more recently social technologies have increased interest among researchers who continue to examine how information is distributed (Borgatti et al., 2009). Brokerage as a social construct concerns social actors going beyond the boundaries of a social entity in an attempt to develop a relationship(s) with another person(s) or group(s) in order to achieve a personal gain (Wolff et al., 2008), i.e., some type of utility or reward that arises from the social capital inherent in the new connection (Kilduff & Brass, 2010). Whilst brokerage is described by some as building bridges between social entities, or across structural holes (Burt, 1992), others may describe brokerage as ‘social networking’ which is similarly defined as building relationships among social entities (Wolff, Moser, & Grau, 2008), or spanning the boundaries between them (Fleming & Waguespack, 2007).

The benefits of brokerage are widely discussed and supported in numerous studies that measured the effects of brokerage on individual and team level innovation. For example, at an individual level brokerage was found to be related to creative ideas receiving resources for development and implementation (Baer, 2012; Burt, 2004; Granovetter, 1973). At team level brokerage had the strongest correlation with innovation (Brown & Baer, 2015; Hsu & Lim, 2014; Tsai & Ghoshal, 1998). Brokerage was found to have a strong correlation with research (Allen, Tushman, & Lee, 1979), facilitates product development teams (Ancona & Caldwell, 1992), and is essential for Collaborative Innovation Networks (COIN) or virtual teams whose members use technology to achieve a common goal (Gloor et al., 2008).

There are several related terms for brokerage which are frequently used in the social network literature with different and, at times, multiple meanings (Fleming & Waguespack, 2007). These include, brokers (Burt, 2004; Fleming & Waguespack, 2007; Hsu & Lim, 2014), brokering (Burt, 2005: 55), boundary spanning (Faraj & Yan,
2009), boundary spanners (Hsu et al., 2007), social networking (Boso, Story, Cadogan, Micevski, & Kadić-Maglajlić, 2013; Ertug & Castellucci, 2013), and networker (Baer et al., 2010; Joshi et al., 2009a; Pettigrew, 1998). Broker, boundary spanner, and networker concern the person who proactively engages in building new relationships. Alternatively, boundary spanning, brokering, and social networking refers to the action of building new relationships (Casciaro & Piskorski, 2005; Casciaro, Gino, & Kouchaki, 2014; Joshi et al., 2009). Extra organisational communication is a term used by Allen et al., (1979) to describe team members’ communication with those outside the boundaries of their team to support the research stage of the innovation process.

Separate from brokerage, but arguably similar in the context of the innovation process, is exploration. Exploration is a concept largely discussed in the literature in relation to organisational learning and design (Lavie et al., 2010). Exploration describes activities such as search, variation, risk, experimentation, flexibility, discovery, learning, newness, difference (Hirst et al., 2015; March, 1991; Perretti & Negro, 2006; Raisch et al., 2009). These activities provide learning opportunities that can enhance performance (Kostopoulos & Bozionelos, 2011; Levinthal & March, 1993). March (1991) first began the discussion on the benefits of exploration for organisational advantage and later Kostopoulos and Bozionelos (2011) found empirical support for team exploration and innovative team performance. Table 2 outlines similarities between brokerage and exploration.

<table>
<thead>
<tr>
<th>Brokerage</th>
<th>Exploration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanning boundaries for</td>
<td>Search</td>
</tr>
<tr>
<td>information gain</td>
<td></td>
</tr>
<tr>
<td>Different opinions or practices</td>
<td>Different/variation</td>
</tr>
<tr>
<td>Non-redundant information......new thinking</td>
<td>Newness</td>
</tr>
</tbody>
</table>

*Table 2 | Similarities between brokerage and exploration*
Exploration and brokerage brings a social capital that provides new ideas and new knowledge to the innovation process, or as Lavie et al. (2010) suggests, exploration builds on the existing knowledge base. However, an entity can explore in isolation to brokerage, meaning an entity can explore via technology rather than people, but brokerage is perhaps a good vehicle for exploration.

Like excessive exploration, there is a downside to excessive brokering. If team members excessively engage in brokerage activity, it can generate changing or confusing information which may reduce team viability (Ancona & Caldwell, 1992; Hsu & Lim, 2014). Excessive brokering can distract or confuse group members by under-utilising informational resources already existing within the team (Fliaster & Spiess, 2008). Equally, exploration should be done in moderation, as excessive exploration can result in a team engaging in endless experimentation resulting in failure (Levinthal & March, 1993).

2.2.6.2. Closure

Closure refers to the act of specialising within a social entity where the strength of relations compels members to adapt and align their thinking, leading to a narrower range of perspectives, attitudes and opinions creating social norms that govern actions (Coleman 1988). Or closure may simply ‘amplify existing opinion’ (Burt, 2005: 214). High levels of closure imply that a group shares a vision of its goals, which Nahapiet and Ghoshal (1998) view as an important cognitive dimension. Closure may be depicted by lines connecting each entity within a social network to each member of the network to the extent that every member has a tie to every other member (Baer et al., 2015).

The benefit of closure is trust (Burt, 2005). Actions are therefore predictable, reciprocal and benefit every member (Coleman, 1988). With trust comes learning (Edmondson, 1999) as members feel safe to use their voice and express their opinions. For example, members are encouraged to exchange information and feel compelled to combine
this information to support existing knowledge (Nahapiet & Ghoshal, 1998). Knowledge exchange and combination between members supports innovation (Baer et al., 2010; Baer & Frese, 2003; de Vries et al., 2014; Gong, Kim, Lee, & Zhu, 2013; Jia et al., 2014; Reagans & McEvily, 2003). Research by Allen et al. (1979) found support for a social entity closing external communication in order to create efficiencies during the development stage of their research, holding, that is, for a ‘gate-keeper’ to translate all necessary external communication so that nothing gets lost in the process. Equally, ‘boundary buffering’ was found to close the team from external exposure to protect them against uncertainties and ‘boundary reinforcement’ aims to manage team boundaries so the team can manage task focus (Faraj & Yan, 2009).

Closure is measured in terms of density (for example, Jia et al., 2014). Dense networks or ‘dense communication networks’ are associated with effective communication because members freely share, compare, and contrast information with one another, including tacit knowledge (Fliaster & Spiess, 2008). Density in this sense facilitates members refining ideas, coordinating actions, and ‘developing synergistic solutions’ (Jia et al. 2014: 875). Another, arguably, similar term includes social cohesion which refers to the strength of ties among members (Kilduff & Brass, 2010b; Reagans & McEvily, 2003). Social cohesion supports team workflow including the extent to which members pool resources and reciprocate behaviours especially when workflow is intense (for a review see, Beal, Cohen, Burke, & McLendon, 2003; Fleming et al., 2007).

Exploitation is conceptualised as an activity associated with “refining existing knowledge and skills” (Kostopoulos & Bozionelos, 2011: 386) for narrowing choice and selection, putting ideas into practice, and driving efficiency for execution and implementation (Mahoney, 2004; March, 1991). Exploitation is a group activity, based on collaboration and standardising knowledge (Hirst et al., 2015; Kostopoulos & Bozionelos, 2011). It is about actors who are more
concerned about working within established trust structures rather than building new relations (Buskens & van de Rijt, 2008). An entity focused on exploitation aims to protect itself against external threats by viewing each other as interdependent (Baer et al., 2010). An entity that engages in exploitation shares information to the extent that information is redundant, that is, members have access to the same information, so that information flows more efficiently, is accepted more readily, making coordination and progression more effective (Alderfer & Smith, 1982; Joshi, 2006). Mapping key terms associated with exploitation and team learning onto key terms associated with closure and innovation are highlighted in Table 3.

<table>
<thead>
<tr>
<th>Closure</th>
<th>Exploitation</th>
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<tbody>
<tr>
<td>Specialising within a social entity</td>
<td>Collaboration</td>
</tr>
<tr>
<td>Social norms</td>
<td>Interdependence</td>
</tr>
<tr>
<td>Refinement of knowledge</td>
<td>Standardised knowledge</td>
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</table>

Table 3 | Similarities between closure and exploitation

Whilst the terms related to both closure and exploitation may be similar, they do not necessarily mean the same thing. Closure within a social network may support exploitation, for example, a social entity that has closure can exploit internal resources through knowledge exchange and combination (Nahapiet & Ghoshal, 1998). Closure may also enable exploitation because closure reinforces the status quo (Burt, 2005: 214).

There are downsides for a group that remains closed for a prolonged period, where they spend an inordinate amount of time exploiting only those resources from within. Closed teams reinforce boundaries, increase density, deepen, and widen the holes between them and other ties (Burt, 2005). For this reason, closure can have a negative relationship with innovation (Baer et al., 2015).

2.2.7. Factors that influence social relations

There is considerable empirical support for several factors that affect important elements and characteristics of social networks. Given the fact brokerage is an individual level construct due to the dyadic
nature, while closure a group level construct due to the alignment of multiple members, such factors span both individual and collective levels of analysis and include: individual characteristics such as, interpersonal cognitive structure (Brands, 2013) and proactive personality (Grant & Ashford, 2008); as well as contingency conditions such as leadership (Pettigrew, 1998), team dynamics (Edmondson, 1999; Schippers, 2014), and culture (Borgatti et al., 2009; Sørensen, 2002). Beyond the individual there is limited research that measures the impact of individual brokering activity on inter-team performance. Exceptions include research on functional experience (de Vries et al., 2014) and meta-knowledge structures (Mell, van Knippenberg, & van Ginkel, 2014).

Given the complexities associated with the innovation process (Amabile, 1988; Garud et al., 2013) and social networks (Brands, 2013; Nahapiet & Ghoshal, 1998; Wolff et al., 2008), Woodman, Sawyer, & Griffin (1993) recommend that product, process, person, and situation, as well as a micro, meso, and macro approaches are considered when examining the antecedents or determinants of boundary spanning by team members. These are outlined below:

2.2.7.1. Organisation, macro level

Organisational structure, culture and climate have been found to impact total quality management systems (Baer & Frese, 2003) with culture creating effective norms for continuous innovation, climate permitting people to take risk and structure facilitating the flow of communication. These social norms are considered the least visible yet the most powerful forms of control over workers’ actions (Bettenhausen & Murnighan, 1985). Organisational wide behaviours generate a climate of trust that facilitate knowledge sharing and combination (Brass et al., 2004; Nahapiet & Ghoshal, 1998) and a capability or capacity for the organisation to respond to the opportunities that this social capital offers (Collins & Smith, 2006). Research has found evidence that these efforts by the employees are increased when rewarded by the organisation through HR (Galbraith,
Downey, & Kates, 2002; Jolink & Dankbaar, 2010; Yuan & Woodman, 2010).

2.2.7.2. Group/team, meso level

Task characteristics, task complexity, and intergroup competition are driving forces for intra and intergroup collaboration (Faraj & Yan, 2009; Kostopoulos & Bozionelos, 2011; Scott & Bruce, 1994). Expectations by team members is also a large influencing factor in determining which behaviours are accepted by the group as a whole (Detert & Burris, 2007; Lewin, 1951) especially when it comes to decision making (Cyert, Dill, & March, 1955) as workers like to feel supported in their actions (Edmondson, 1999). Separately, the leader has a significant role in intergroup networking as their effectiveness reflects onto the team; if it is central, like an individual social entity this provides greater advantage for information flow (Balkundi et al., 2011; Hogg et al., 2012).

Team structure is also a significant factor on team performance as it determines lines of communication, status and influence (Ertug & Castellucci, 2013; Pearce & Xu, 2012). As we learned from the social networking literature, structure provides social capital and there are largely two conflicting network structures, brokerage and closure, each bringing advantage and disadvantage. A dynamic network structure supports the capacity for an entity to bridge relationships that are thought to provide diverse information and knowledge, and bring this back to the closed network where bonding facilitates recombining new information with current knowledge (Han et al., 2014; Henttonen, Johanson, & Janhonen, 2014). As was discussed in section 2.2.3.3.2 Stage two, development, diverse team structures can support the team to integrate new knowledge with existing knowledge for innovation.

Perhaps a third category of network structure would support the modern team, one that is neither closed nor open but ‘clopen’- a portmanteau of the words ‘close’ and ‘open’ used in topology to
describe the relationship between sets (Kanibir & Reilly, 2011). In the context of social networks, a ‘clopen’ team is a team that recognises the strength within the team and the advantages beyond the team for the team, thereby, maintaining a focus on both brokering connections with significant others whilst managing closed relations. A ‘clopen’ team could mean a more diverse team with people pooling resources to build an intellect and capability for survival and competitive advantage (Goyal & Akhilesh, 2007; Joshi, Pandey, Han, 2009).

2.2.7.3. Individual, micro level

Personal connections are formed for at least four reasons: homophily, people network with like-minded or similar others, for example race (Flynn, Reagans, & Guillory, 2010); situational, depending on the need, for example task related information (Wolff, et al., 2008); personality, some people enjoy building new relationships, for example, proactive personality traits (Grant & Ashford, 2008); and cognition, who we perceive is in our network (Anderson, 2008; Brands, 2013; Kilduff, Crossland, Tsai, & Bowers, 2015). Whatever the reason, individuals shape personal networks.

2.2.8. **Conclusion**

The research question that led the SLR was - *what role(s) do social relations have in the innovation process?* The response to this question is summarised below.

Innovation is a process consisting of three stages, invention, development, and implementation. Teams rather than individuals innovate because no one person or entity has all the relevant resources required to bring an idea from conception to implementation. Therefore, innovation is a social process. One of generating new knowledge to combine with existing knowledge. However, herein lies the complexity associated with innovation because it can be difficult for some teams to source knowledge external to the team and recombine with existing knowledge from within the team.
Sourcing and combining knowledge is a process in itself because it concerns the structural arrangement of social relations, both the number of ties and strength of ties. For example, fewer ties allow actors to improve relationships as they spend more time on the smaller number of entities they relate to (Granovetter, 1973). Alternatively, more ties provide actors with access to additional information and resources and possibly greater variety (Allen et al., 1979; Podolny & Baron, 1997). If social actors were constantly working towards building additional relationships, then the advantages of such relationships are lost (O’Reilly & Tushman, 2008; Reagans & Zuckerman, 2008). Similarly, if actors are exclusively focusing on existing relationships then despite the high levels of trust typically found (Burt, 2004) they cut themselves off from new relationships where different information is available, thereby converging their advantage (Buskens & van de Rijt, 2008). Weak ties (measured in time, intensity, and reciprocity) also bring unique advantage by way of access to non-redundant information (Granovetter, 1973). Alternatively, knowledge is typically redundant among strong ties (Fliaster & Spiess, 2008; Jack, 2005).

Two dominant categories of social network structures, brokerage and closure, each bring distinct advantages and disadvantages (Baer, et al., 2015). Conflicting activities for innovation, largely described as brokerage and closure, are linked to the conflicting demands of innovation, largely described as creativity and innovation, to roles for exploration and exploitation in the innovation process (Gupta, Smith, & Shalley, 2006; March, 1991; Posen & Levinthal, 2012). Exploration and exploitation are strategic learning phases which have appropriate roles throughout the innovation process that, when made explicit, give permission to manage a reflexive team structure for the purpose of progress.

Thus, all other things being equal the literature reflects the assumption of a trade-off between the quality and number of relationships an entity has (Brass, Galaskiewicz, Greve, & Tsai,
2004: Ibarra et al., 2005) and network structures. A multilevel perspective on social network structures (Brass et al., 2004) which examines the opportunities and constraints inherited in networks generally suggest a benefit in balancing large number of connections in a network (brokerage) with smaller numbers (closure) (Burt et al., 2013; Ibarra et al., 2005; Janhonen & Johanson, 2011; Tsai & Ghoshal, 1998). Thus, a degree of balance is often seen as beneficial, which mirrors related arguments in the areas of strong and weak cultures (Sørensen, 2002), people and task-oriented cultures (sociability and solidarity, see Goffee & Jones, 2000), and exploitation and exploration more generally (Kostopoulos & Bozionelos, 2011).

2.3. The relevance of the SLR for theory development

A systematic literature review brings rigor and thoroughness to the literature review process. It provides a roadmap for a reproducible, reliable, knowledge stock (Tranfield et al., 2003). This was important because the traditional approach provided only the possibility of conceptual framework. Whereas the SLR provided a more promising conceptual framework owing to the rigorous process. However, there were two other advantages of the SLR that were transformational in shaping the study. The first was the confidence that no stage model existed of the innovation process at team level. The second was that SLR allows for considering the role of alternative concepts (to social relations) for the innovation process. This process shifted the focus from roles for social relations, to roles for exploration and exploitation as strategic learning phases. Overall, the SLR of the social/relational element of the innovation process highlighted three things:

One, many studies tested the relationship between social relations and innovation but not the role of social relations within and across the innovation process at the level of the team. Obstfeld’s 2005 study is significant because it investigated the role of social relations across time for new product development. Although the study was
conducted at the level of the organisation, it found diverse and dense social arrangements predict involvement in innovation.

Two, innovation is largely a team activity (Alexander & van Knippenberg, 2014; Ancona, Backman, & Bresman, 2008). Innovation requires a balance of new and existing information at different stages for progress and thus a certain balance of conflicting activity needs to be found (Andriopoulos & Lewis, 2009; Carnabuci & Dioszegi, 2015; Smith & Tushman, 2005). ‘Activity’ refers to exploration and exploitation, search and selection, brokerage and closure, etc.

Three, social relations are significant for innovation owing to the inherent social capital by way of knowledge, skills, attributes (power and influence) and resources. Social capital is dependent of the structural arrangement between entities as well as cognition and interpersonal relations. A team, structurally, is like closure which makes it a challenge for the team to benefit from knowledge, skills, and resources potentially available through brokerage, and herein lies the difficulty for innovation at the level of the team. To meet the significant challenges an entity, such as a team, is required to create a learning climate and the capacity to challenge norms while simultaneously maintain trust (O’Reilly & Tushman, 2008; Sugarman, 2014). Shifting focus from social relations to a trajectory of learning gives permission to engage in relevant activities for progress through the innovation process. Therefore, informed by the SLR the conceptual framework that guided the empirical study shifted focus towards learning strategies facilitated by social relations.

Chapter three will discuss the theory and research model.

3. THEORY DEVELOPMENT AND RESEARCH MODEL

This chapter builds a theory to explain how teams progress through the innovation process. A review of key concepts is provided – the
innovation process, teams and team learning, and, exploration and exploitation as learning strategies and activities. Then, a theory is presented that explains how teams make progress through the innovation process by cycling between learning strategies and activities facilitated by social relations. This theory provides the hypothetical conceptual framework for the empirical investigation. The chapter continues by describing approaches to research on the innovation process and concludes with an introduction and discussion of the research question.

Innovation is dependent on “variation–selection–retention” (O’Reilly & Tushman, 2008: 200), a process that includes both the availability and use of new information and the subsequent selection and retention of only a subset of such information (Ancona & Caldwell, 1992). Separately, team performance is enhanced when teams engage with both internal learning and external learning. Internal learning refers to how team members explore options and seek clarification within the team; external learning refers to team members exploring options and new information from beyond the team (Bresman & Zellmer-Bruhn, 2013). Exploration and exploitation are often recognised as two types of learning processes (March, 1991) that contribute to the acquisition or development of knowledge, both of which form a central component of innovation (Paananen, 2009). Exploration is learning by acquiring new knowledge while exploitation is learning by combining new knowledge with existing knowledge (Gupta et al., 2006; March, 1991; Nieves & Osorio, 2013). Therefore, in the context of innovation both exploration and exploitation activities are necessary for progressing through the innovation process (Gupta et al., 2006). Exploration with its focus on novelty, difference, and acquisition is akin to an opening of the process to the outside, while exploitation with its focus on existing knowledge, integration and use represent a form of closing. These terms (opening and closing) are prominently used in the social network literature where they refer to an entity opening outwards to
explore new contacts and to receive new information, knowledge, and ideas before turning inward to combine this information with knowledge they already possess within their closed system (March, 1991).

The challenges associated with exploration and exploitation for innovation concern the trade-off, balance, and choices between exploration and exploitation as each offer unique but limited and converging rewards, and compete for scarce resources (March, 1991). While methods for organizations to manage these competing yet complementary learning strategies are discussed in the literature (e.g., (Raisch & Birkinshaw, 2008) there is a distinct lack of work that considers how this is and can be managed at team level. This topic is elaborated in two ways: the role and value of each approach is discussed in the context of an ideal type model of the team-based innovation process, and how teams deploy these approaches as part of their progress through the innovation process are described.

In this context, innovation is conceived of as a process rather than an outcome and link the extant literature on exploration and exploitation to the fundamental processes of innovation (i.e., the generation of novelty) and implementation (i.e., the application of novelty) that are central to most dual-process conceptions of innovation (e.g., Amabile, 1988; West, 2002a). Next, this dual-process logic is applied to a contemporary three-stage model of innovation (Garud et al., 2013) which offers a more refined analysis of the innovation process by locating exploration and exploitation as driving forces within each of the three stages of the innovation process. This approach results in an ideal type model of the innovation process that is employed as the theoretical framework to discuss the way teams make use of these approaches in their progress through the innovation process. The focus on the team-level of analysis results in considering both trans-team activities that facilitate exploration activities focused on newness and variety, and intra-team activities that facilitate exploitation activities aimed at refinement and alignment. Further, the
ways in which teams’ balance and switch between exploration and exploitation is described as well as factors that can facilitate or hinder progress. Finally, the potential of this approach to guide empirical investigations of team-level innovation activities is discussed, and the managerial and organisational implications of this work is highlighted.

3.1. The innovation process

While considerable theoretical and empirical attention has been given to conceptions of innovation as an outcome (Parthasarthy & Hammond, 2002; Quintane, Mitch, Reiche, & Nylund, 2011), innovation is defined here as “the process of inventing, developing, and implementing new ideas” (Garud et al., 2013: 776). The first stage of this innovation process is invention, the fuzzy front end of innovation (Biedenbach & Müller, 2012) where opportunities are explored (Garud, et al., 2013) and ideas are generated, captured, or presented (Amabile, 1988; Hagedoorn & Cloodt, 2003; Hirst et al., 2015). Development is the second stage of the innovation process where ideas are elaborated and made explicit or even warranted being labelled a ‘project’ (Amabile 1988; Garud et al., 2013). Implementation is the third stage in the innovation process where products, processes, or services are brought to a point where they can be deemed ready for deployment to the market or user setting (Garud et al., 2013; Van de Ven, 1986), leading to the outcome of the innovation process. While the sequence of stages makes it easier for protagonists and observers to structure the process, stage models assume the stages occur in order even though empirical and anecdotal accounts of innovation indicate that they often do not (e.g., Burgelman, 1983; West, 2002b).

This three-stage model is preferred over the more traditional two-stage model of innovation which distinguishes between two phases, they are invention and implementation (e.g., Birkinshaw, Hamel, & Mol, 2008) or creativity and innovation (Paulus & Dzindolet, 2008; West & Farr, 1990) because the three stage-model provides greater
depth for investigating how a team manages the innovation process. However, the two-stage model is worth mentioning here because it reflects the logic of the fundamental roles of exploration and exploitation for the innovation process. Invention and creativity is the discovery of a problem, emergence of an idea, initiation and generation of something new or different, or the discovery of a problem (Amabile, 1988; Baer & Oldham, 2006; Garud et al., 2013; Paulus & Dzindolet, 2008). Implementation or innovation, in this context, comes after creativity and is the acceptance or application of the idea by relevant stakeholders (Baer & Oldham, 2006; Garud et al., 2013). This foundational distinction between idea invention (creativity) and idea implementation (innovation) is referred to here when assessing the role of exploration and exploitation for innovation processes.

3.2. Teams and team learning

Innovation is largely conducted at level of the team (Bessant, Alexander, Tsekouras, Rush, & Lamming, 2012; Bouncken et al., 2016; Bresman & Zellmer-Bruhn, 2013) because teams are “information-processing systems” (Edmondson, 1999: 350). Their structure and design influences learning behaviours for innovation (Argote & Fahrenkopf, 2016; Bunderson & Sutcliffe, 2003).

This section of the thesis provides a review of the literature on team learning. First, a definition of innovation project teams is provided as is the context for this study. Then, a review of team learning is provided, what is team learning, how teams learn and factors that influence team learning in the context of innovation.

There are many different types of groups and teams (Guzzo & Dickson, 1996; Hackman, 1990) but this study is concerned with the innovation project team using this definition, a team “whose members take individual and collective responsibility for their shared objectives and interactively coordinate their interdependent activities through role and specific assignments” (Martin & Fellenz, 2017: 192).
Team members must learn what their role is and how to be in their role, both politically and task orientated at any point in time and across time (Woolley, Aggarwal, & Malone, 2015). Also, the team, collectively, must learn how to be a team, what their role is as a team and how to achieve their team objective (McGrath, Arrow, & Berdahl, 2000). In addition, the organisation learning literature provide insights on three additional aspects of learning: how teams learn from other teams; how knowledge changes over time; and how context such as structure affects knowledge acquisition and retention (Argote, Gruenfeld, & Naquin, 2001). These aspects of learning suggest that teams learn and advance through social-cognitive elements (Konradt, Otte, Schippers, & Steenfatt, 2016).

Team learning is a branch of organisation learning stemmed from education where Dewey (1922, in Edmondson, 1999) described learning as an iterative process. As a process, team learning “consists of activities carried out by team members through which a team obtains and processes data that allow it to adapt and improve” (Edmondson, 1999: 351). Such activities include: seeking, sharing, asking, talking about, experimenting, discovering, feedback, etc. Alternatively, as an outcome team learning is defined by “a change in knowledge” (Argote, Gruenfeld, & Naquin, 2000: 370).

The majority of research on teams is conducted in a laboratory setting (Argote et al., 2001; McGrath et al., 2000) where researchers observe group dynamics and processes in order to distinguish what changes and how (Cronin, Weingart, & Todorova, 2011). In terms of what changes Argote et al., (2001) highlight four elements (CORE): Construction including recruiting members and establishing themselves for performance; Operations in terms of how the team problem solve technical issues and resolve conflict; Reconstruction that describes how they modify themselves for progress; and, External relations that acknowledge the team’s connection to relations beyond the boundary of the team.
In terms of how teams learn there are three stand-out theories in the group literature, including reflexivity, goal orientation, and knowledge transfer. Reflexivity “describes the extent to which teams think about their strategies and behaviors and adapt their functioning” (Konradt et al., 2016: 2). Likewise, teams learn from experience, either direct experience or indirect experience by encoding, storing and retrieving knowledge (Levitt & March, 1988). To store and retrieve knowledge members need to think about the information both on receipt and to retrieve to apply learning thus leading to the outcome of changing knowledge.

Second, teams learn depending on their proactive goal orientation of which there are at least two conflicting goal orientations that teams may switch between. There is a learning orientation which is focused on developing competencies or building new competencies, and there is a learning orientation focus on proving competence for personal or other recognition (Bunderson & Sutcliffe, 2003). In addition, there is a learning orientation towards acquiring new and different information and a performance orientation on maintenance (Alexander & van Knippenberg, 2014; Yaping Gong et al., 2013).

Third, teams learn by transferring knowledge (tacit and explicit) between members and non-team members. There are various sources for facilitating knowledge transfer including: tools (Web 2.0 for storing and transferring knowledge), tasks (demonstrating routines or methods), and networks (social networks) (Argote & Fahrenkopf, 2016). Networks are highly utilised for transferring knowledge both internal and external (Bresman & Zellmer-Bruhn, 2013). Internal concerns knowledge transfer between team members and external concerns knowledge transfer between team members and non-team members such as experts (Woolley, Gerbasi, Chabris, Kosslyn, & Hackman, 2008).

Team learning is contingent on several factors including trust, leadership, shared beliefs, and team structure and design
Trust or a climate of psychological safety affects the extent to which team members are comfortable to ask questions or share their unique knowledge or views without fear of negative judgement (Edmondson, 1999). Team learning is therefore an intentional activity where the climate permits learning in a positive way. This climate is created by the team, their cognition and interpersonal factors as well as team leadership (Edmondson, 1999). Cognitive tendencies influence individual, and group level perception of relationship structure, and collective goals (Brands, 2013; Lester, 2013); and an entity’s capacity to build effective relationships with others either individually (Grant & Ashford, 2008) or collectively (Hogg, van Knippenberg, & Rast, 2012).

A learning environment is therefore one where it is assumed safe to learn by challenging, questioning, providing feedback and sharing knowledge (Kostopoulos & Bozionelos, 2011). Without trust, there is no learning, and without learning adaptation is challenging because of the status quo and equally, intervention is challenging because it is forced, although necessary.

Team leadership has a pivotal role to play in influencing team learning by flexing between encouraging and promoting team learning and team performing (Gong et al., 2013). Leadership has the ability to discern where the direction of energy, the power to make the decision to switch between orientations and the status to influence beyond the team boundaries for learning (Hogg et al., 2012).

The team must make a ‘collective shift’ in their goal orientation, move to a shared vision of a goal and decide the actions and activities required to achieve that goal to learn as a team (Alexander & van Knippenberg, 2014). Alternatively, individual learning may be valuable to the individual and perhaps the team if the individual(s) are able to influence the team.
Team design has perhaps the biggest influence on team learning because design includes team task, resources, rewards, context, etc. (Edmondson, 1999). Structure is also an aspect of team design and is defined by hierarchy height, degree of specialization, and formality (Bresman & Zellmer-Bruhn, 2013). Structure informs roles, rules, and norms but also the quality and amount of information, power, and influence (Burt, 2004; Balkundi & Harrison, 2006) as team members organise themselves for performance. Structure, depending on cognition and interpersonal relations shapes social capital certain actions by those involved (Burt, 1992; Carmeli & Halevi, 2009; Coleman, 1988).

Cognitive perception of relationships is both an individual and group level concept (Brands, 2013; Nahapiet & Ghoshal, 1998). Individuals differ in how they perceive relationships that may facilitate or hinder their ability to capitalize on the potential benefits of such social capital (Brands, 2013; Kilduff, Crossland, Tsai, & Krackhardt, 2008). Personality can influence these interactions (Fang et al., 2015; Seibert, Crant, & Kraimer, 1999). Openness to experience, for example, facilitates external information seeking and new relationship building (Baer & Oldham, 2006a); self-monitoring maximises advantage or decrease the disadvantage that can be gained from interactions in social settings (Mehra, Kilduff, & Brass, 2001); and initiation (Baer & Frese, 2003) and other effective social skills contribute to individual’s capacity to navigate the social and political landscape and create opportunities for improved performance (Thomas, Whitman, & Viswesvaran, 2010). At group level shared vision of the group’s goals and purpose can support group collaboration and lead to improved performance (Lester, 2013; Nahapiet & Ghoshal, 1998; Tsai & Ghoshal, 1998). The social capital generated at individual level is converted to communal and human capital (Dost, Badir, Ali, & Tariq, 2016), a higher-level capital based on the diverse make-up of the group (Richter et al., 2012) and collaboration amongst team members (Baer et al., 2010).
Relationships are based on factors at individual and team levels (Randsley de Moura, Leader, Pelletier, Abrams, & Abrams, 2008). At an individual level these factors include: personality, for example proactivity which can support reaching out to connect with another person (Grant & Ashford, 2008); and homophily that describes the comfort in preferring to build relationships with others from a similar background or with whom individuals believe they have something in common (Joshi, 2006). At team level, climate and leadership can have a significance influence on relationships: A psychological safety climate concerns how people collaborate (Collins & Smith, 2006) as it “describes perceptions of the consequences of taking interpersonal risks” (Edmondson & Lei, 2014: 30), to challenge norms, ask questions, express doubt and anxiety about the work (Lovelace, Shapiro, & Weingart, 2001); and, a leader can create an effective coalition between groups when managing the relational element by recognising different groups’ identity (Hogg et al., 2012).

Two categories of structural arrangements that can facilitate team learning and innovation are trans-team and intra-team relationships. Trans-team relationships link the whole team or individual team members to entities outside the team. Such relationships offer access to non-redundant information (Burt, 2005), increase diversity and variety of information available to the team (Ancona & Caldwell, 1992; Coleman, 1988), and help transfer different opinions or practices (Carnabuci & Dioszegi, 2015). Thus, trans-team relationships enable and import novel thinking and action.

Intra-team relationships operate between and among the members of a team and are often salient to all team members (Alderfer & Smith, 1982). These relationships are crucial for internal alignment (Pearce & Ensley, 2004) and aid conformance and cooperation (Flynn et al., 2010; Hu & Randel, 2014; Oh, Chung, & Labianca, 2004; Tan, Zhang, & Wang, 2015).
3.3. **Both exploration and exploitation activities drive the innovation process**

Exploration and exploitation are considered strategies and activities (Gupta et al., 2006). A strategy is a plan for action (Cunningham & Harney, 2012) whereas activities are a form of action (Ancona & Caldwell, 1992; Cross, Yan, & Louis, 2000). Exploration and exploitation are considered in their guise as strategies (where they are used as descriptive categories, or as purposeful approaches to achieve outcomes) and as activities (where actions by individuals, teams or other actors contribute or detract from progress along the innovation process). Originally described as two broad types of learning strategies (March, 1991), exploration is largely associated with increasing diversity, creating newness, difference, and generating variety (Lavie et al., 2010; McGrath, 2000) via search, discovery, and experimentation (March, 1991). Exploitation is largely associated with refining and using existing knowledge and competencies (Levinthal & March, 1993) and reducing variance (Lavie et al., 2010) via selection and execution (March, 1991). Each brings unique benefits - exploration offers possibilities by experimenting with new alternatives, and exploitation enables the refinement of existing competencies (March, 1991; Raisch et al., 2009). Search and selection are strategies (March, 1991) whereas increasing, creating, generating and refining ideas are activities (Amabile, 1998). This distinction between strategies and activities (Gupta et al., 2006) is significant and will be highlighted further in comparing the logical strategies involves in the innovation process with the typical activities pursued by individuals and teams which come into clearer focus through the lens of the ideal-type model of the innovation process below.

As strategies, exploration and exploitations are frequently described as either competitive or complementary, depending on how they are defined (Gupta et al., 2006). March (1991) argues they are both. They compete if they are required at the same time or if they use limited
resources, yet they complement each other if they are arranged sequentially (Kostopoulos & Bozionelos, 2011) or if they can be appropriately balanced (March, 1991). As competitive strategies they vie for resources; both require time, attention, and effort (Laureiro-Martínez, Brusoni, Canessa, & Zollo, 2015) and crowd out activities aimed at the alternative strategy. As complementary strategies one feeds the other; the advantages earned by exploring are harvested by exploitation, and the advantages earned by exploiting can and must be further explored to assure continuous adaptability and survival in complex and dynamic environments (March, 1991).

As activities exploration and exploitation are also essential for learning (Lavie et al., 2010). The distinction lies in the intention and the action, for example, a team member may be conducting a customer survey (an exploration activity) for the benefit of selecting which product idea they should choose (an exploitation activity) (Gupta et al., 2006). Therefore, precise definitions of exploration and exploitation and their unit of analysis are required (Gupta et al., 2006).

The value in engaging in these strategies and activities is context dependent. The time and effort allocated to exploration or exploitation is determined by returns from the process, self-motivated goals and objectives (Yuan & Woodman, 2010), or exogenous events such as executive decisions or market requirements (March, 1991). For example, the sale of a product is often dictated by many factors outside the control of the organization, such as a season or trend (Knight, 1967). In such circumstances the organization is dependent on simultaneously exploring alternative products or services to replace the product they are currently exploiting (Gupta et al., 2006) to remain in business.

Still the challenge how to manage exploration while exploiting remains (March, 1991). Balance is typically achieved in two different ways simultaneously or sequentially (Andriopoulos & Lewis, 2009).
At organizational level, architectural solutions (Gupta et al., 2006) structurally separate exploration and exploitation so they can be managed and resourced simultaneously, such as through strategic alliances or business units (Andriopoulos & Lewis, 2009; Raisch & Birkinshaw, 2008). Some of the world’s largest organizations apply this approach such as Google, Microsoft, and Allergan. Google have two methodologies for attracting innovation: one approach encourages employees to interact with each other to generate and submit ideas through a variety of communication channels; the other encourages anyone, from inside or outside Google, to generate innovation ideas via their Open Source methodology (He, 2013). Microsoft initiated over 100 innovation centres (MIC) across the globe, bridging the gap between local government, universities, and industry partners to generate new ideas. Microsoft funds the MICs and offer workshops for innovators to generate, develop and bring their idea to proof of concept (Microsoft, 2017). Equally, Allergan drives long-term growth with an innovation ecosystem designed to integrate collaboration with biotech companies, academia, and other pharmaceutical companies via their ‘Open Science’ model (Allergan, 2018).

At team level there are even fewer resources than at organizational level for engaging in the alternative strategy, however, it is conceptually possible that similar practices apply (Andriopoulos & Lewis, 2009) when exploration and exploitation are regarded as activities. For example, a team can appoint individual members to specific roles and responsibilities, or split the team into sub-groups (C. Fang, Lee, & Schilling, 2010) so they are able to simultaneously explore additional resources while exploiting current competencies.

Sequential attention more akin to a punctuated equilibrium pattern (Tushman & Romanelli, 1985) is an alternative option (Gupta et al., 2006). This approach to sequencing exploration and exploitation is compared to the two-stage model of innovation, creativity and innovation. The more traditional two-stage model of innovation
highlights conflicting value in sequencing competing activities such as the plethora of terms used to describe aspects of innovation including: divergence and convergence that describe respectively the imaginative nature of an entity to invent something followed by their structured approach to producing it (Lewis & Wright, 2012); development and introduction refers to the creative process of developing an idea followed by its implementation in a practice setting (Anderson, 2008); risk and influence invoke the complexities involved in creating disruption in the organization by making changes followed by the ability of the organization to influence others that their idea is innovative (Kanter, 2006, 2010); learning and performing characterises the team switching between goals for radical innovation (Alexander & van Knippenberg, 2014); and finally, getting ready to perform and then performing (Gersick, 1988; Romanelli & Tushman, 1994).

This sequential approach, similar to search and combination (Savino, Messeni Petruzzelli, & Albino, 2015; Singh, Kryscynski, Li, & Gopal, 2016), is generously covered in the literature with several studies reporting the benefits of opposing strategies, such as ‘bridging and bonding’ (Henttonen et al., 2014), that is bridging the benefits of external relationships with the benefits of internal relationships for performance; as well as the benefits of integrating open and diverse networks with closed and specialised networks (Ter Wal, Alexy, Block, & Sandner, 2016). Further research has also considered the effect of contrasting leadership styles such as delegative and directive which was found to counteract the negative effects of using only one of the two (Gebert, Boerner, & Kearney, 2010). However, Paananen (2009) found that regardless of where knowledge comes from, e.g., customers, employees, market, etc., its value is determined by the extent to which it complements existing knowledge to decrease risk and uncertainty.

These distinctions are related to different processes where the first reflects activities in which alternatives are generated, identified, and
explored; new data and potentially additional resources are acquired, and the variety of information considered increases. In contrast, the second set of terms relate to processes that capitalize on this data to complete the innovation task by evaluating, selecting, combining, refining, and using an ultimately reduced set of data. The distinctions between these two sets of processes are closely related to the process strategies and activities of exploration and exploitation.

Extant research on antecedents and consequences of exploration and exploitation at team level are extremely rare (Hirst et al., 2015). Findings suggest individual self-efficacy is a factor at team level (Hirst et al., 2015). Alternatively, the majority of studies have focused on the organisation where findings suggest organisational structure and social status (Andriopoulos & Lewis, 2009; Perretti & Negro, 2006), context (Lavie et al., 2010), and social networks (Stadler, Rajwani, & Karaba, 2014) have a positive relationship with an entity’s capacity to balance exploration and exploitation.

Focusing on the team as the unit of analysis in the context of the innovation process at team-level, exploration and exploitation are defined as mutually exclusive learning strategies (March, 1991) encompassing complementary activities (Lavie et al., 2010). Exploration is the most appropriate strategy when the team needs to increase information variety and other resources through search activities such as questioning current assumptions, seeking new or additional information, resources, knowledge, or capability (McGrath, 2000). Alternatively, exploitation is the most appropriate strategy when the team needs to decrease information variety through selection activities such as gaining consensus, discarding and converging options, and refining ideas to capitalize on existing potential (Beckman, 2006). Both strategies and activities of exploration and exploitation are important for innovation at different stages (Ancona et al., 2008; Marrone, 2010; Nahapiet & Ghoshal, 1998).
3.4. The research model

All three stages of the innovation process (invention, development, and implementation) contain a complex set of within-team processes where progress is made by exploring opportunities derived from gaining new knowledge and exploiting opportunities derived from refining and using current knowledge (Ibarra et al., 2005; Aparna Joshi et al., 2009; Tsai & Ghoshal, 1998). This creates a logical pattern for sequencing phases with exploration occurring first in each stage to generate increased information variety, and exploitation following in each of the three stages to extract value and refine the available information to a point where the stage can be completed. In other words, this pattern reflects the requirement in each stage to begin with a phase of exploration to obtain new knowledge and increase informational resources, and end with the competing, yet complementary phase of exploitation to capitalize on earlier efforts.

Progress along the innovation process requires frequent switching between exploration and exploitation, and a range of endogenous and exogenous factors or events can trigger such changes of focus or direction. These triggers may be time related (Gersick, 1988; Grief & Keller, 1990), where there is demand for progress to meet a certain deadline or where external attention is expected at times. They can also be deliberate, for example if team members review progress and decide to switch to another phase (Andriopoulos & Lewis, 2009).

This is most obvious at the end of each of the three stages where a singular event typically heralds the start of one of the stages of innovation, such as in decisions to solve a problem, address a particular need or pursue an idea (which starts the invention stage), to select a specific idea for further development (which heralds the end of the invention stage and the beginning of the development stage). Or, the decision to finish further idea refinement and start the introduction of the idea in a particular practice (which indicates the end of the development stage and the beginning of the implementation stage). In any case, both exploration and exploitation are necessary for innovation to progress, and it is the interplay of
these different strategic phases and activities that enables progress through the innovation process.

The resulting ideal-type model (3DM) of the innovation process is presented in Figure 1. As is common for ideal type model (see Swedberg, 2018), the 3DM accentuates certain aspects of the innovation process and does neither claim to be a comprehensive description of, nor a normative prescription for, actual innovation processes. Rather, it is a conceptual device that structures and highlights selected elements of innovation processes that are unlikely to be found exactly as described “empirically anywhere in reality” (Weber, 1949: 90) but may be valuable for inquiry, analysis, and evaluation. As such, the 3DM depicts the simplest logical pattern of exploration and exploitation given the three-stage nature of the innovation process. The 3DM demonstrates the complementary nature of both approaches (exploration and exploitation) which are necessary for progression through the innovation process. The 3DM contains numerical labels across events and processes: the odd numbers represent events for starting, stopping, or switching between phases while the even numbers represent phases and activities of exploration and exploitation. The left side of each diamond (numbers two, six, and ten) represent phases of exploration characterized by search for verdant information and resources; the right side of each diamond (numbers four, eight, and twelve) represent phases of exploitation reflecting the refinement and selection of available information and resources (Oh et al., 2006). Collectively, the 3DM highlights 13 distinct events and phases in an ideal-type model for any innovation process.

![Figure 1](image-url)
This model is limited to three geometric diamond shapes to reflect the three-stage model of innovation, although its logic can be applied for different conceptions of the innovation process (e.g., the two-stage approach discussed above, or a four-stage process that includes a final stage of dissemination or market roll-out (e.g., Burrus, Edward Graham, & Jones, 2018). As an ideal type of the innovation process the 3DM reflects a significant reduction of complexity. Many innovation processes may have more than three sets of exploration and exploitation activities because of iterative processes, false directions, restarts, or other complications due to the complicated nature of innovation and the complex context in which they take place. Below, the 3DM is elaborated as an ideal type model of innovation process taking place at the team level in an organization.

3.4.1. The innovation process at team level, invention
In this context the innovation process begins with the presentation of an idea (or problem, opportunity, etc..) to the team (Amabile, 1988). Invention is the first stage where an idea or ideas are accepted to the point that they command attention and consideration, leading to search and exploration. Exploration in the invention stage typically invites external search, individual and collaborative creativity, intuition, non-rational thought processes, and lateral thinking (Pirola-Merlo & Mann, 2004); and often requires playful and non-judgmental approaches (de Bono, 1995) all of which are necessary for creativity and innovation (West, 2002b). The value of exploration is dictated by the organization or other stakeholders, or by other factors within or beyond the group. Ultimately, the value of exploration can only be realized by exploitation (March, 1991). Therefore, after some time exploring is it advantageous for the team to switch to a strategy of exploitation (Salter, Ter Wal, Criscuolo, & Alexy, 2015). Exploitation in this stage is akin to the concepts of innovation (Amabile, 1988), selection (Paulus et al., 2010), convergence (Lewis & Wright, 2012), influence (Kanter, 2010), or performing (Gersick, 1988); it contains activities that result in a reduction of variation in thinking, restricts
problem-solving and decision-making to already available information, and reduces the variety of ideas ‘in play’. Exploitation directs creative urges towards internal recombination and synthesis in service of maximising efficiencies and gaining value from exploration (Andriopoulos & Lewis, 2009; W. K. Smith & Tushman, 2005).

The value of invention as a stage of the innovation process is fully realised by cycling between strategies of exploration and exploitation at appropriate, project specific levels. Such cycles are further discussed below but not modelled in Figure 1. At some time or dictated by some event, an explicit or implicit selection or decision is made concerning the acceptance or rejection of relevant ideas. If they are rejected the team may revert to an earlier phase of invention to explore alternative ideas, or they may exit the innovation process altogether. The successful conclusion of invention would provide at least one idea worthy of further development because of its inherent promise of being capable to realize the initial (or current) objective, for example, the elimination of the original problem that initiated the innovation process. A special case of concluding the invention phase would be the realization that no idea exists (or has been found or developed) that is capable to solve the problem or realize the objective. This special case would end the innovation process at step five. Alternatively, step five represents the decision to select an idea and continue its development starts the next stage of the innovation process.

3.4.2. The innovation process at team level, development
Development is the second stage of the innovation process where ideas are elaborated (Garud et al., 2013). A singular idea or distinct idea set needs further development, testing and critical evaluation to a point at which they can demonstrate some form of 'proof of concept' (Garud et al., 2013) - such as sketches, models, or other forms of compelling evidence (Hagedoorn & Cloodt, 2003) all of which can take considerable time, energy, and resources (e.g., equipment,
knowledge, technology, time, capital, senior management attention, etc.,). Development is a process that demands opening-up in the form of experimentation, learning, discourse and discovery as much closing down through analysis, evaluation, and selection (Van de Ven, Polley, Garud, & Venkataraman, 2008).

Exploration during the early part of the development stage typically involves a team to focus outwards for new perspectives and, additional information about their proposed idea, or negotiate additional resources such as money, time, equipment, or to focus on exploring internal resources in search of additional and new options for talking the emerging problems and challenges of development the idea further (e.g., Fleming & Waguespack, 2007; Hopp & Zenk, 2012; Aparna Joshi et al., 2009a; Perry-smith, 2006). Time and energy allocated to this phase of development is dictated by internal and external factors. Outcomes may include successful exploration and progress through the development stage, or alternative outcomes such as failure to secure necessary resources for developing the idea which forces the team to exit the process altogether; a re-orientation of the team’s attention to alternative idea(s); or reverting to the invention stage. External factors such as time can push the team in a different direction (Gersick, 1988). In any case, the value of exploring new possibilities in the development stage can only be realized by ultimately switching to exploitation (March, 1991).

Advancing the development of an idea(s) to proof of concept by presentation, sketch, or model (Hagedoorn & Clooadt, 2003) requires exploiting resources garnered from the earlier phase for maximum efficiency (e.g., Baer et al., 2010; Balkundi et al., 2011; Carnabuci & Dioszegi, 2015). An exploitation strategy in this latter phase of development is an opportunity for members to narrow their focus and mobilize the team towards a valid concept in preparation for presentation and implementation. Even at this latter stage of development, there is every possibility that the team are unable, for several reasons, bring the idea to a tangible form. For example, the
team learns they need to secure additional funds, resources, and knowledge, or they learn their idea lacks essential features. Any number of factors may dictate they return to an earlier phase of development, invention or exit the process altogether. There is no telling how long the idea will stay in the development stage nor how many times the team switches between exploration and exploitation strategies to maximise the opportunities this stage of the process offers innovation.

3.4.3. **The innovation process at team level, implementation**

Implementation is the third stage in the innovation process, the ‘long tail’ of innovation (Fleming, 2007) where products, processes or services are deemed ready for implementation in a distinct setting such as an organization or market (Garud et al., 2013). Several personal and contextual conditions are necessary for the developed idea to be implemented into a working concept (Baer et al., 2015) before innovation has happened (Van de Ven, 1986). Contextual factors include, for example, production capacity and economic conditions (micro and macro) (Garud et al., 2013). For this reason innovation is often conceived of as an outcome and measured by the number of research and development outputs, patent counts, patent citations, and new product announcements as indicators for innovative performance rather than actual sales of new innovations (Hagedoorn & Cloodt, 2003; Quintane et al., 2011) as full organizational or market implementation is often beyond the scope of the team involved in the original development of the respective innovation. In the present context, the full market or organizational roll-out is not considered as part of every innovation process, although the logic of the 3DM can accommodate this as well if desired. Full market roll-out is best captured by the innovation diffusion literature (Weenig, 1999). In any case, the following were included, activities such as the exploration of opportunities for implementation and influence attempts to prepare and create acceptance and use of a distinct, elaborated, and usable innovation.
proposition (i.e., the new product, service, or organizational arrangement).

In the initial phase of implementation, a strategy of exploration enables the team to learn how to best implement their idea. Other requirements in this early phase of implementation may include additional resources such as a marketing budget, plant equipment, time, or simply learning more about their ideas’ readiness for the market or practice setting it is aimed at. At some time or because of some event, the team will exploit these resources bringing the idea to close. Alternatively, the team may be required to return to earlier phases (i.e., invention or development) based on their learning during exploitation, on their decisions during the exploitation processes, or due to extrinsic factors (e.g., market conditions; executive decisions imposed on the innovation team).

3.4.4. The temporal interplay between exploration and exploitation
The effort expended on exploration and exploitation activities within each of the three stages is influenced by the goals and objectives, relevant incentives, and other factors such as external conditions and time (Gersick, 1988; Romanelli & Tushman, 1994). In addition, extensive exploration of potential ideas that leads to excessive collection of information and resources can lead to information overload and becomes as hindrance rather than a help in trying to progress the innovation process (Ahuja & Lampert, 2001; March, 1991). Equally, excessive exploitation will sharpen current competencies and extract value but also tends to prevent the team learning anything new (March, 1991) and moving on to the next stage – the potentially hindering fallacy of overdesign (Coman & Ronen, 2010) where the perfect becomes the enemy of the good. To ensure innovation progress, exploration ultimately needs to be constrained by exploitation to impose some form of closure and focus through evaluation, selection, rejection, and acceptance (March, 1991). Similarly, ultimately exploitation must be constrained through a
choice event that initiates the next stage of the innovation process. Thus, to assure progress through the innovation process some form of trigger is required to switch the team from a focus on one learning strategy to the other.

The diamonds shapes in the 3DM represent the three stages of the innovation process, each containing exploration and exploitation which lead, respectively, to an initial increase and subsequent decrease in the information variety actively considered by the team in each stage (see Figure 1). Realistically, any innovation process is unlikely to show this level of symmetry across the stages, because each stage will have its own unique shape and size in relation to the time and effort given to and the success achieved by exploration and exploitation activities. Equally, real-life innovation processes do not follow a perfectly linear path (Kanter, 2006) and contain many twists, turns, and pauses along the way (Bartel & Garud, 2009). To depict the complexity of activities inherent in the innovation process, elements of the 3DM can be further elaborated along the dimensions of time and information variety. The amount of time given to periods of exploration and exploitation is represented by the length of the diamond shape, and the variety in information (e.g., data, knowledge, resources, and opportunities) is represented by the height of each diamond shape. Logically, while the initiation of exploration leads to an increase of the variety of information collected and considered (and an expansion of the left side of the diamond – see two, six and ten in Figure 1), the shift from exploration to exploitation always begets a reduction of the relevant information variety effected through sorting, selection, and choice. Clearly, the linear and symmetric depiction in the ideal-type model does not reflect empirically observable instances of innovation progress in real life settings.

The volume (information variety) and length (time) aspects of exploration and exploitation in each stage are influenced by many factors including cognitive ability, motivation, and leadership
(Amabile, 1988; Garud et al., 2013; Jia et al., 2014; Kijkuit & van den Ende, 2007). Volume (information variety)

The interplay of these factors determines the degree of information considered and the time it might take for an innovation team to reach its goal. In addition, exogenous factors such as information availability, network connections, market conditions, demands by client or customers, executive decisions, and other context factors also influence progress, with stakeholder expectations and time particularly prominent factors (Gersick, 1988). The indeterminacy of innovation activities (Bartel & Garud, 2009) makes it difficult to predict ex ante how long a team may engage in exploration before they switch to exploitation.

Taking these factors and dynamics into account, for any given innovation process the actual shapes of the diamonds representing different innovation stages may differ significantly. In fact, across stages of innovation for any given project there are a variety of diamond shapes, representing the variances in time and effort given to periods of exploration and exploitation activity within and across stages. The invention stage of some innovation projects (see an example in Figure 2) may be described as having a strategy of aggressive exploration whereby the team accumulates significant amounts of information in a short time before switching to a strategy of intense exploitation. By comparison, the subsequent development stage in this example may involve a slow and limited set of exploration and exploitation activities which result in a less expansive and longer diamond. Such changes in breath and speed may be the result of resource constraints, lack of motivation, process difficulties in the team, lack of available information or other resources, or a range of the external factors mentioned above. Clearly, vertical symmetry of innovation stages will be a rare exception in real-life situations which is highlighted in the third diamond in Figure 2 which reflects a short but intense and successful exploration followed by a significantly longer exploitation, which may reflect team preferences,
external influences or simply problems in refining, selecting, and choosing implementation options form the variety of information assembled in the exploration.

![Figure 2](image)

*Figure 2* | The temporal interplay between exploration and exploitation

3.4.5. **Exploration and exploitation as activities within phases**

Additional complexities exist within each stage of the innovation process because the phases of exploration and exploitation contain numerous activities that may contain elements of each other. Any search for new information – a central part of exploration – will also include selection and choice elements enacted in determining the relevance of new ideas. Similarly, any exploitation will also require the elaboration of existing and the integration of additional information which are essentially exploration activities. Such activity-level exploration/exploitation sequences are represented through smaller diamonds within the main three diamonds (see Figure 3). Such sub-diamonds may represent a thought, an idea, an initiative, a problem, or a task, considered and dealt with in the context of the relevant stage. These activities may cross the strategy switch between exploration and exploitation (point three, seven or eleven in Figure 1); they may be completed within one of the strategy phases; or they may initiate an iterative and recurrent movement back to an earlier stage (or a step back from an exploitation focus to an exploration focus within the same stage). Given the indeterminacy and often random, circular, or chaotic nature of such processes (Nutt, 1984; Okhuysen, 2001), exploration activities may begin and remain open without receiving any attention for a while and may in fact
never be returned to at all. Innovation is full of such unfulfilled departures and cul-de-sacs.

The 3DM as an ideal-type model of the innovation process maps the opportunities and challenges of each stage (invention, development, and implementation) and indicates the appropriate phases and activities of exploration and exploitation necessary to progress. It problematizes both how a team might manage competing yet complementary strategies by highlighting when they are required. Below, team-level concepts and dynamics that interact with these activities, exploration and exploitation, to support or hinder innovation progress are considered.

![Diagram](image-url)

**Figure 3** | Exploration and exploitation activities within phases of the innovation process

3.4.6. **Trans-term and intra-team relations as facilitators**

Trans-team relationships are highly useful for exploration (Mehra, 2006; Somech & Khalaili, 2014; Stadler et al., 2014) as team members can avail of access to information and other cognitive resources and inputs that may exceed those available inside the team (Faraj & Yan, 2009). Trans-team relationships can also offer access to legitimacy, power and other social resources that help to justify and endorse new products, services and practices, help create external support, and help align team innovation processes with external demands, expectations, and quality standards (Ancona & Caldwell, 1988; Ertug & Castellucci, 2013; Pearce, 2011; Smith, Menon, & Thompson, 2012). Such external alignment and support is often
crucial for team-based innovation in organizational contexts (Aparna Joshi et al., 2009).

Close intra-team relations are immensely helpful for exploitation. The strength of relationships within the team helps members to adapt their thinking, leading to increasing alignment of perspectives, attitudes, and opinions. Moreover, it creates and supports shared social norms that further facilitate collaboration and effectively govern shared actions (Coleman 1988). Close intra-team relationships also foster trust and can support voice for learning (Butler, 1999; Edmondson, 1999).

A team’s capacity to manage intra-team and trans-team relationships will substantially affect the efficacy of its exploration and exploitation activities. Some teams may be particularly well equipped for exploration through their individual members’ and their collective trans-team relationships which supports their generation of variety and additional resources. At the same time, a team may be much less successful in developing the close, effective intra-team relationships that facilitate successful exploitation. At the other extreme are teams who may be very successful at exploitation through their strong intra-team relationships but struggle with gaining access to external sources that would offer enriched access to new ideas and novel suggestions. Yet even strengths on both fronts may not necessarily lead to successful progress through the innovation process. As the 3DM shows, the task of managing the competing yet complementary processes of exploration and exploitation by switching between these strategies in the right order and at the right time is a crucial element that is important for successfully dealing with the challenges of team-based innovation. In other words, effective trans-team relationships that offer access to external resources, knowledge, and opportunities will be valuable if constructively coupled with close intra-team relationships that enable collective and collaborative work to progress the innovation tasks by capitalizing on such information variety through effective refinement, selection and joint action. Enabling
successful team-based innovation therefore requires effective management of exploration and exploitation activities.

3.5. **Towards a framework for empirical investigation and managerial intervention**

The 3DM, the ideal type model of the innovation process introduced here, is the outcome of a conceptual analysis of the roles of the competing yet complementary strategies of exploration and exploitation for innovation. It outlines a sequence of processes and events that are required for progress through the innovation process. Applied at the team level of analysis it helps identify challenges that innovation teams in organizations face. The 3DM offers value for both empirical investigations and managerial interventions.

An ideal type model can effectively guide empirical investigation (Swedberg, 2018). The 3DM helps to structure the logical steps of innovation and can be used as a framework to assess the current stage of the innovation process and innovating entity (such as a team) or innovation project is currently at. It reinforces a clear process focus that is in line with procedural research that investigates innovation in organizations (Mørk et al., 2006). It provides a useful theoretical framework for investigating how entities such as teams manage the switch between different strategies and activities, that is the temporal element of sequencing. It is also compatible with variance approaches that investigate specific process and context factors that support or hinder innovation progress. Promising variables here include those related to knowledge, skills, and competencies for executing exploration and exploitation activities; the internal and external climate within which an innovation team operates; managerial and leadership approaches that support effective switching between exploration and exploitation; the role of external stakeholders in this process; or the role of social or technological resources in the innovation process.
Extant literature discusses the innovation process as stage models which vary between two and five stages. Amabile’s (1988) seminal study of individual level creativity, which she generalises to group level, identified five stages - task presentation, preparation, idea generation, idea validation, and outcome. Specifically, at team level, West (e.g., 2002) describes two fundamental stages of the innovation process, creativity and implementation. Creativity concerns the process of generating and developing an idea, and implementation concerns the process of implementing the idea.

At the organisation level of analysis there exists several innovation process models. First, a significant study of the innovation process, conducted over more than ten years, at the levels of the organisation, community, and multi-party networks identified three stages, concluding that the innovation process concerns the “invention, development, and implementation of new ideas” (Garud et al., 2013: 776). Meanwhile, Bagno, Salerno, and da Silva (2017) provide a review of several process models. These include, for example, Cooper’s ‘stage-gate’ model that indicates points for evaluation and monitoring. Bagno et al., (2017) comment that these models are more representative of organisational-level innovation, for example, new product development or research and development where processes are already established. In this regard, the models are thought to help management justify their decisions on which product to support.

Alternatively, the 3DM highlights the temporal arrangement of exploration and exploitation as strategic learning phases and activities to explain how teams progress through the innovation process. There is no such study of the innovation process at team level, only those studies that generalise process research to the level of the team (West & Farr, 1990).

3.6. Innovation at team level as a research domain
The organisation innovation process research is largely dominated by the Minnesota studies that sought to answer this research question
“How and why do innovations develop over time from concept to implementation” (Garud et al., 2013; Van de Ven et al., 2008: 6). Conducted by members of the Minnesota Innovation Research Program (MIRP), researchers took a process perspective to observe events over time with regards to “five factors that define innovation” (Van de Ven et al., 2008:6) - ideas, people, transactions, context, outcomes, and process. The project followed the innovation journey within and across firm and community level innovation projects (Van de Ven, Angle, & Poole, 2000). MIRP researchers adopted the premise that the innovation process consists of three stages: invention, development, and implementation and that each stage has its own journey.

The research revealed four sub-processes or complexities: co-evolutionary, affecting multiple levels of analyses; relational, they require diversity in people and resources; inter-temporal, the sequence of events are experienced in multiple ways; and, cultural, context influences how they unfold. (Garud et al., 2013). In addition, the studies exposed a repetitive cycle of divergent and convergent phases, whereby efforts and expenditure of people and resources drive innovation only to be constrained by endogenous and exogenous factors such as limited resources and norms.

Separately, Tushman (1977) conducted a longitudinal, individual level study of the innovation process to explore the role of the organisations boundaries with regards to gathering information from and transmitting information to external information areas.

There is no model of the innovation process for group-level innovation and although Amabile’s 1988 model of creativity addresses the relevance of social factors for creativity (Amabile, 1988) it does not describe how the model applies to group level innovation (King & Anderson, 1990). King and Anderson (1990) propose researchers developing stage models of the group level innovation process based on data from real-time observation.
validated across multiple case studies, an argument supported by Van de Ven, Polley and Garud (2008) who claim there are limited studies that have examined innovation in real time nor empirically investigated how or why innovations emerge, develop, grow, or terminate, over time (Van de Ven et al., 2000).

Separately some research took the approach of investigating network characteristics appropriable to purpose or stage of innovation, for example, at team level: Lovejoy and Sinha (2010) investigated which network structure is most efficient for ideation and found support for large, decentralized networks as well as support for group meetings, depending on the level of complexity associated with the problem; at individual level, Ohly, Kase and Škerlavaj (2010) empirical investigation found evidence to suggest that network characteristics differ depending on which stage of the innovation process an entity is in, that is, idea generation or idea validation. Alternatively, an empirical investigation of the relationship between network structure and innovation type and found evidence to suggest that optimum network structure depends on the innovation type, that is, radical or incremental (Hemphälä & Magnusson, 2012). Comparably, Christiansen and Varnes (2007) case study of group-level innovation, presents an explanation of how decisions about innovations are influenced by the process of interaction of human and non-human actors. And, Faraj and Yan (2009) took a variance approach to investigate characteristics of a team’s boundary spanning activities on team performance and found a positive relation when there is task uncertainty and scarce resources.

Only a relatively small amount of research has tested the relationship between combined social network features and innovation performance, for example; Ter Wal, Alexy, Block, and Sandner (2016) found support for higher success in venture capital investments when the venture is either open to specialised contacts or closed with diverse contacts. At team level, examples include: Oh, Chung, and Labianca (2004) who found support for an optimal team structure for
team performance as consisting of team closure combined with the team’s bridging connections both vertically and horizontally within the organisation; and, Obstfeld (2005) who found innovation involvement was higher for those who socialise across the firm and combine new knowledge within their dense networks. However, neither study considered when bridging was appropriate or when external knowledge was required, nor the reasons why bridging and external knowledge was even useful.

3.7. The research question

Innovation is imperative for business survival yet very few studies have examined how and why innovations emerge, develop, grow, or terminate over time (Crossan & Apaydin, 2010). More specifically, what we don’t know is how teams progress through the innovation process. Process theories provide a useful roadmap for managers to manage innovation (Van de Ven et al., 2000) and yet empirical research on the innovation process at group level is sparse.

Existing process theories describe individual or firm level innovation (Amabile, 1988; Garud et al., 2013). Research on team-level innovation has focused on the distinction between creativity and implementation (Anderson, Potočnik, & Zhou, 2014; Kijkuit & van den Ende, 2007; West, 2002b). Alternatively, deductive studies attempt to generalise findings based on correlations between empirical patterns giving rise to a debate about the optimum group structure for innovation (Henttonen et al., 2014; Perry-Smith & Mannucci, 2017), for example, open network structures, and density (Ancona, Backman, & Bresman, 2008; Hemphälä & Magnusson, 2012; Mørk et al., 2006; Nahapiet, Ghoshal, 1998; Reagans & Zuckerman, 2001); bridging and bonding (Han et al., 2014); or, building the capacity to explore or exploit (March, 1991). We know competing factors can affect innovation, but we don’t know if these competing factors cause innovation.
In summary, extant research looks at antecedents of exploration and exploitation, and group innovation but not on the process or pattern of either.

The research question for this study is:

1. How do teams progress through the innovation process?
   a. What patterns of exploration and exploitation are associated with teams’ progress through the innovation process?
   b. How do these patterns occur - what do teams say and do that enables these patterns of exploration and exploitation related activities and behaviours?

4. METHODOLOGY

Methodology addresses both the research design and the choice of methods for collecting and analysing data. The structure of this chapter is in line with Yin's (2014) framework for case study research which will address decisions made to collect and analyse the data, and actions taken to improve methodological rigor (Langley, 1999; Mohr, Lawrence, 1982; Poole, Van de Ven, Dooley, & Holmes, 2000). Yin’s six component model includes the following stages: plan - addresses the research question and rationale for a case study design; design - describes the choice of cases selected for inclusion; prepare - concerns the pilot study and protocol; collect - describes the type of data and data collection process; analyse - describes the strategy for analysing the data; and, share - describes how the data will be reported to answer the research question (see Figure 4).

Yin’s (2014) six component model (Figure 4) highlights the iterative process of case study research with double pointed arrows between stages and multiple arrows leading to some stages. For the benefit of the reader, these stages are described as a linear process and reference is made to Yin’s model throughout this section to help the reader navigate the order of content.
4.1. **Step one, Plan** (Yin, 2014) — the research question as context for a case study design

The research question has already been discussed in-depth in Chapter 3, Theory development and the research model.

The research question leads the study by informing the most appropriate methods for answering the question (Edmondson & McManus, 2007). The research question is perhaps the most important element of the research project because it must be relevant and aim to create or shift consensus to make a theoretical contribution (Aguinis & Vandenberg, 2014; Yin, Robert, 2014). In this study, the research question is framed in the context of extant innovation process literature. This research aims to elaborate on the concepts of exploration and exploitation by investigating their role in the innovation process for the team, and to do so justifies a case study design (Eisenhardt & Graebner, 2007). There is no catalogue or best practice for a case study design (Yin, 2014), rather an “ideal-type … with hard-and-fast rules” (Gerring, 2004: 346).

Grounded in extant literature the research questions are:

1. How do teams progress through the innovation process?
a. What patterns of exploration and exploitation are associated with teams’ progress through the innovation process?

b. How do these patterns occur - what do teams say and do that enables these patterns of exploration and exploitation related activities and behaviours?

The research questions concern the innovation process which refers to the “temporal sequence of events that occur as people interact with others to develop and implement their innovation ideas within an institutional context” (Van de Ven et al., 2000: 32). ‘Institution’ in this context refers to the nature of change inherent in the “conceptual structure” of a social system (Van de Ven, 1986). Temporal is defined as the “negotiated organizing of time” (Granqvist & Gustafsson, 2015: 1009). A process design using a multiple-case study provides the opportunity to gather qualitative data that can add insight to complex social processes that is otherwise impossible with quantitative data (Eisenhardt & Graebner, 2007).

Questions one and sub-question b are ‘how’ questions. ‘How’ questions lend themselves to a process study to describe and explain ‘why’ things happen (Lee, 1999; Pettigrew, 2012). Process research can focus on “context, activity, and actions that unfold over time” (Pettigrew, 2012: 1316). The data from a case is used to build a narrative that explains ‘how’ (Mohr, 1982; Pratt, 2009). Consistent with most process studies, this study is limited to describing, analysing, and explaining patterns in the innovation process at the level of the team and will not extend to linking these patterns to variations in observed outcomes (Pettigrew, 2012) because that is not asked of this study. Although progress through the innovation is a precursor to innovation as an outcome, the outcome of the innovation process is also determined by many exogenous factors beyond the control of the team such as market conditions (Fleming, 2007). Innovation as an outcome and process is discussed in Chapter two, subsections 2.2.3.2 (Creativity and Innovation) and subsection 2.2.3.3
(The innovation process). This study continues to focus on the innovation process and not innovation as an outcome.

Sub-question two is focused on elaborating theory by illuminating the theoretical concepts of exploration and exploitation in the innovation process at team level (Lee, 1999; Siggelkow, 2007). It is more prevalent for these concepts to be studied and discussed at organisation level (e.g., March, 1991). Qualitative data gathered from cases is useful for elaborating theory (Lee, Mitchell, & Sablynski, 1999; Siggelkow, 2007) for at least three reasons: the data are typically collected in the natural setting reflecting the participants’ perspective; it is reflexive by design, meaning it explains what is happening by the description provided by participants (Lee, 1999; Merrick, 1998); and, it builds an authentic narrative (Pettigrew, 2012). Therefore, qualitative data can facilitate the investigation of meaning and purpose for the observable events and activities an entity engages in and uncover theories or concepts that could otherwise be overlooked (Guba & Lincoln, 1994). In doing so, the “what is occurring?” question is more usefully addressed with a process design using a multiple-case study (Lee, 1999: 38).

In conclusion, a process study using multiple cases is the approach taken to answer all three research questions.

4.2. Step two, Design (Yin, 2014) - the choice of design

Research design describes the framework for the collection, analysis, interpretation, and reporting of data to answer the research question (Bryman & Bell, 2007; Creswell & Clark, 2007). Therefore, a carefully chosen and appropriate research design is crucial for bringing rigor to the research process and facilitate the production of new and relevant knowledge (Aguinis & Vandenberg, 2014; Eby, Hurst, & Butts, 2009; Gioia, Corley, & Hamilton, 2012).

The choice of research design for this study is a process approach using multiple cases. The process approach will enable the sequencing of events that describe temporal patterns (Scott & Van de
Ven, 2004) to explain how teams progress through the innovation process. Process research is a dynamic approach because it moves backwards and forwards through events and theory and permits a study of the phenomena regardless of the level of analysis (Langley, 2007). The case study approach can provide empirical evidence to enhance theory (Yin, 2014), and a multiple-case study provides theoretical replication by rigorously comparing and contrasting multiple cases (Yin, 2014). Multiple cases provide variety, that is, variety in context, variety in variables such as team size, team behaviours, etc., thereby providing rich data for enhancing theory.

A rigorous methodology can navigate a qualitative study and achieve what quantitative research struggles to do, which is report rich stories that carry breadth and depth from their natural setting to explain complex social arrangements (Eby, Hurst, & Butts, 2009; Gioia et al., 2012). However, there is a trade-off; clearly these social arrangements and the explanations given do not have the causal certainty that other approaches bring, for example, an experimental design can offer much stronger causal inference. But a laboratory setting is not applicable for real life innovation project teams (see, 4.3.3. alternative options to case study). Nor does the study seek to measure the outcome of the innovation process. However, in investigating how teams progress through the innovation process, progress is the effect of team actions and behaviours. Therefore, in providing an ecological inference, certain assumptions are made about the relationship between constructs and causality (Poole et al., 2000) which is sometimes seen as a weakness of process research (Yin, 2014).

Process data has at least four challenges (Langley, 1999; Poole et al., 2000). It can be difficult to sequence the array of data on a conceptual entity, because in the beginning at least the researcher is not entirely sure of what they are looking for. How the data was coded is described in the data analysis section of this thesis (4.5). It can be difficult to determine the boundary of the level and unit of analysis due to an entity and event being inextricably linked to the
environment. The unit of analysis is specified and justified in section 4.2.1. Temporal context varies in terms of duration and context. The temporal context is determined by the team as described and justified in section 4.2.1 of this thesis (Unit of analysis). Finally, process data often contains an eclectic mix of data which can be challenging to organise, triangulate and analyse. Data management is described in subsection 4.3.3, and data analysis is described in subsection 4.5.

In summary, a process approach to research offers a narrative that explains how a path of events or actions lead to a certain outcome (Mohr, 1982; Poole et al., 2000; Yin, 2014). “Events are the natural units of the social process; events are what central subjects do or what happens to them” (Poole et al., 2000: 40). These events or/and actions include the role of a human entity as the agent or mechanism of change (Scott & Van de Ven, 2004). As a result, process research can provide a theory of how teams progress through the innovation process by transcending the description of events to find logic and cause (Yin, 2014; Poole et al., 2000).

4.2.1. **Unit of analysis**

The unit of analysis is that which is being analysed, or "a spatially bounded phenomenon observed at a single point in time or over some delimited period of time” (Gerring, 2004: 342). The unit of analysis is also dictated by the research question (Bryman & Bell, 2007). The research question - how do teams progress through the innovation process? - determines the unit of analysis as ‘a team engaged in the innovation process’. A team engaged in the innovation process captures innovation-team relevant and innovation-project relevant data concerning progress through the innovation process. Alternatively, ‘the team’ as the unit of analysis is too wide because general team related data are of little interest unless it related to how the team makes progress through the innovation process. Equally, ‘the innovation process’ as the unit of analysis is not focused on the phenomenon of interest because it does not identify the team as the entity that progresses and drives the process. The overlap of the
innovation-project team engaged with the innovation-project process is depicted in Figure 5. A team engaging with the process is the spatially bounded phenomena, and teams’ progress through the innovation process determines the period of time – the enactment of the innovation by the team is effectively determining time, as long as the team is still attempting to make progress with their innovation project.

Exogenous events provide context, but they are not included in the unit of analysis. For example, a decision by senior management to provide additional funding for the development phase of the innovation process is relevant to the innovation process, but it is not directly relevant to the process by which the team engaged in the innovation process makes progress through the innovation process and is therefore excluded from the unit of analysis (this does not mean it is excluded from the analysis, however). Alternatively, the team seeking additional funding for the development stage of the innovation process is included in the unit of analysis because it is data relevant to the how the team (a team engaged in the innovation process) makes progress through the innovation process.

Gathering data on ‘a team engaged in the innovation process’ will provide a theory on how teams progress through the innovation process.

4.2.2. Methodological rigour
Methodological rigor concerns three types of validity – construct, internal, and external (Aguinis & Vandenberg, 2014; Eby, Hurst, &
Butts, 2009; Gioia et al., 2012). Countering the myth that qualitative research generally lacks validity, Eby et al. (2009) argue validity is inherently character related, and “not a commodity” (p. 236).

Meaning, regardless of the research being quantitative or qualitative, validity is depending on the capacity and integrity of the researcher to choose appropriate methods and rigorously follow processes that gather authentic data and conduct relevant analysis.

All three types of validity are discussed below but are ultimately dealt with in the research paradigm and the choice of research design and methods for data collection and analysis as informed by the research question and guided by the research paradigm. The research paradigm is described in the beginning of the thesis (see section 2.1) because of its influence in investigating the phenomena.

4.2.2.1. Construct validity

Construct validity is concerned with the validity of measurement tools used in a study (Eby et al., 2009). Qualitative studies do not use tried and tested measurement tools and there is no factor analysis (Eby et al., 2009). However, qualitative researchers “demonstrate” (Eby et al., 2009: 238) construct validity in their explicit description of how they collect and triangulate the data, and their role as the researcher. The instruments used to collect data are described below. The triangulation of the data is described in Analysis, section 4.5.2. The role of the researcher is implied in the research paradigm and the choices made to conduct the study.

There are three instruments used in this study. The researcher is the primary instrument since the researcher gathers and analyses the data (Danermark et al., 2002; Lance & Lance, Vandenberg, 2015; Meyer & Lunnay, 2013). However, as the phenomena being studied and interpreted is based on knowledge socially constructed by the researcher, prior knowledge, experience, and biases are integrated in the data collection and analysis thereby influencing the study. It is not assumed that these biases are a positive or negative factor but merely
that they exist. Therefore, the benefit of describing methods informs the reader how the researcher reached the findings they did.

A priori theory is also an instrument used in the study (Danermark et al., 2002) in so far as it informed the empirical framework that was used as a lens for gathering and analysing the data. The theory development and empirical framework is presented in chapter three of this thesis. The a priori theory informed what questions to ask the participants. A priori theory also informed definitions for coding the data. And a priori theory also informs the interpretation of results. Finally, a priori theory is the lens that selects data and helps make sense of the data to ultimately reconceptualise the theory.

The final instrument used in this study concerns the actual method of data collection which was the interview as the main source, and observation. As an instrument, the interview questions control the type of data being collected both in the content of the question and in how the questions are asked. The teams were interviewed on two occasions to mitigate bias (Eisenhardt & Graebner, 2007). The interviews captured retrospective descriptions as well as current and future thinking which were combined to build the narrative to explain progress and so a chain of evidence was captured by the interview questions – (How would you describe the process to date? What was helpful to the process?) and the choice to collect data at time one and time three. Data was also collected by non-participant observation by recording a team meeting conversation using a voice recording device. Finally, artefact data such as documentation was collected by photographing the data.

To enhance construct validity, that is, the validity of measurement tools used in the study (Eby et al., 2009) a protocol was produced. The protocol outlines how to collect data for replication as in a multiple-case study and therefore supports reliability, that is, getting the same result when repeating the study (Yin, 2014). Yin (2014) outlines four sections of the protocol to guide the researcher. First
there is an overview of the case study to provide context for the data collection. Next there are prescribed actions and behaviours for the researcher to follow before, during and after data collection. For example, there are guidelines for preparing for data collection meetings, including the coordination of those attending the meetings, getting to the meeting on time, contact details for sponsor, as well as having the appropriate equipment and paperwork ready and getting mentally prepared for the meeting. The protocol also provides the research questions and guidelines on how to be during the meeting. Finally, the protocol provides recommendations for how to manage the data following the meeting including information on the data storage system. The complete protocol is provided in Appendix 2.6.

4.2.2.2. Internal validity

Internal validity refers to the extent to which we can be confident about cause and effect (Eby et al., 2009; Sandberg, 2005). How do we know that the data (in relation to what happened, or what was experienced) collected by the researcher is an accurate representation of what the informant has provided and therefore how can we be confident about cause and effect? Although this study is not measuring the outcome of the innovation process, progress is recognised as the effect of teams’ actions and behaviours. To enhance the validity of gathering data on teams engaged in the innovation process the researcher followed a Protocol (discussed in subsection 4.3.3).

All data was gathered using a voice recording device or in the case of artefact data, the data was photographed. All voice recording data were transcribed verbatim and coded. In reporting the data, quotations as evidence was used as much as possible to support claims.

4.2.2.3. External validity

External validity refers to the applicability of findings from one research setting generalising to other settings (Eby, Hurst, & Butts, 2009; Gioia et al., 2012). In elaborating theory, it is appropriate to
select cases based on theoretical sampling or cases which have the
capacity to illuminate relationships among constructs and offer
theoretical insights (Eisenhardt & Graebner, 2007). This study used
nine cases selected for their potential to illuminate innovation-project
specific activities and behaviours by the innovation-project team that
contributed to their progress through the innovation process.
Selection of cases is described below in section 4.3.5.1.

4.2.3. Selection of cases for inclusion in the study
Although the pilot study, described later in section 4.4.2, helped to
inform the criteria for case recruitment and selection, the recruitment
and selection of cases is described here because it is in keeping with
the linear sequence of Yin’s (2014) model.

A multiple-case study typically contains between six and twelve
individual cases (Yin, 2014). Each case represents an analytic unit,
and each replication seeks to contrast and/or extend the theory
(Eisenhardt & Graebner, 2007). For example, one case can support or
contradict findings from another case. Some cases may contain
similarities and therefore help identify contingencies and or boundary
conditions for theory. Alternatively, all cases may contain a common
mechanism that elaborates theory. Some of the seminal contributions
to group-level innovation projects used multiple case studies
including: King (1989) (in, King & Anderson, 1990b) who compared
reports of two groups’ perceptions of the influence to direct an
innovation project in their respective cases; (Ancona & Caldwell,
1992) who accessed two groups when investigating the range of
activities a group uses to carry out their tasks; and Gersick (1988)
who investigated eight groups when exploring how groups develop
over time.

Cases were recruited for inclusion in this study by theoretically
profiling the case to fit the study. The starting point was the unit of
analysis, as discussed in section 4.3.1 (Unit of analysis) but repeated
here for the benefit of the reader – ‘a team engaged in the innovation
process’. For this study, the definition of a team is provided in section 3.3 (Teams and team learning) but repeated here - a team “whose members take individual and collective responsibility for their shared objectives and interactively coordinate their interdependent activities through role and specific assignments” (Martin & Fellenz, 2017: 192). The innovation process is defined as “the process of inventing, developing, and implementing new ideas” (Garud et al., 2013: 776) as outlined in section 3.2 (The innovation process). The teams were provided with a definition of the innovation process to ensure cases were comparable; as did Ibarra (1993) in a study of individual level involvement in innovation projects. Amabile (1988) also asked participants to “define creativity as they saw it” (p.127) because it is a concept with many definitions.

Next, twelve companies were identified that represented a broad range of industry sectors, vary in employee numbers or company size, and with whom there was some form of access, they included: three pharmaceuticals; three service companies; two IT companies; two manufacturing companies; one utility provider; and one academic institution. The objective for the initial communication to these companies was to introduce the study, express an interest in their participating, and seek permission to send a letter of proposal for their consideration with colleagues and relevant personnel. The letter of proposal formally introduced the researchers and the study, it described the benefits of participation, it confirmed that all data would be treated with confidence, and it closed with an invitation to meet to discuss further (see Appendix 2.1). The letter of proposal was followed with a second telephone conversation to establish interest and arrange a meeting to discuss suitability. In the meeting with potential sample companies, the study was formally presented and discussed for potential team suitability.

Cases were selected for inclusion in the study if they meet the following criteria – the team consisted of two members or more working on a specific innovation project such as generating new
ideas, or solutions for organisational products, procedures, processes, and service offerings; of developing, testing, and refining these ideas for use; and of implementing them in a specific context. The project is in the early stage of the innovation process and team members have responsibilities towards other types of work outside this team, so the focus of our study is gathering data on strategies, activities, and behaviours on this team’s specific innovation project.

Two cases were recruited later than the others because it was felt that more diversity in teams would benefit the study. The two late cases were complex construction projects.

It is very difficult to find innovation projects with a time-line that overlaps with an academic study, and especially PhD research that is time specific. Projects that were in the latter end of the process were excluded because the data would be mostly retrospective. Equally, projects that were in discussion stage of the project were excluded because there was the risk that these projects would not progress. Rather, projects were selected on the basis that were underway but in the early stage of the process so that some data was retrospective but mostly it was possible to follow the project for at least nine months.

4.2.4. Alternative options to multiple-case study

Alternative options to using a multiple-case study are briefly discussed here, they include: single case study; historical case study; experiment; ethnography study; and survey:

4.2.4.1. A single-case study can be powerful when the case represents a significant event, such as a ‘talking pig’ (Siggelkow, 2007); or, is a significant enough case to represent the researchers phenomena of interest (Mäkimattila, Melkas, & Uotila, 2013). Alternatively, a multiple-case study makes a more compelling and robust study because it repeats the study several times which enhances design and improves predictive power and reliability (Eisenhardt, 1989; Yin, 2014).
4.2.4.2. A historical case study can be useful for collecting data to describe past events (Gerring, 2004; Yin, 2014). For example, King (1989) (in, King & Anderson, 1990) asked participants to reflect on a historical innovation project. But for this study, it was decided to gather data in real-time for two reasons. First, real-time data provides a current, subjective perspective (Bartel & Garud, 2009) rather than a retrospective account. Although some retrospection is useful, for example, when the project is current because the participant is still engaged in the process and therefore it reflects the subject perspective. Alternatively, historical case studies carry retrospective bias. Secondly, studies using real-time data of the innovation process at the level of the team is extremely rare (West & Farr, 1990).

4.2.4.3. Experiments are useful for explaining causal relationships and testing theory (Casciaro et al., 2014; Yin, Robert, 2014) in a closed and controlled setting. This research is not interested in testing theory, rather investigating how the team progresses through the innovation process in a natural setting, that is an open setting. We cannot create controlled laboratory conditions in a field. Rather, the field is a natural, open setting that appreciates how the phenomena of interest can affect and is affected by the environment thereby providing a subject, authentic setting (Danermark et al., 2002).

4.2.4.4. Ethnography studies are useful for providing theoretical descriptions, such as describing objects and events at a specific time or in a specific place (Hammersley, 1990; Van Maanen, 2011). Describing events and objects does not explain ‘how’ teams progress through the innovation process and is, therefore, an unsuitable approach for this study.

4.2.4.5. Surveys are useful for collecting structured data especially for testing relations between variables (Bryman & Bell, 2007). Therefore, mixing quantitative data with qualitative data are particularly beneficial for intermediate level theory studies (Edmondson & McManus, 2007). However, the objective of this study is to gather qualitative data by semi-structured interview,
without specifying variables, because we know so little about the innovation process at team level (Paulus et al., 2010; Ramos et al., 2016; West & Farr, 1990).

4.2.5. **A description of the multiple-case study**

The nine cases that made up the multiple-case study may be described as follows. Four cases were hospital-based teams engaged in a part-time diploma in the Royal College of Physicians Ireland. As part of their academic program, the teams were tasked with identifying an improvement project which they had to work on for the duration of the program. The teams’ projects were spread across four health service sites and included – increase the opportunity for patient and service user feedback and improve the overall service experience in line with the National Charter; improve patient safety by making changes to a current document to include additional input from doctors; improve patient safety by making changes to the system for drug prescription; improve service user experience by piloting a system for gathering and responding to feedback. Each team was sponsored by a senior executive within the hospital. Their academic program provided support for their project by way of lectures on change management, peer reviews, shared experience, and motivation.

Two teams were working on client construction projects based in Dublin airport with objectives and deadlines dictated to them by the client. Their innovation projects were challenging owing to the number of stakeholders involved and the innovative solutions required to reach their objective. The team expanded and contracted in size depending on the knowledge and skills required to meet project demands across stages. Both teams were following industry standard project management frameworks which dictated stages.

One team was working on developing a national framework for managing hospital waiting-lists as directed by their client that was a government department. Their innovation was challenging due to the
scale of the project in terms of change across the entire national system and the number of stakeholders involved. This team adapted a formal project management approach and the team size contracted and expanded depending on knowledge and skill demand from the project.

Two teams were working on developing new products that were initiated by the teams under the direction of a large multi-national utility provider. These projects grew from an innovation hub where the motivation by the utility provider was to look for new ideas with commercial potential. These projects had no formal project direction nor definitive outcome.

Appendix 2.2 provides a summary of the nine teams that make up the multiple-case study.

In all cases the innovation project was underway when data collection began. While not being present from inception may be a limitation for the study, there are at least two factors that dictate this. It can be difficult to determine when an innovation project becomes a formal project. Until then, it may be simply an idea (Amabile, 1988; West, 2002b). The teams selected believed their project would continue for some months and therefore the opportunity to gather data over time was possible.

4.3. **Step three, Prepare (Yin, 2014) - ethics, pilot, and data management**

There were three events in preparation for collecting data: gain ethical approval; conduct a pilot study; and, develop a filing system for managing the data.

4.3.1. **Ethical approval**

To protect the researcher and the human subjects of research the following principles apply (Trinity Business School, n.d.): respect for the individual subject or population; maximum benefit with minimal harm; and fair. In line with (Davies, 2010) who adds all interests are respected and handled equitably.
The process for seeking ethical approval from the School of Business, Trinity College Dublin was a review by The School of Business Research Ethics Committee, Level One Committee. The study was considered low to moderate risk to participants because interviews were consensual, and participants are non-vulnerable adults (Trinity College Dublin, n.d.). See Appendix 2.3 for the Application for Research Ethics Approval.

4.3.2. **Pilot study**

The pilot study was instrumental in helping to make final research design decisions, as outlined above in section 4.3, including refining the profile for final case selection and writing the protocol for data collection. The pilot study, described here, was conducted following the first draft of the research design and on seeking ethical approval. In general, a pilot study is useful for several reasons (Bryman & Bell, 2007), but it was found most useful for the following reasons: it provided the opportunity to pre-test the interview questions to ensure they are valid and are understood by the interviewees; it acted as a ‘dry run’ for organising meetings, asking questions, testing the equipment, managing the data, and generally building experience and confidence; finally, the pilot study provided the opportunity to reflect on personal interviewing style, for example, staying close to the interview questions set, adapting an appropriate tone of voice, and balancing depth of probing.

Prospective pilot groups were introduced by Martin Fellenz in December 2016. Martin was teaching a module to health service staff in the Royal College of Physicians Ireland on a part-time postgraduate diploma in leadership and quality in health care. As part of their diploma participating groups were tasked with working on a real-world quality improvement project. Following introductions, permission was sought from the class for their email address to send a letter of proposal (see Appendix 2.4). The letter formally introduced the study and asked for a meeting to conduct a pilot study. The letter of proposal went to all fifteen groups of which eleven expressed an
interest in participating in the pilot study by return email. A meeting was arranged with all interested groups with the objective of piloting the interview questions set. Five cases were included in the final pilot, one group withdrew from the process, and five groups were held for inclusion in the final study.

At the beginning of each meeting with the pilot group, permission was sought to record the interview. Prepared questions and interviewees probed as applicable. Transcribing the recordings was helpful for reflection and learning on the interviewing style, the validity of the questions, and the value in the data the questions were gathering. Personal learning and reflection are chronologically listed here:

- **Main questions were appropriate. Some probing questions could be leading.**
- **Group was a little guarded so ensure team members do not feel judged in their approach.**
- **Feeling confident now and focused on gathering evidence to support explanations.**
- **Practicing a new confidence and practising asking questions in a non-judgemental way and gathering evidence.**
- **Too much coaching ...**

See Appendix 2.5 for a summary of the pilot study including brief comments about observations on all pilot cases. The 3DM was shared with groups that would not be included in the final study and they found it helpful for making sense of their process. These teams were able to locate them in the model and found value in recognising where they came from and where they were going. This discussion on the 3DM was beneficial to both parties since there was learning in listening to those teams make sense of their journey through the lens of the 3DM.

The pilot study built confidence in meeting with and interviewing participants and guided final decisions on research design and the protocol. Whilst the interview questions did not change, how the questions were asked did. Simply, the teams had described their process, what they did, why, and how. There was value in remaining
objective and simply allowing the questions to gather the data. There was also value in recognising what type of data management system was required, and the time required to transcribe the recordings. Overall, the pilot study helped to prepare for the actual study.

4.3.3. **A database for managing the data**
A database can help organise the evidence and manage the complexity associated with eclectic data (Langley, 1999). There are three filing system for managing the data for this study, a cloud-based soft file, a portable hard disk, and a hard box file. All interview data were collected using a voice recording device with copies made of the recording and filed electronically on both the cloud-based soft file and the portable hard disk. Recordings on the portable voice recorder were deleted from the voice recording device once copies were made. This protected the recordings from distribution should the device ever become misplaced. All interview data were transcribed, and copies of the transcripts were filed in all three files, cloud-based file, portable hard disk, and hard copies printed and filed in a hard box file. Data were managed within the filing system by keeping an inventory sheet of data collected on each case as the data were gathered, for example, photographs of sample work or additional documentation provided by participants. Separately, an Excel spreadsheet was used to track each case activity including, date and time of meeting, how long the meeting lasted, and date for next meeting. See Appendix 2.9 (Tracking data collection across cases) for a copy of the Excel spreadsheet with information identifying each case, number of team members, type of innovation, dates for all three data collection meetings, and a brief description of the data collected on each case.

4.4. **Step four, Collect (Yin, 2014) - the type of data and data collection**
Evidence can come from at least six sources (Yin, 2014) of which this study used three: interviews, non-participant observation, and physical artefacts such as documentation provided by the case.
Following Yin’s (2014) principles for collecting evidence, the approach taken to collect evidence from multiple sources for construct validity is now described.

4.4.1. **Multiple sources of data**

Process research using multiple cases requires data over time to describe temporal patterns (Scott & Van de Ven, 2004). Cases selected for inclusion in this study were working on projects that coincided with the time of the actual study.

Case study evidence was collected at three different times on each case across a ten-month period using interview, non-participant observation, and artefact data if available. A voice recording device was used to collect the audio, a laptop was used to collect observations, and artefact data was collected if available. For example, some teams provided additional documentation such as a meeting agenda or a copy of the administration changes.

Table 4 provides an overview of the data collection dates and methods for gathering data. The data for cases G1-G5 were gathered between January 2017 and July 2017. The data for cases G6-G9 were gathered between March 2017 and October 2017. Cases G6 and G9 were late cases to the study which is why the data collection started as late as it did. As much as possible, data was gathered across a six-month period with approximately two months between each data collection meeting. However, accommodation had to be made for the teams and their schedules.

At time one and time three, the team was interviewed to gather data on how they progressed through the innovation process. Typically, the team included the core members of the team or those wholly responsible for the innovation project from beginning to end as decided by the team. These meetings lasted on average 35 minutes (plus/minus 14 minutes). At time two, a team meeting was observed to gather data what team members said, both relationship relevant data and task relevant data. The voice recording device gathered the
conversation while a laptop computer was used to gather observations. The team meeting was attended by whomever was required by the team for that meeting. Typically, these meetings included the ‘core’ team as defined by the team, but for some cases this meeting included additional individuals who are involved with the project to some degree.

<table>
<thead>
<tr>
<th>Case</th>
<th>Time one – interview. Artefact data if relevant</th>
<th>Time two – non-participant observation. Artefact data if relevant</th>
<th>Time three – interview (repeated from time one). Artefact data if relevant</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>Mid-January</td>
<td>End March</td>
<td>Late June</td>
</tr>
<tr>
<td>G2</td>
<td>Mid-January</td>
<td>Mid-April</td>
<td>Late June</td>
</tr>
<tr>
<td>G3</td>
<td>Late February</td>
<td>Early May</td>
<td>Early July</td>
</tr>
<tr>
<td>G4</td>
<td>Late February</td>
<td>Early April</td>
<td>End June</td>
</tr>
<tr>
<td>G5</td>
<td>Begin Feb</td>
<td>Mid-March</td>
<td>Late May</td>
</tr>
<tr>
<td>G6</td>
<td>Begin July</td>
<td>Early Aug</td>
<td>Late Oct</td>
</tr>
<tr>
<td>G7</td>
<td>Begin May</td>
<td>Begin July</td>
<td>Early Oct</td>
</tr>
<tr>
<td>G8</td>
<td>Mid-March</td>
<td>Late June</td>
<td>Mid-August</td>
</tr>
<tr>
<td>G9</td>
<td>Mid-July</td>
<td>Mid-August</td>
<td>Late October</td>
</tr>
</tbody>
</table>

*Table 4: Date collection times and method*

The data from all three meetings combines retrospective and contemporary data to build a fuller and more complete picture (Eisenhardt & Graebner, 2007) that when analysed can provided explanations for how teams progress through the innovation process. The data are described in more detail below.

**4.4.1.1. Data from semi-structured interview**

The interviews were conducted at time one and time three for each case. These data are main source of data because they describe context, events, and activities that occur over time (Poole et al., 2000) hence satisfying the need for real-time data that is lacking in group innovation studies (Van de Ven et al., 2000). Time one and time three interviews questions are the same because it was decided to gather the same type of data on ‘a team engaged in the innovation project’ close
to the beginning and towards the end of time. The interview was semi-structured around four key questions for the reasons given below:

a. What are you working on? The main objective of this question is to generate a description of ‘what’ the team is doing and why, both retrospectively and currently. This is a loaded question to generate a lot of information. Typically, this question brings the team back to the beginning of the project by describing the genesis of the project, the recruitment of the team, and the process to date. The second objective of this question, as the first question, is to put the interviewees at ease by asking about something familiar yet relevant to the meeting. Whilst the question also solicits context related data, context is outside the unit of analysis as discussed in section 4.3.1. Section 4.6 provides a description of how context data was gathered and managed.

b. Where is your focus right now? This question also has two objectives: the first is to locate ‘the team engaged in the innovation process’ in a stage of the innovation process (invention, development or implementation) to track progress over time. But also, to gather descriptive data on ‘the team engaged in the innovation process’ activities and behaviours. These data would help track innovation stage relevant activities and behaviours to explain how teams progress through the innovation process.

c. What are you doing that helps? Following on from question two, this question aims to gather data on more specific phase relevant activities and behaviours, as described in the 3DM such as exploration and exploitation, for example – is the team mainly focused on acquiring new information, collecting different opinions, building relationships, generating additional resources, OR, assessing opinions, aligning relationships, and adapting to new norms? Both questions, two and three, are asked through the lens of the 3DM to locate ‘the team in the innovation process’ precisely within a phase and to track progress over time.
d. How are you doing that? This question is asked in the context of the answers to questions two and three, and therefore often elaborated upon – for example, how did/will [you] get the information you need to make that decision? This was useful for learning what resources or by what means the team is able to make progress to explain progress. The context of this question was to expose the social structural element of the team, the skills, and tools the team access for progress.

The interview questions are designed as open questions to invite a broad theoretical discussion throughout the research process (Timmermans & Tavory, 2012).

4.4.1.2. Data from non-participant observation

Data from non-participant observation was collected approximately at mid-point between the interviews at time one and time three (see Table 4). Even though the data at time two provide little, if any, descriptive data on how teams progress through the innovation process, it has the potential provide some data that defines the stage or phase of the innovation process and therefore track progress.

Time two is a voice recording of a team conversation during a regular scheduled team meeting. These data provide the language used by the team that may explain the evolution of relationships between people and innovation progress or the effect of an event on progress (Langley, 1999). Therefore, these data supplement interview data (Corley & Gioia, 2004).

4.4.1.3. Data from artefacts

Data from artefacts was collected across all three data collection meetings if available or relevant to ‘the team engaged in the innovation process’. These data were collected by taking a copy or a photograph of the artefact, such as a copy of the meeting agenda or administration change. These data replaced the interview at time one for case G5 because the artefact data provided all the information that would have been gathered at the interview. At time one, this team
were attending a workshop that did not permit voice recording. Notes were made of the oral conversation with the team as they described the process to date and provided the artefact data to substitute a recorded interview.

In summary, data was gathered from nine cases across the healthcare sector and the service industry between January 2017 and October 2017. The innovation-project team size averaged 4 core members. The innovation-projects include administration procedures, work processes, new products, buildings, and services. For each case, the team was interviewed at time one and time three. Non-participant observation data was gathered at time two. Artefact data was gathered if relevant. All three data collection meetings were spread as evenly as possible across the data collection process. All data was gathered using a voice recording device and transcribed. All data was saved in three locations as back-up – two soft copies and one hard copy. The total data gathered equated to 1258 minutes of voice recorded data, 256 pages of transcribed data, and 28 artefact items – see Table 5.

<table>
<thead>
<tr>
<th>Case ID</th>
<th>Industry</th>
<th>Team size</th>
<th>Project</th>
<th>Data collection dates</th>
<th>Time1 data</th>
<th>Time2 data</th>
<th>Time3 data</th>
<th>Data totals per group</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>Healthcare: acute G.Hospital</td>
<td>4</td>
<td>Improve customer services</td>
<td>18th Jan; 28th March; 20th June</td>
<td>33</td>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>G2</td>
<td>Healthcare: intellectual disability</td>
<td>1</td>
<td>Change the auditing protocol</td>
<td>18th Jan; 12th April; 20th June</td>
<td>45</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>G3</td>
<td>Healthcare: Hospital</td>
<td>3</td>
<td>Improve prescribing admin</td>
<td>26th Feb; 5th May; 7th July</td>
<td>38</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>G4</td>
<td>Healthcare: Hospital</td>
<td>3</td>
<td>Improve patient safety</td>
<td>24th Feb; 7th April; 30th June</td>
<td>47</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>G5</td>
<td>Service Industry</td>
<td>3</td>
<td>Create new software product</td>
<td>1st Feb; 15th March; 28th May</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>103</td>
</tr>
<tr>
<td>G6</td>
<td>Service Industry</td>
<td>9</td>
<td>Construct a new building</td>
<td>18th Jan; 9th Aug; 26th Oct</td>
<td>40</td>
<td>13</td>
<td>3</td>
<td>120</td>
</tr>
<tr>
<td>G7</td>
<td>Service Industry</td>
<td>5</td>
<td>Develop a new service</td>
<td>2nd May; 3rd July; 12th Oct</td>
<td>25</td>
<td>13</td>
<td>3</td>
<td>73</td>
</tr>
<tr>
<td>G8</td>
<td>Service Industry</td>
<td>4</td>
<td>Patient waiting list management system</td>
<td>18th March; 22nd June; 15th August</td>
<td>35</td>
<td>7</td>
<td>1</td>
<td>55</td>
</tr>
<tr>
<td>G9</td>
<td>Service Industry</td>
<td>6</td>
<td>Construct a new building</td>
<td>12th Apr; 16th August; 20th Oct</td>
<td>39</td>
<td>14</td>
<td>1</td>
<td>120</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>252</td>
<td>79</td>
<td>17</td>
<td>687</td>
</tr>
</tbody>
</table>

Table 5: Total data across cases

4.5. Step five, Analyse (Yin, 2014) - the strategy for analysing the data

Analysis includes examining and recombining evidence to draw a conclusion in response to the research question (Yin, 2014). For case study research there is no clearly defined technique other than the
researcher should follow “a general analytic strategy, defining priorities for what to analyse and why” (Yin, 2014: 126). The choice of analytic strategy is abduction and retroduction. Abduction and retroduction are closely related analytical tools for refining and redeveloping social theory in qualitative theory-driven research (Meyer & Lunnay, 2013). In this section of the thesis, abduction and retroduction are defined and briefly discussed before describing their role as analytical tools.

4.5.1. **Abduction**

There are several definitions of abduction following Charles S. Peirce’s (1931-1958) coining of the term (e.g., Danermark et al., 2002; Rozeboom, 1997; Swedberg, 2017; Timmermans & Tavory, 2012). They include this definition that conceives of abduction as “a process of forming an explanatory hypothesis for poorly defined phenomena” (Dunne & Dougherty, 2016: 135). For example, in this study, ‘how’ teams make progress through the innovation process is a poorly defined phenomenon for which the theoretical model, the 3DM was developed as a hypothetical conceptual framework.

Abduction allows for the inclusion of data that falls outside the initial theoretical framework for the empirical investigation (Danermark et al., 2002; Timmermans & Tavory, 2012). This is done by distinguishing or deconstructing various components of the a priori theory to find valid indicators or concepts (Danermark et al., 2002). For this study, the 3DM acted as the lens for examining ‘team engaged in the innovation process’ data and therefore provides concepts for deconstruction to make sense of data. The abductive approach also permitted the movement between the data and the literature to find alternative theories to explain progress.

Abduction is distinct from induction and deduction, although Rozeboom (1997) argues all good science is abductive and not hypothetic-deductive. Purely deductive research is analytical and therefore does not explain reality but rather tests theory as a particular
description of that reality. Purely inductive research generalises from empirical data to develop and conclude with theory. These alternative approaches to abduction may be compared as follows: each has a rule, a case, and a result (see Table 6) but they differ in their chronological order. Abduction begins with a rule or theory, like deduction. Next, abduction finds a result, like induction. Finally, abduction infers theory by reconceptualizing the theory using a case (retroduction). For example, the 3DM was the starting point as the theoretical framework. But after considering all empirical data gathered, the theory was reconceptualised to more actually explain how teams progress through the innovation process by deconstructing the current hypothetical framework and revisiting the literature for relevant concepts and definitions.

<table>
<thead>
<tr>
<th>Deduction</th>
<th>Induction</th>
<th>Abduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rule: All beans from this sack are white</td>
<td>Case: These beans are from this sack</td>
<td>Rule: All beans from this sack are white</td>
</tr>
<tr>
<td>Case: These beans are from this sack</td>
<td>Result: These beans are white</td>
<td>Result: These beans are white</td>
</tr>
<tr>
<td>Result: These beans are white</td>
<td>Rule: All beans from this sack are white</td>
<td>Case: These beans are from this sack</td>
</tr>
</tbody>
</table>

Table 6: Formal structures of inference (Danermark et al., 2002: 90)

4.5.2. Retroduction

Retroduction is a process of shifting from a priori theory to reconceptualising the theory in a new context by describing what must exist to explain an event (Danermark et al., 2002; Meyer & Lunnay, 2013; Zachariadis, Scott, & Barrett, 2013). There are three approaches to doing this (Fisher & Aguinis, 2017). (1) Contrasting, that concerns comparing the application of a theory from one setting to another, for example across industry sectors. (2) Construct specification that concerns refinement of a construct such as splitting the construct, for example Meyer and Lunnay demonstrated this in their 2013 paper with trust. (3) Structuring that concerns describing and explaining theoretical relations so that they more accurately align with empirical observations to improve explanatory potential and
predictive adequacy (see Figure 6). This study applied the structuring approach by describing and explaining theoretical relations with empirical observations.

There are three tactics to applying the structuring approach (Fisher & Aguinis, 2017) (see Figure 6). (1) Identifying or specifying relations between constructs that have not been previously defined. (2) Accounting for a recursive relation between constructs. (3) Providing an explanation of a sequence of relations. The latter approach was applied, sequence relations, because the study concerns the innovation process and sequencing is a fundamental part of process research (Langley, 1999; Van de Ven & Poole, 1995). Counterfactual thinking was an analytical strategy used in retroduction to help identify constitutive factors and circumstances under which concepts exist (Meyer & Lunnay, 2013). Using knowledge and experience of the literature and the data, moving between cases was useful to identify unusual associations (Danermark et al., 2002), “the presence of finer nuances” (Bazeley, 2009: 9), or alternative components from the theoretical framework.

Figure 6/Theory elaboration tactics (Fisher & Aguinis, 2017:451)

4.5.3. The application of abduction and retroduction as analytical tools
As an overview, the two-step process of applying abduction and retroduction in this study is as follows.
1) First (abduction). Moving between the 3DM as the hypothetical conceptual framework, discussed in chapter 3 (subsection 3.5), and studying the data, empirically and conceptually distinct definitions were developed for categories of relevant data (Danermark et al., 2002). From this process, the codebook was produced, and all the data coded according to the codebook.

2) Next (retroduction). The coded data was bracketed in a temporal order for each case and a model fitted to the data. Models across cases were compared and contrasted to reconceptualise the 3DM and provide an explanation for how teams progress through the innovation process.

This composite approach to analysing the data reflects the researcher’s explanation of context, events, and activities (Rozeboom, 1997), and the social processes that cause events (Meyer & Lunnay, 2013). These analytical strategies are discussed in detail as subprocesses in analysis and results, chapter 5.

4.6. Step six, Share (Yin, 2014) – Reporting the data

Process research explains how things evolve over time and why, by exposing events over time - “a small number of events and behaviours might begin to accomplish what large numbers of variables have simply failed to do” (Mohr, 1982: 13). Presenting case study evidence is challenging owing to the sheer volume of rich, qualitative data, however the literature does make several recommendations for reports on a multiple-case study. One of which is temporal bracketing. Temporal bracketing is a strategy for revealing mechanisms in process research (Langley, 1999). Typically, temporal data are arranged in a chart or figure with the horizontal axis, along the bottom of the figure represent periods of time. Largely descriptive, it can be useful for mutual shaping - that is how actions of one period can lead to changes in the subsequent periods. Temporal bracketing, essentially, transforms a shapeless mass of process data (Langley, 1999). Temporal bracketing was used to present the data that describes the innovation process.
Separately, data that describes the team and the innovation context will be presented as a narrative of the team and innovation context. And, data that describes what was said between team members will be presented as quantitative data.

4.6.1. **Presentation of data that describe the innovation process**

Data that describes the innovation process were arranged in a temporal order (Langley, 1999) and built as a chart in Excel to see the evolution of strategies, activities, and events (Langley, 2007). The chart becomes an abstract representation of the innovation process. A template for the abstract representation was created in Excel. Each row and column had the same width and height. The columns, two normal column widths, represent time, a month per expanded column. There are seven rows. Row one names the key phases or stages of the project; row two outlines the project progress/timeline; and rows three through to seven represent sources used in pursuit of exploration and exploitation, that is, within the team, outside the team, and outside the organisation. Within team is centred between outside the team and outside the organisation (see Figure 7).

Thick lines (blue) were used to represent stages for two reasons: according to the definition used in coding strategies, a strategy describes a team’s plan for innovation (Cunningham & Harney, 2012) therefore the lines outline a phase of exploration or exploitation; and the lines make space for nested activities in pursuit of achieving the plan.

Block-coloured (grey), geometric diamond shapes were used to represent activities for two reasons: according to the definition used for coding activities, an activity is the practice of fulfilling the plan (Ancona & Caldwell, 1992; Cross et al., 2000; Cunningham & Harney, 2012) and so the block-coloured geometric diamond shapes are distinguishable from, and nested in strategies; and the ‘block-filled’ geometric shape represents the fact that there is no data.
available to describe activities and behaviours within these activities, merely that they happened.

<table>
<thead>
<tr>
<th>Time-line</th>
<th>Jan-17</th>
<th>Feb-17</th>
<th>Mar-17</th>
<th>Apr-17</th>
<th>May-17</th>
<th>Jun-17</th>
<th>Jul-17</th>
<th>Aug-17</th>
<th>Sep-17</th>
<th>Oct-17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation Process</td>
<td>Scoping</td>
<td>refining</td>
<td>Seek resources</td>
<td>develop</td>
<td>Pilot</td>
<td>implement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Temporal bracketing diagram]

*Figure 7* | Temporal bracketing – an abstract representation of the innovation process for teams

Each team has their unique chart representing their data. Temporally ordering each team’s innovation process data enables a comparative analysis for the replication of theoretical ideas (Langley, 1999).

Data displayed as temporal bracketing is the evidence for elaborating theory. Eisenhardt and Graebner (2007) suggest focusing on the objective, that is a report of theory elaboration supported by empirical evidence. To do this, a story, rather than a theory is provided to construct a compelling theory (Eisenhardt & Graebner, 2007). The story is about how the team progresses through the innovation process. In the introduction, First, a profile the individual cases is presented. Then a story, using data across cases is provided. The ‘story’ will be made up of sections with each section representing a stage and phase of the innovation process. Data that describe team strategies and activities will be integrated into the story as evidence. A story about theoretical relations that can “accurately explain and/or predict outcomes of interest” is a credible approach for advancing theory (Fisher & Aguinis, 2017: 444)
4.7. **Methodology conclusion**

To answer the research question - how do teams progress through the innovation process? - this study used a multiple-case study. The unit of analysis is ‘a team engaged in the innovation process’. Yin’s (2014) framework was used to guide the description of the methods used. In preparation for the study, ethical approval was sought from the School, a pilot study was conducted, and a protocol developed for collecting the data. A database was systematically used for storing the data following every data collection. Data was gathered from nine teams across a ten-month period using semi-structured interviews, non-participant observation, and artefacts. Using the 3DM as the conceptual framework, a codebook was produced for coding the data in NVivo. The analytical strategy was abduction and retroduction to elaborate theory that might describe the mechanism that causes progress for team-level innovation. The evidence is split into categories of data and for presentation by telling a story of how teams progress through the innovation process.

5. **DATA ANALYSIS AND RESULTS**

The previous chapter, Methodology, described the research design and methods for data collection and analysis. This chapter will describe the data analysis process and then present the results.

The data analysis process was a four-step process. (1) In the first instance the data was viewed through the lens of the 3DM model. The 3DM is the hypothetical conceptual framework that informed the empirical study. However, the model did not capture all the data gathered and therefore was effective for data collection but not the full analysis. (2) Next, an inductive approach was taken to pre-code the data to find alternative concepts and theories. In pre-coding the data, the Gioia Methodology (Gioia et al., 2012) was applied. This approach led to new concepts for capturing data that fell outside the initial hypothetical conceptual framework. (3) Then, all the data was coded as per the codebook. (4) Finally, further analysis of the units of data was conducted for each of the three categories of data by
transferring the data from NVivo to an Excel Workbook. Data that describes team and innovation context provides a narrative. Data that describes exploration and exploitation strategies and activities are temporally bracketed and presented as individual charts. What members say with reference to their innovation project (task-based) or what members say with reference to others character (relationship-based) are presented as quantitative data. The process is explained in section 5.4

5.1. **Step one, viewing the data through the lens of the 3DM**

The 3DM is the hypothetical conceptual framework used in this study for initially guiding the empirical investigation. The model is discussed in chapter 3 of this thesis, subsection 3.5. and a summary is provided below for the convenience of the reader. The model builds on extant literature by overlying competing concepts exploration and exploitation onto the widely accepted three-stage model of the innovation process.

There is an abundant amount of research that describe, discuss, and propose how to balance exploration and exploitation for adaptation at the level of the organisation but not at the level of team. The model implicitly hypotheses that the team can balance these competing yet complimentary learning strategies by cycling between them within and between stages of the innovation process. Therefore, the model guided the data collection and the analysis to a point. Thereby providing a hypothetical conceptual framework for the empirical investigation as is the abductive approach to research.

5.1.1. **A summary of the 3DM as the hypothetical conceptual framework**

All three stages of the innovation process (invention, development, and implementation) contain a complex set of social processes where progress is made by exploring opportunities derived from gaining new knowledge and exploiting opportunities derived from refining and using current knowledge (Tsai & Ghoshal, 1998). This creates a
logical pattern for sequencing the strategies, with exploration occurring first in each stage to generate new or additional information or variety, and exploitation following in each of the three stages to extract value, capitalize on new information and refine ideas to a point where the stage can be completed. Progress along the innovation process requires frequent switching between exploration and exploitation, and a range of endogenous and exogenous factors or events can trigger such changes of focus or direction. Triggers for switching strategies may include timing, that is, a deadline or external event demands progress, an outcome or a deliberate decision based on a review of progress (Andriopoulos & Lewis, 2009; Gersick, 1988; Grief & Keller, 1990). This is most obvious at the end of each of the three stages where a singular event typically heralds the beginning of another stage. For example, a decision to solve a problem, address a particular need, pursue an idea, or accept a project (Amabile, 1988) starts the invention stage. The team (or an external agent like a sponsor, manager or client) selecting a specific idea for further development heralds the end of the invention stage and the beginning of the development stage. The decision to finish further idea refinement and start the introduction of the idea in a practice indicates the end of the development stage and the beginning of the implementation stage. In any case, both exploration and exploitation are necessary for innovation to progress, and it is the interplay of these different strategies and activities that drive the team’s progress through the innovation process. The resulting 3DM (Figure 1) depicts the simplest logical pattern of exploration and exploitation given the three-stage nature of the innovation process.

The 3DM highlighted opportunities for exploration and exploitation within and across stages of the innovation process but the data gathered across teams contained data that were neither exploration nor exploitation related such as remarks and contributions members made during the meeting at the time two, non-participant observation, and information about the team and about the innovation project.
5.1.2. **Using the 3DM to view the data**

The approach to collecting data was designed to gather data that would fall within and beyond the conceptual model. The interview questions were designed to locate ‘a team engaged in the innovation process’ in one of three stages of the innovation process and further, a phase or stage, for example, exploring in development stage. There were no preconceived definitions to identify data that would describe this. In addition, the interview questions were designed to gather data on ‘how’ and ‘why’ teams do what they do to investigate factors that influence progress.

Therefore, the conceptual model is merely a model for informing the empirical investigation and providing a framework for the data, but it does not describe how to analyse all the data gathered.

5.2. **Step two, coding data that falls outside the theoretical framework**

There were significant data that fell outside the initial theoretical framework which was discovered through pre-coding. Pre-coding is a process of highlighting words or text that might hold significance (Meyer & Lunnay, 2013). Data was pre-coded by taking an inductive approach following the Gioia Methodology (Gioia et al., 2012). The Gioia Methodology prescribes creating a template with three columns: column one is for informant-centric data or first order concepts; column two is for second order themes or informant terms; and column three is for distilling the data to an aggregate dimension (Gioia et al., 2012). Pre-coding is a popular method for inductively coding qualitative data as it does not require a priori categories as the method facilitates the discovery of constructs (Clarke & Braun, 2017; Solis, Sinfield, & Abraham, 2013).

Pre-coding the data highlighted that the transcripts needed ‘cleaning’ to make coding more reliable. The first draft of transcripts reported what the participants said, verbatim, including every ‘mmm’ and ‘ah’ sound, which was quite a lot during group discussions (Van Maanen,
However, it was difficult to define these sounds accurately, or conceptually for coding and they interfered with comprehension. In response to this, drafts of all transcripts were saved as ‘cleaned’ with a separate line given to each statement ‘spoken’ by a team member so every informant statement was distinctly recognised as a unit of coding which enhanced comprehension and accuracy (Uzzi, 1999).

To demonstrate pre-coded data, see Figure 8 (and Appendix 3.1, Induction, pre-coding the data).

![Figure 8 Pre-coding data using word](image)

In the example provided in Figure 8; first, each informant centric term “you have to include information...”, is given a second order theme - ‘informing’; next the second-order themes are aggregated to make sense of the phenomena. The observation with these data was that the things team members said were either task oriented or relationship oriented. In addition, things team members said with regards to task facilitated either convergence or divergence in team thinking; and things team members said in relation to relationships could be categorised as either positive or negative.

To demonstrate pre-coding using NVivo see Figure 9. NVivo is a software application for storing, coding, and analysing qualitative data (QSR, 2018). Transcripts were uploaded to NVivo and activities were labelled within codes of exploration (Xor) or exploitation (Xit).
For example, “we had an existing card, but we wanted to have the same card in both hospitals….so [we went to the librarian for help]” (G1) was coded as exploration, or “before the walkarounds we went through the mapping process … and signed off on the questions” (G2) was coded as exploitation as well as being allocated a task name for example ‘comment card’, and ‘questions’. However, this coding system could not work across cases because not all cases would have units of coding that could be categorised as ‘name badge’ for example. Rather this activity which was considered ‘pre-coding’ was an opportunity to become familiar with the data and inform the final codebook.

![Figure 9] Pre-coding data using NVivo

The key observation from pre-coding was that these data represent phases as well as activities, that is some exploration activities or tasks were nested in phases of exploration or exploitation. Therefore, to accommodate all categories of data, exploration and exploitation strategies and activities, separate codes were generated and definitions for inclusion in the final draft of the codebook.

Extensive pre-coding was done with several drafts of transcripts using hard copies as well as soft copies and NVivo. Whenever, themes were found within a single case, the same coding rules were applied to the next case. Pre-coding the data within cases and across cases continued until all data could be accounted for and a codebook produced. The final draft of the codebook exposed three categories of data: data that describes context (team and innovation); data that
describes the innovation process (strategies and activities); and data that describes team behaviours (things members said).

5.2.1. **The codebook**
The codebook is made up of five elements (Boyatzis, 1998): the label and code name; definition; description; examples to support the decision to code; and, what data to exclude. The codebook contains two main categories of data plus sub-categories. (1) Data on the innovation team includes sub-categories of data on the innovation content and the innovation process, see Figure 10. (2) Data on the innovation project plus sub-categories of data on the innovation project content and the innovation process, see Figure 11. These categories of data are further described below.

5.2.1.1. **Data that describe context**
These data were collected by interview at time one and time three and describe the innovation-project team (team content) and the innovation project as context for the innovation (innovation content). Data related to context is outside the unit of analysis but still included in the codebook for two reasons - to provide a narrative about the team and their innovation project; and, to separate these data from data concerning the unit of analysis – ‘a team engaged in the innovation process’. Referring to Figures 10 and 11, these data fall on the left-hand side of each figure.

Within this category of data there are two sub-categories, team content and innovation content.

5.2.1.1.1. **Team content**
Team content or ‘group content’ is the label given in the codebook so not to confuse team one or T1 with time one or T1. This category of data includes two sub-categories. (1) Membership that is coded as GCmem (Group Content membership) includes data that identifies that they are a member of the team or not. For example, why are these members in the team, or how did they become members or not? (2)
Individual Knowledge, Skills, and Attributes that is coded as GCksa (Group Content knowledge, skills and attributes) include data that identify characteristics in individual capacity for performance. For example, “[Person] is a pharmacist and so knows about fluids, and I am a nurse by background” (G3).

5.2.1.2. **Innovation content**

Innovation content include data that describe what the team is working on and why. This category of data includes two sub-
categories. (1) Innovation that is coded as ICinn (Innovation Content, innovation) includes data that describe what the team is inventing, developing or implementing (Garud et al., 2013) and why. For example, “a platform that would allow incident and crisis control for industrial and manufacturing facilities ... with emergency services” (G5). (2) Context that is coded as ICcon (Innovation Context, context) includes data that describes the purpose, direction, and pace of innovation. For example, what contextual factors influenced the pace of innovation?

5.2.1.2. Data that describe the innovation process

These data were collected during interviews at time one and three and represent the innovation process as described by team members.

5.2.1.2.1. Exploration and exploitation strategies

A strategy describes ‘a plan’ for action (Cunningham & Harney, 2012). Exploration Strategy is the label given to describe a strategy or phase of exploration. Coded as IPrs (Innovation Process exploration strategy) this category includes data that describes a plan for increasing variety and options, acquiring new or additional information, resources, knowledge, or capability (McGrath, 2000).

Exploitation strategy is the label given to describe a strategy or phase of exploitation. Coded as IPos (Innovation Process exploitation strategy), this category includes data that describes a plan for gaining consensus, decreasing variability, and converging options to capitalise on existing potential (Beckman, 2006).

5.2.1.2.2. Exploration and exploitation activities

An activity describes ‘the practice of fulfilling the plan’ (Ancona & Caldwell, 1992; Cross et al., 2000; Cunningham & Harney, 2012).

Exploration activity is coded as IPra (Innovation Process exploration activity), this category includes data that describes a single task or action members engage with to increase knowledge, skills, and resources, for example, acquiring, procuring, collecting, exploring, gathering, generating, searching, sourcing, seeking, looking....
Exploitation activity is coded as **IPoa** (Innovation Process exploitation activity), this category includes data that describes a single task or action members engage with to capitalise on knowledge, skills, and resources, for example, assessing, testing, producing, moulding, absorbing, resolving, analysing, experimenting, converging, exploiting....

5.2.1.3. **Data that describe team behaviours**
The final draft of the codebook contained the following codes and definitions for things team members said.

- Group Process relationship positive (**GPrp**) are things members say (implicit in tone, explicit in words) which suggests solidarity, tension release, support (Bales, 1950; Schein, 1998)
- Group Process relationship negative (**GPrn**) are things members say (implicit in tone, explicit in words) which suggests antagonism, tension, or withdrawal (Bales, 1950; Schein, 1998)
- Group process task divergence (**GPtd**) are things members say (implicit in tone, explicit in words) about the project that deviates from current thinking, increases variety of options, or raises doubt
- Group process task convergence (**GPtc**) are things members say (implicit in tone, explicit in words) about the project which synchronises thinking, reduces variety of options, or eliminates doubt

These data were counted as quantitative data and are reported as such. The full codebook is provided in Appendix 3.2.

5.3. **Step three, code the data using the Codebook**
Once the codebook was written, with definitions of each concept shown in Figures 10 and 11, all data was coded using NVivo. For example, within NVivo the concepts were coded as GC for Group Context, GP for Group Process, IC for Innovation Context, and IP for Innovation Process. Further, within key categories, are sub-categories. For example, within GP is GPrn which is code for Group Process Relationship Negative. All the transcripts and artefacts were
uploaded to NVivo and coded case by case. A snapshot of coding for each case is provided in Figure 12, NVivo summaries of case coding.
Figure 12|NVivo summaries of case coding
NVivo counts all the units of data per code. For example, each reference is a unit of data. Figure 12 shows the reference counts for each case. In total, the data analysis generated 2,549 units of data across all cases, with an average of 283 units of data per case (see Figure 13 and Appendix 4 for a larger copy).
## 5.4. Step four, final analysis of data

An Excel worksheet template was created for transferring the coded data, for each case, from NVivo for final analysis by reduction. Using a format similar to that recommended by Gioia et al., (2012) and used during pre-coding. Each row contains a label for each category of data and each adjacent column holds the units of data corresponding to that label. For example, Figure 14, innovation content (ICinn) column one and units of data in column two. A review of the units of data in column two highlighted themes which were subsequently listed in the adjacent column three. Finally, themes were aggregated in column three and a summary provided in column four.

### Figure 14: Analysing the units of data

The analysis for each case is provided in Appendix. Data that describes the innovation context (innovation team and innovation project) are listed for each case in Appendix 4.2. Data that describe
the innovation process (strategies and activities) for each case are provided 4.4. Data that describe team behaviours are provided in Appendix 4.3. In addition, the units of data concerning things team members said about tasks or relationships were counted (as in Figure 13) and the output is presented in Figure 15.

In summary. The gathered data were viewed through the lens of the 3DM as the hypothetical conceptual framework. But not all the data was accounted for by the model. The Gioia Methodology (Gioia et al., 2012) was used to inductively pre-code the data to discover other concepts and theories that might explain progress. Pre-coding the data exposed main categories and sub-categories of data that were then empirically and conceptually defined to produce the codebook. All data was coded in NVivo using the codebook as the referencing framework. Finally, the units of data for each case were further analysed for an explanation of how teams progress through the innovation process.

<table>
<thead>
<tr>
<th>Team</th>
<th>Relationships</th>
<th>Task behaviours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% Positive</td>
<td>% Negative</td>
</tr>
<tr>
<td>Team 1</td>
<td>92</td>
<td>8</td>
</tr>
<tr>
<td>Team 2</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>Team 3</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>Team 4</td>
<td>47</td>
<td>53</td>
</tr>
<tr>
<td>Team 5</td>
<td>41</td>
<td>59</td>
</tr>
<tr>
<td>Team 6</td>
<td>88</td>
<td>12</td>
</tr>
<tr>
<td>Team 7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Team 8</td>
<td>82</td>
<td>18</td>
</tr>
<tr>
<td>Team 9</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>Totals</td>
<td>73</td>
<td>27</td>
</tr>
</tbody>
</table>

5.5. The results

First there is a brief description of the results for each case under the following sub-headings: the team and innovation context; the innovation process; and things members said. A complete report for each case is provided in Appendix 4.5. Then, the cases are aggregated
and an explanation for how teams progress through the innovation process is provided.

5.5.1. **Case one**

Case one was working on a system for meeting and maintaining a national Health Charter as a real-life quality improvement project that was supported by the academic programme they were collectively enrolled on.

5.5.1.1. **Team and innovation context**

A core team of three members, plus a team sponsor who was not active within the project but still recognised as a member. All team members have relevant and specialist knowledge and training, working on a system for meeting and maintaining a national Health Charter driven by a formal program for change and supported by executive management. The main challenge for this group was their influencing front line personnel to engage with the project. Most helpful to the project was the influence of executive management on front line personnel the one member's extensive contribution. See Appendix 4.5.1. for a complete description.

5.5.1.2. **The innovation process**

Team one’s exploration and exploitation phases and activities are temporally ordered and abstractedly depicted in Figure 16. The top row labels the key phases of exploration and exploitation for each stage of the process. These phases are represented in subsequent rows as blue lines (strategies phases) and blue dotted lines. The dotted blue lines represent a phase for collecting and analysing data that happened in the background while the team were getting on with increasing awareness of the project and the Health Charter and gaining consensus. The third stage finished here with a half diamond only because this stage remains open. Collectively the lines produce three and a half geometric diamond shapes.
Activities are represented by block-filled grey geometric diamond shapes and labelled by a grey speech bubble which names the activities and the corresponding exploration and exploitation make-up of the activity. Team meetings are represented by a long block-filled geometric diamond shape across the middle of the chart demonstrating on-going, regular team meetings throughout the life of the project. The circular arrows within the team meetings’ diamond demonstrate the continuous and iterative cycle of to-do lists and follow-up. Like stages of the process, the key activity described by the team consists of an element of exploration followed by exploitation for completion. Card design is the one key activity the team talked about. The team implied there were other tasks or ‘to do' items which came out of their regular team meetings, but the team did not go in to these tasks in any detail although the implication is that each to-do item requires a follow-up. See Appendix 4.5.1. for a complete description.

5.5.1.3. Things team members said
Task behaviours: In this team 34% (multiple-case average = 43%) of the things this team said concerning task behaviours were diverging and 66% (multiple-case average =57%) were converging. Therefore, this team used less task diverging language than the teams overall, and more task converging language than the teams overall. Also, within this team, the number of converging things said were twice as
much as diverging things said (34% and 66%) which suggests this team put almost twice as much effort into synchronising their thinking than creating doubt or increasing options.

Relationship behaviours: In this team 92% (multiple-case average = 73%) of the things this team said concerning relationships were positive and 8% (multiple-case average = 27%) were negative (Table 15). Therefore, this team used more positive language than the overall teams and less negative language than the overall teams. In addition, most things said about or to each other in this team were positive.

In commentary, one team member took on extra work - “you guys are all on holidays, and I am trying to get these comment cards going” and it is thought that they had a lot of challenges - “I don't think it is unfair to say that one of the reasons [Person] is not here with us right now is because she has had a very challenging year”. Therefore, in interview two at time three, the two remaining team members give a lot of compliments about this person’s contribution to the project, for example, “... she thinks she hasn't been contributing enough which is absolutely ridiculous because we couldn't have done it without her”. Separately it was sensed by the researcher, during time two non-participant observation, that relationships in this team were split two to one against the team member who had to take ‘leave’. In addition, this person had a bigger challenge with the hospital they were responsible for – “…a massive ogre of a machine that is very difficult” and took responsibility for managing the other two in terms of having regular, formal meetings – “so we had the informal ones, whereas [Person] did make us be more formal…. that says a lot about us, doesn't it?” (group one, time three interview). So, whilst there were mostly only positive relationship things said perhaps the reason is that they were patching the relationship between persons one and two, and three? Regardless, progress through the innovation process was made.
5.5.2. **Case two**

Case two was working on a service-user health and safety project as a real-life quality improvement project supported by the academic programme they were collectively enrolled on.

5.5.2.1. **Team and innovation context**

A core group of three members piloting a process for improving service user health and safety experience, and organisation communication, driven by a formal program for change, supported by CEO and complemented with a Steering Committee with relevant resources. Most helpful was the commitment of the team to a common goal. The pilot achieved approval for a company-wide roll-out plan. See Appendix 4.5.2 for a complete description.

5.5.2.2. **The innovation process**

Team two’s exploration and exploitation strategies and activities are temporally ordered and abstractedly depicted in Figure 17. The top row labels the key phases of exploration and exploitation for each stage of the process. These phases are represented in subsequent rows as blue lines. Collectively the lines produce three geometric diamond shapes. The project consists of three stages: planning, developing, and piloting. Each stage begins with a phase of exploration and ends with a phase of exploitation before moving to the next stage. Planning - acquiring additional resources via steering committee and briefing sites about pilot; Developing - gathering ideas for an amended document and presenting to committee for approval; Piloting - visit pilot sites and complete actions.

Overall, the closing of one strategy enabled the beginning of another. Separately, but less obvious due to limited data, the team engaged in several activities which appear to reflect their approach to strategies, that is each activity consisted of an exploration stage followed by an exploitation stage. See Appendix 4.5.2 for a complete description.
5.5.2.3. Things team members said

Relationship behaviours: In this team 100% (multiple-case average = 73%) of the things this team said concerning relationships were positive (Table 15). Therefore, this team used more positive language than the overall teams. In commentary, the researcher found this team always relaxed, finishing each other’s sentences, giggling, and joking during sessions and generally relaxed in each other’s company.

Task behaviours: In this team 33% (multiple-case average = 43%) of the things this team said concerning task behaviours were diverging and 67% (multiple-case average =57%) were converging. Therefore, this team used less task diverging language than the teams overall, and more task converging language than the teams overall. Also, this team used almost half as much task diverging language than converging (33% and 67%) which suggests this team put almost twice as much effort into achieving consensus than creating doubt or disruption.

5.5.3. Case three

Case three was working on a prescription administration project as a real-life quality improvement project supported by the academic programme they were collectively enrolled on.
5.5.3.1. Team and innovation context
Team three is made up of a core team of three members with relevant medical training working a project for improving prescription administration and improving safety. The team describe their working relationship as good based on shared work-load and standards, good energy, similar writing style, good psychological safety as well as being highly motivated and having role status within the organisation to influence others. The project is driven by a formal change program that dictates time, a methodology, momentum, and techniques for influencing change. The biggest challenge for the team was influencing front-line personnel with whom the team rewarded with cupcakes when positive change was noted. See Appendix 4.5.3 for a complete description.

5.5.3.2. The innovation process
Team three’s exploration and exploitation phases and activities are temporally ordered and abstractedly depicted in Figure 18. The top row labels the key phases of exploration and exploitation for each stage of the process. These phases are represented in subsequent rows as blue lines and blue dotted lines. The dotted blue lines represent a phase for collecting and analysing data that happened in the background while the team were getting on with increasing awareness of the project and the Health Charter and gaining consensus. The third stage finished here with a half diamond only because this stage remains open. Collectively the lines produce three and a half geometric diamond shapes. This project can be described as consisting of three stages: planning, engagement, and piloting. Each stage begins with a phase of exploration and ends with a phase of exploitation. (1) Planning began with a phase of exploration to generate ideas, acquire information about stakeholders, and gather data before exploiting this data and the driver diagram to refine their project. (2) Engagement dictated an initial phase for engagement with frontline personnel to solicit their ideas and resources before switching to a phase of exploitation to gain buy-in with frontline
personnel for the project. (3) The pilot stage began with a phase of exploration for gathering information about the re-designed chart and ended with a phase of exploitation by refined the recommendations for implementation to gain acceptance for a re-print and roll-out beyond the project. The team would revert to this phase of the pilot several times. See Appendix 4.5.3 for a complete description.

Overall, the closing of one strategy enabled the beginning of another. Exploration and exploitation activities described by team three are provided in Appendix 4.5.3.

<table>
<thead>
<tr>
<th>Time-line</th>
<th>Oct-16</th>
<th>Nov-16</th>
<th>Dec-16</th>
<th>Jan-17</th>
<th>Feb-17</th>
<th>Mar-17</th>
<th>Apr-17</th>
<th>May-17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation Process</td>
<td>Planning: acquiring information and data; and refine their project</td>
<td>Engagement: acquire support; and gain buy-in</td>
<td>Pilot: gather information; and revise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**5.5.3.3. Things members said**

Relationship behaviours: In this team 100% (multiple-case study average = 73%) of the things this team said concerning relationships were positive (Table 15). Therefore, this team used only positive language which is more than the multiple-case study average. In addition, most things said about or to each other in this team were positive.

Task behaviours: In this team 45% (multiple-case study average = 43%) of the things this team said concerning task behaviours were diverging and 55% (multiple-case study average =57%) were
converging. Therefore, the language this team used in relation to tasks was close to the multiple-case study average.

5.5.4. **Case four**

Case four was working on an administration project as a real-life quality improvement project supported by the academic programme they were collectively enrolled on.

**5.5.4.1. Team and innovation context**

A core team of three members, plus a team sponsor who is available for advice but does not participate in the project on a daily basis. All members are professionally trained, with diverse, yet complementary skills motivated to learn how to make improvement in quality in their organisation. There appears to be two key challenges for this project: two team members leaving the organisation before the project was complete and restarting the project a number of times because the team initially tried to make big changes outside their area of responsibility where they neither understood the system nor had support from the personnel there. Most helpful was the team shifting focus to a small local problem/idea. See appendix 4.5.4. for a complete description.

**5.5.4.2. The innovation process**

Team four's exploration and exploitation phases and activities are temporally ordered and abstractedly depicted in Figure 19. The top row labels the key strategies of exploration and exploitation for each period, phase, or stage of the process. These strategies are represented in subsequent rows as blue lines. Collectively the lines produce three geometric diamond shapes. The circular blue arrows represent the iterative process within stage one, refining the problem/solution. Activities are represented by block-filled grey geometric diamond shapes and labelled by a grey speech bubble which names the activities and the corresponding exploration and exploitation make-up of the activity. The circular grey arrows within the data collection
diamond demonstrate the continuous and iterative cycle of auditing and analysing. See Appendix 4.5.4 for a complete description.

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**Figure 19| Case four, the innovation process**

### 5.5.4.3. Things members say

Relationship behaviours: In this team 47% (multiple-case study average = 73%) of the things this team said concerning relationships were positive and 53% (multiple-case study average = 27%) were negative (Table 15). Therefore, this team used more negative language than positive, and more than the average negative language used across all nine cases. In commentary, the relationship was sensed as strained between two members with one member much more aggressive for progress than another.

Task behaviours: In this team 34% (multiple-case study average = 43%) of the things this team said concerning task behaviours were diverging and 66% (multiple-case study average =57%) were converging. Therefore, this team used less task diverging language than the multiple-case study average, and more task converging language than the multiple-case study average. Also, this team used almost half task diverging language than converging (34% and 66%) which suggests this team put almost twice as much effort into achieving consensus thinking than creating doubt or increasing options.
5.5.5. **Case five**

Case five was building an IT platform as part of a project sponsored by an MNC.

**5.5.5.1. Team and innovation context**

Team five consists of three strangers who worked on an idea to build an IT platform for incident and crisis control. Their award-winning idea was generated over the course of a weekend at a Hackathon event sponsored by an MNC who will also sponsor workshops for the team to develop their idea - “…we met at the Hackathon”; “…over the course of the weekend the [team] proposed their idea and it was actually selected by the adjudication panel as being the best idea that was there at that point in time”; “We are kicking off a new initiative with the winners of the recent Big Energy Hack. The [team] have been invited to a day-long workshop exploring the Value Proposition and the early Business Model Canvas. In a way this workshop will serve 2 purposes: it will allow [Sponsor Company] to see how committed the remaining members of the [team] are and it will also enable them to better understand what will be involved in developing out their new business proposition”. Team trust and commitment were their biggest challenge - “And, you’re not going to be able to do it! He was kinda like that! It was very kinda aggressive, like I am not going to do it, you won’t be able to do it”; “…towards the end the more the pressure came, and I think that is when he kinda disappeared”. In addition, it must be said that this team are not employees of the organisation, rather they are employed separate to the project – “Because it is hard to keep momentum of these things especially when it is not your job, you are not obliged to do, so meeting up every week kept momentum”.

**5.5.5.2. The innovation process**

Team five’s exploration and exploitation strategies and activities are temporally ordered and abstractly depicted in Figure 20. The top row labels the key phases of exploration and exploitation for each stage of the process. These phases are represented in subsequent rows
as blue lines. Collectively the lines produce one geometric diamond shape because this team did not progress to the development stage of the innovation process. During the initial phase of invention, a group of individuals explored various ideas that would transform them as a team. After only two days, “So over the course of the weekend the [team] proposed their idea and it was actually selected by the adjudication panel as being the best idea that was there at that point in time”, they switched to a phase of exploitation to consider their idea further before a decision was made to shelve the project “… so we met every week to work on it”.

Activities are represented by block-filled grey geometric diamond shapes and labelled by a grey speech bubble which names the activities and the corresponding exploration and exploitation make-up of the activity. The circular grey arrows within the team meetings diamond demonstrate the continuous and iterative cycle of meeting and closing.

The successful completion of key activities also enabled progress in the innovation process of which the team briefly described two: a workshop and weekly team meetings. The workshop was a single event where the team gathered resources from business consultants to use for developing their value proposition - “The [team] have been invited to a day-long workshop .... it will also enable them to better understand what will be involved in developing out their new business proposition”; and, they used this time to brainstorm their idea - "the brainstorming we did at the start was very good in the initial meeting when we sat down in [location] with [consultants] "(Workshop); "the sessions with DBIC were great, to be honest. It gives you someone to bounce ideas off, you really kinda end up in your own bubble and for someone external to come in ...and just pick it apart...". Weekly team meetings were just briefly described but more in the context that they were both productive and destructive - "And then we set up weekly meetings, so we met every week to work on it"; “they were good, they were mostly productive ... they
sometimes varied to be honest…. depending on his mood, if he was in a good mood we all got along well, we got a lot done and then sometimes he would come in and he would derail the whole two hours because he was just, (sighs and giggles), maybe he was right sometimes but he would just, like if he wasn’t feeling it, that was it, no one would get any work done”.

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**Figure 20** | Case five, the innovation process

5.5.5.3. Things members said

Relationship behaviours: In this team 41% (multiple-case study average = 73%) of the things this team said concerning relationships were positive and 59% (multiple-case study average = 27%) were negative (Table 15). Therefore, this team used more negative language than positive, and more than the average negative language used across the multiple-case study. The team at time three interview described issues between relations which may have affected progress – “depending… if he was in a good mood we all got along well, we got a lot done and then sometimes … if he wasn’t feeling it, that was it, no one would get any work done. So, it was quite hard”; “[Person] and I worked quite well together throughout the entire process and if we were still working on it with [other], I would have no idea how we could progress”.

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Task behaviours: In this team 66% (multiple-case study average = 43%) of the things this team said concerning task behaviours were diverging and 34% (multiple-case study average = 57%) were converging. Therefore, this team used also twice as much task diverging language as task converging, and more task diverging language than the teams multiple-case study average. These statistics suggest this team was less successful in achieving consensus in their thinking than the multiple-case study average and perhaps this is way their project was rejected from progressing to the development stage.

5.5.6. **Case six**

Case six was constructing a new building as a project commissioned by their client.

5.5.6.1. **Team and innovation context**

A core team of thirteen members, with dotted lines to an extended team of skilled personnel working on constructing a new building commissioned by their client. Their biggest challenge was the working conditions, i.e. strict deadlines, limited working space, and managing multiple stakeholders’ requirements. Most helpful was the team and their combined experience, as well as professional skill, healthy working relationships, collaboration, common goal, respect, and trust. See Appendix 4.5.6 for a complete description.

5.5.6.2. **The innovation process**

Team six’s exploration and exploitation strategies and activities are temporally ordered and abstractedly depicted in Figure 21. The top row labels the key strategies of exploration and exploitation for each period, phase, or stage of the process. These strategies are represented in subsequent rows as blue lines. Team six’s project has four distinct stages as described by the team: inception; feasibility study; outline design; tender; detailed design and build - “...effectively the process we went through is inception, very, very short – what is it we want to do”; "feasibility, very, very short – what are the various options we can do, outline (very short) tender, builder on board, start building
while you design it. And that is how we developed this project through”.

Activities are represented by block-filled grey geometric diamond shapes and labelled by a grey speech bubble which names the activities and the corresponding exploration and exploitation make-up of the activity. The circular grey arrows within the team meetings diamond demonstrate the continuous and iterative cycle of meeting and closing. See Appendix 4.5.6 for a complete description.

**Figure 21** Case six, the innovation process

### 5.5.6.3. Things team members said

Relationship behaviours: In this team 88% (multiple-case study average = 73%) of the things this team said concerning relationships were positive and 12% (multiple-case study average = 27%) were negative (Table 15). Therefore, this team used mostly positive language and more positive language than the teams multiple-case study average.

Task behaviours: In this team 40% (multiple-case study average = 43%) of the things this team said concerning task behaviours were diverging and 60% (multiple-case study average =57%) were converging. Therefore, this team used similar task converging and diverging language than the teams multiple-case study average.

### 5.5.7. Case seven

Case seven was developing a data analytics service as a project to fulfil an organisation level objective.
5.5.7.1. Team and innovation context

Case seven is made up of a core team of five people situated within an innovation unit of a multi-national utility provider. The team has extended lines to a network of personnel across this multi-national organisation working on a developing a data analytics service to fulfil an organisation level goal. The team trades their reputation for opportunities to piloting their service within the organisation and generate sales leads beyond the organisation using their network of connections. See Appendix 4.5.7 for a complete description.

5.5.7.2. The innovation process

Team seven’s exploration and exploitation strategies and activities are temporally ordered and abstractedly depicted in Figure 22. The top row labels the key strategies of exploration and exploitation for each stage of the process. These strategies are represented in subsequent rows as blue lines. Collectively the lines produce two and a half geometric diamond shapes. Data collection ended in August 2017 which is why there is no further data to complete this stage.

Team seven’s project has three distinct stages as described by the team but interpreted by the researcher as – invention, development, and implementation. Each stage contains a phase for exploration followed by a phase of exploitation. In this first stage, two of the team members took on the challenge of finding a product or solution to meet an Organisational objective - "... there were four key areas the business wanted to target, this is around 'Big Data', so I took that one on ...". Initially the team engaged in a phase of exploration to gather information on what ‘big data’ means and switched to a phase of exploitation to limit options and variability by using a roadmap to gain consensus - “we did a Big Data strategic roadmap for [the organisation], that was delivered June 2016 and that confirmed Big Data as an area [we]...” (2) The second stage began with a phase of acquiring resources by way of seeking cases to build for proof of concept - “we have been trying to get ourselves out there … and we are just looking for ideas or used”. This stage progressed with a phase
of exploitation as the team capitalised on their resources - “through the used cases ... we can display to clients and say would you be interested in this”? (3) This final stage began with an exploration phase to increase resources that would facilitate their getting to market by utilising the Organisation’s business development team’s contacts – “… the next step is external customers. See Appendix 4.5.7 for a complete description.

5.5.7.3. Things team members said

Relationship behaviours: This team did not use relationship language, neither positive nor negative. Even though 73% of the things all nine teams team said concerning relationships were positive and 27% were negative (Table 15) it was sensed that this team were comfortable and confident with each other and therefore perhaps there was no need for relationship language, at least during the three data collection times.

Task behaviours: In this team 43% (multiple-case study average = 43%) of the things this team said concerning task behaviours were diverging and 57% (multiple-case study average =57%) were converging. Therefore, this team used the same ratio of task converging and diverging language than the teams multiple-case study average. This team were more successful in uniting their thinking than not.

5.5.8. Case eight

Case eight was creating a new process for managing waiting lists in hospitals as a project commissioned by the Department of Health.
5.5.8.1. Team and innovation context

Team eight consists of core team of four members with extended lines to numerous personnel, including senior stakeholders within the industry for relevant knowledge, skills, and attributes as required for implementing a new process for managing waiting lists in hospitals as commissioned by the Department of Health. The team believes their experience, reputation, network, ability to build relationships, effective communication, and collaboration are instrumental to the project. In addition, the team believe a key contributing factor to reaching targets was their managing the project in accordance with a pre-determined ‘terms of reference’ and ‘project charter’. A delay in one aspect of the project was due to a change in decision by a change in senior management within the organisation. See Appendix 4.5.8 for a complete description.

5.5.8.2. The innovation process

Team eight’s exploration and exploitation phases and activities are temporally ordered and abstractedly depicted in Figure 23. The top row labels the key phases of exploration and exploitation for each stage of the process. These phases are represented in subsequent rows as blue lines. Collectively the lines produce two and a half geometric diamond shapes. Data collection ended in August 2017 which is why there is no further data to complete this stage.

The team were simultaneously engaged in three phases of exploration during the second stage of their project: communicating the project nationally; developing the toolkit; and developing the training program. The dotted blue line in stage three represents the team’s plan for continuation. 1) Stage one, the Protocol. The team began the project with a strategy of exploration to prepare and acquire additional resources that would enable them to deliver the project - "...a workshop and that we would invite forty-eight people from around the country to come together and share their knowledge, experience within waiting list management". This stage progressed with a phase of exploitation to capitalise on gathered knowledge
“There would be named responsibilities, project advisor, project sponsor, advisor, so you really had to free up your time for this project and make decisions or it would delay the project”;

The data gathered during the workshop was analysed to inform the Protocol – “data was taken away, it was analysed, and it was reported back within three weeks.

(2) Stage two, the Toolkit. This stage began with a period of exploration to resource the development of the toolkit "so I have gathered samples from each of the sites involved"; “... we are commissioning consultancy to help us with that, they are, at the moment, scoping that, and it is due back to me by the end of next week".

This stage continued with a phase of exploitation by selecting three patient correspondences and testing their effectiveness - "We are starting with just three letters (administration strand) and at the moment we are taking bits from a couple of the different letters".

(3) Stage three, Training. This third stage concerns a training programme to support the toolkit which will fulfil the Protocol. This stage began with a phase exploration to design a training program that would implement the project - “The 3rd piece is to provide training and developing around the protocol and we are in the design phase of the T&D programme”; “Before the end of the year October-December will be training”. There is no data available for the range of activities to complete this stage.

![Figure 23] Case eight, the innovation process

5.5.8.3. Things team members said

Relationship behaviours: In this team 82% (multiple-case study average = 73%) of the things this team said concerning relationships
was positive and 12\% (multiple-case study average = 27\%) were negative. Therefore, this team used mostly positive language and used more positive language than the teams multiple-case study average.

Task behaviours: In this team 58\% (multiple-case study average = 43\%) of the things this team said concerning task behaviours were diverging and 42\% (multiple-case study average = 57\%) were converging. Therefore, this team appear to have some difficulty in achieving consensus in their thinking. See Table 15.

In commentary, much of what this team were dictating was just that, a dictation. Time two, non-participant observation provided evidence, by way of diverging language, that perhaps the wider team are disagreeing with some of the decisions being made by the core group.

5.5.9. Case nine
Case nine was constructing a stand to facilitate the parking of twelve aircrafts as a project commissioned by their client.

5.5.9.1. Team and innovation context
Team nine consists of a core group of four members with an extended team of contractors and stakeholders working together for the exclusive purpose of this project. This group has not worked together before but believe they have good working relationships - “we are a team who by and large haven't worked together before”; [Project managers] are relatively new [to the company], this is the first time we have worked with the consultants ... We are a small enough team and because of the type of environment .... we have ALOT of stakeholders”; “we have all stakeholders involved, initially the workshops were concise but now they are expanded ... the stakeholders circulation list has increased or widened”. They are working on a construction project commissioned by their client which affects multiple stakeholders both on the client site and beyond, into the surrounding community and environment, as well as national
tourism - “We have such a wide community interested in what we do, people want to have a say in what do, so we are under a lot of scrutiny”; “agendas, wants and needs, they are all relevant, every suggestion put forward from a stakeholder ... are all extremely valid ... you have to risk assess and prioritise them and there is huge client buy-in”; “you have external stakeholders as well, statutory authorities, county council, the EPA, Irish Water, and they bring an external influence on the project as well”.

For a more complete description of the team nine team and innovation context see Appendix 4.5.9.

5.5.9.2. The innovation process

Team nine’s exploration and exploitation phases and activities are temporally ordered and abstractedly depicted in Figure 24. The top row labels the key stages of exploration and exploitation for each phase of the process. These phases are represented in subsequent rows as blue lines. Collectively the lines produce four and a half geometric diamond shapes. Data collection ended in October 2017 and at that time the team described the process that would take them up to January 2018 which is why the fifth stage finishes here as it does. The stages are linear. The stages of the process were: the feasibility design, tendering process for a consultant to do the design phase; outline design phase; detail with the design; the procurement process for the contractor to build the works. We could also see this project progressing as follows - the first stage, invention, concerns exploring the concept. This stage begins with a phase of exploration to gather information about the proposed building and switch to a phase of exploitation to refine the proposal. This stage includes the key activity of tendering for a consultant to assess the feasibility study and accept or reject the proposal. The second stage, development, concerns developing a solution. This stage begins with a phase of exploration to gather ideas and research design options before switching to a phase of exploitation to refine the design and get sign-off. The third stage, implementation, concerns providing the
solution. This stage begins with a phase of exploration to recruit a building contractor and develop the relationship(s) upon which implementation is dependent. This stage continues with a phase of exploitation for the construction and delivery of the building.

Team nine’s project has five distinct stages as defined by the team: feasibility; tender for consultant; outline design 30%; outline design 100%; tender for construction. - the stages of the process were: the feasibility design would have been done last summer, and then the tendering process for a consultant to do the design phase would have been carried out at the end of last year and [consultant] were appointed in April, .... Then they begin the outline design phase to develop the design fully because feasibility is a high-level design and that is where they are at the moment and once it is completed at the end of summer then they will go into more detail with the design as we also start the procurement process for the contractor to build the works next year.

For a more complete description of team nine’s innovation process see Appendix 4.5.9.

5.5.9.3. Things team members said
Relationship behaviours: In this team 100% (multiple-case study average = 73%) of the things this team said concerning relationships was positive. Therefore, this team used only positive language and used more positive language than the teams multiple-case study average. See Table 15.
Task behaviours: In this team 28% (multiple-case study average = 43%) of the things this team said concerning task behaviours were diverging and 72% (multiple-case study average = 57%) were converging. Therefore, this team was more successful in achieving union thinking than not.

5.6. Results of the multiple-case study

5.6.1. Team and innovation context

The types of innovation these teams are working on vary from administration procedures, to work processes, to new products, buildings, and services. The teams were in various stages of invention, development, and implementation when the data was being gathered. A timeline of each cases’ innovation project progress is mapped onto a timeline of data collection in Chart 1. Data collection began in January 2017 when some projects had already begun their invention stage (represented by a 1 on the y axis). When data collected ended in October 2017 only two projects were nearing completion while two projects would continue indefinite. A college change program drives four projects (Cases G1-G4); three are client projects (Cases G6, G8, and G9); and two grew from time spent in an innovative hub (Case G5 and G7). The client or management team typically dictate time scales.

Chart 1: Project and data collection timeline

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The teams average five members (between three and thirteen) who formed for the sole purpose of a specific innovation project. All members of all teams have responsibilities towards other types of work outside this team, but the focus is their actions and behaviours on this team’s specific innovation project. However, Case G7 did change their locus to expand their energy on a single project that was the project described in this study. All projects have the support of a senior manager or executive representative, and access to relevant resources.

The teams list the following as key challenges (see Figure 25): influencing front-line personnel; time constraints; changes in employment and project focus; team trust and commitment; managing stakeholders; and generating external sales leads. The majority of challenges highlighted by the Teams reflect collective team challenges whereas two teams (Case G4 and Case G5) appear to focus more on challenges owing to structural and behavioural issues within their teams, specifically: Team 4 found the project more challenging when two out of three members left the organisation before the project was completed; Case G5 described a lack of trust in members ability to complete the project was an issue as was membership commitment to the project. Case G5 is a unique team in this study because they are the only team geographically dispersed who were personally motivated to volunteer in a publicly announced innovation project.

The things that team members said were helpful to the project include: skills learned during the project; team relationships, shared values, narrowing the project focus, previous relevant work experience, collaboration within and beyond team boundaries, respect, trust, personal reputation, personal network, communication, listening skills, and project planning and preparation. There were some noticeable observations between teams with regards to what was helpful: Five teams, Cases G3, G6, G7, G8 and G9 emphasised the significance of relationships and their network, shared values or
common goals, reputation, trust, and communication. Whereas there was no emphasis on these elements with the other teams, Cases G1, G2, G4 and G5 who put more emphasis on the transactions element which they found helpful, that is, narrowing their objective, the program for change, and sponsored workshops. See Appendix 4.3 for a chart of things team members said were helpful and challenging to the process.

In summary, some teams were very clear in their description of tasks and progress and were inclined to emphasise the value of relationships for making progress. Other teams were less clear about the direction they were going and appeared to be working it out as they went along. These teams were more inclined to describe tasks. Relationships (intra/trans-team) were considered a challenge and cause of slower than expected progress. Considering both groups of teams emphasised the significance of relationships, this would suggest relationships are central for progress, either they enable progress when managed effectively or this hinder progress if not considered relevant.

5.6.2. The innovation process

In response to the research question, a story will explain how teams progress through the innovation process that includes data, as evidence, from across all teams used in this multiple-case study. This is a story about how teams cycle between learning phases of exploration and exploitation, punctuated by events, to progress through the innovation process. Therefore, this story is about teams in the context of the innovation process.

5.6.2.1. In the beginning

The innovation process has a definitive starting point; a time or event when a problem is raised, an idea is born, or a project is accepted. At the time of this event, the problem, solution, and project has not been explored by the innovation team. This is merely a starting point. However, this is still a significant event in the innovation process.
because it acknowledges an idea and therefore initiates relevant activities for progress. For example, a team cannot begin work on an innovative idea unless the idea presents itself. Even after the idea presenting itself, the team cannot begin work on this idea until they accept it as a project. So, an idea, a problem, or an event must be consciously acknowledged and accepted for the innovation process to begin.

An example of events that start the innovation process include: an initiative by the senior management team; an academic program with a formal start date; and a client assignment.

1. An initiative by senior management - “... the biggest conference in the world for emergency medicine is in America.... try to think of something the yanks will find interesting” (G1); “The [Company] has issued a call for tinkerers and hackers to attend its first ever energy hackathon – called The Big Energy Hack -with prizes of up to €5000 available for the brightest idea on the day. As the organisers of the event, the [Company] is calling on people from a diverse range of fields to apply; including IT, innovation, marketing, design, finance and entrepreneurship.” (G5); and, "... there were four key areas the business wanted to target ... so I took that one on and this kinda lobed out of that" (G7).
2. A formal change program which in this case was driven by an academic program – “The project started with the commencement of the course” (G2); I had seen the diploma advertised, .... we feel that it is an area of high risk in the hospital” (G3); and, “I signed up for the diploma without recognising there was a problem to be fixed” (G4).

3. A client assignment - “May 2016 is when we were handed the project as a team and told to deliver it” (G6); “… we are an independent statutory entity ... [to] meet the requirements as set out by the [our client]” G8; “... the brief comes from [the client] originally and then you put forward proposals ... once they can see that you are able to benchmark, you secure buy-in” (G9).

Therefore, an event marks the beginning of a phase, that is, the direction the team will take to progress.

5.6.2.2. The exploration phase of invention

Invention is the first stage of the innovation process where ideas are gathered and/or explored. But for this to happen, invention is also a stage for the team to prepare for the innovation project. ‘Preparation’ refers to the team making sense of what is required by them for the project. The project becomes the vehicle that the team must learn to drive and control. An idea or the idea will evolve and become maturing cargo. At this stage, the team does not know where they are going or what the end-point looks like. Therefore, invention is an opportunity to roadmap the route and lay a foundation for the project.

There are two phases of invention that facilitate the journey the innovation will take. The first is a phase of exploration and the second is a phase of exploitation. Both are initiated by a strategy which is a plan for action (Cunningham & Harney, 2012). Teams will approach this phase in any one of at least three ways: they will immediately explore who do we need to help us (increase resources); what are the options available to us before we go looking for people
and resources (explore options); or what do we know about the problem or idea, so we can build on it (explore the problem/solution).

1. Increase resources “by the time you get the appointment of a steering committee with all the relevant stakeholders .... to support the three of us in the project” (G2); "if you spend a longer amount of time on preparation you are not going to veer off track as easy if you are not spending the time on preparation .... a project charter agreed .... so, you really had to free up your time for this project and make decisions or it would delay the project” (G8).

2. Explore options “... optioneering, what are the various things we can do - and this is more when this team gets involved, how do we achieve it? we could build something like this, that, single story, two stories, we could connect it by bus/monorail/bridge, we looked at all the various options and tried to develop which is the more suitable one (G6)

3. Explore the problem or solution “We are at the very start, we are getting our baseline [data] for the project” (G1); “.... I feel we have being doing a lot of the same things over and over again ... as a group we talked a lot and didn’t really come up with nailing our colours to the mask on one thing” (G4); "... "how we got there initially, was through a number of disruptive mind sort of workshops” (G7); “in the beginning we were quite enthusiastic, and we had lots of ideas ... we defined what the key standards were, we found that no [standards were being met]” (G3); “you would’ve justified in the brief that it can be delivered ultimately ...” (G9).

The amount time a team spends in this phase is time or value dependent. ‘Value’ refers to the resources, the knowledge, the insight, etc. they gather about themselves and the project that enables progress.

5.6.2.3. Switching between phases within invention

After some time, there is a push out of the current phase or a pull to the next phase. This push or pull is value or time dependent. Meaning
the team feels or decides that enough value has been achieved in the current phase or the team is time conscious and pushes ahead accordingly. They may have been able to or wanted to do more exploring but are pushing ahead with what they have. When time is a dictator, the team are very aware of switching to another phase. However, when value is a dictator, there is a switch from one phase to another. Here are some examples extracted from the data to demonstrate the point – these data are out of context here but in the context of the team they were indicators of switching.

1. Value dependent – “I suppose, by the time you get the appointment of a steering committee with all the relevant stakeholders…” (G2); “we found that....” (G3); and, “over Christmas I was thinking ...ok let’s just focus on my lab reports” (G4).

2. Time dependent - "define a time-period for the data ... we did some initial data collection for 3months" (G1); "So over the course of the weekend the team proposed their idea and it was actually selected by the adjudication panel as being the best idea that was there at that point in time” (G5); and, “this would normally take 2.5yrs to deliver and we were given 12mths so that is kinda everything was done on the run...” (G6).

There is also a third option which is some teams do not progress to the next phase because they are simply unable to. There are several reasons for this but ultimately, they were unable to find value in exploring or there was no time pressure to push them forwards. There are many things that can change with the project and with the team during this phase, but value from this phase builds the foundation for subsequent phases. Finally, an event determines sufficient exploration in invention and switching to a phase of exploitation.

5.6.2.4. The exploitation phase of invention

While in the exploitation phase of invention the team are still in preparation mode, still getting comfortable with the vehicle they are charged with. But in this phase the team is beginning to grow in
confidence, they are developing a sense of the vehicle, a familiarity with colour, feel and texture. They may even have imagined what it feels like to have their new idea on board with them. Their focus now is building the team.

Exploitation is a phase where team members share their knowledge and insights with each other in the team. They ask questions of each other and discuss their views, concerns, reservations. They move towards synchronising their description of the project, and more specifically their idea. They make decisions concerning features and develop a general consensus about the fit of the idea as a solution or in response to a requirement. There may be many moments when the team disagrees on features of their idea, but these must be agreed upon for progression. The teams in this study progressed through the exploitation phase of invention by arriving at a point that closed this phase. This was facilitated by their ability to find a common language, reach an agreement, narrow their options, and clarify their objectives, as follows:

1. Common language - "So we wanted to see everything together, in the same way so we could all speak a common language" (G1).
2. Agreement - "that is the next big piece of work that we have agreed on, at the meeting on the 12th Jan, the main decision that was made was ... " (G2); “the protocol was endorsed and signed off at the end of Dec., it was launched in Jan” (G8); and, “the feasibility study would’ve justified that brief in that it can be delivered ultimately” (G9).
3. Narrow the options - “we got [IT person] to help us with a pareto chart and this helped us to focus ... by focusing on the areas with the biggest deficit also happened to be the most important things”; "we learnt a lot we have really narrowed it, we took on too much initially, so we just had to make it smaller and smaller and smaller" (G4); and, “... we have a preferred option ... so from that [the project] was born basically” (G6).
4. Clarify - “a day-long workshop exploring the Value Proposition and the early Business Model Canvas [to] .... enable them to better understand what will be involved in developing out their new business proposition” (G5); and, “we did a Big Data strategic roadmap for [the organisation], ... and that confirmed Big Data as an area [we] want to move into, so hence, we set up the team on the basis of that road map” (G7).

Alternatively, if the team cannot agree on features of their idea then they must revert to an earlier phase or remain here for a longer time. Additionally, the team may discover something about their idea from within the team that causes doubt and determines they must revert to the earlier phase of exploration. Whilst this is highly probable, it did not happen in this study.

The key point here is that exploitation is an important phase for capitalising on the earlier work spent exploring and recombining this within the team for team learning and project development. Regardless of how long a team spends in invention, whether they move backwards and forwards between exploring and exploiting they will choose to cease the project (which happened to one case in this study) or move towards developing their idea further.

5.6.2.5. Switching between the innovation stages of invention and development
Completing the invention stage of the innovation process is a big achievement for at least two reasons: it shows the team have agreed on an idea that they are comfortable developing; and it shows that they are comfortable with their team to make the next step. This stage in the innovation process is marked by an event, that is, most likely, the team have decided that they need to move to develop their product to explore it further. However, time may also put pressure on the team to move to the next phase regardless of the value the team has in their idea. The reason the teams in this study moved from invention to development is because they were ready, they decided to
proceed based because time told them to move with what they had, or they were satisfied with the quality of learning.

Project readiness - "And then the second thing was actually getting the comment cards out" (G1); "that is the next big piece of work that we have agreed on” (G2); “First thing we did was simple education where we went to a medical journal club” (G4); “now we start to design it” (G6); “… we are just building up a different variety of used cases” (G7); “so now we are starting on Phase 2” (G8); and, “which leads into the … [next phase]” (G9).

5.6.2.6. The exploration phase of development
By this stage the team is more comfortable with the process they are going through. The so called ‘vehicle’ they are charged with is less distracting as they turn their focus more towards its maturing cargo, their idea. Like a baby, their idea commands attention and time. Regardless of distractions from other projects, this project keeps calling for more time and more attention and more resources. What the team needs to do now is figure out what the idea needs to transform it from a concept in their minds to something more tangible that they can share with colleagues and clients.

Development is a stage where ideas are transformed from the mind to a proof of concept. Development requires a different set of resources than invention. However, like invention development contains a phase of exploration and exploitation. A phase of exploration at the beginning of development is an opportunity for the team to consider what they need to develop their idea, how they can resource these needs, and what else is it they need to do to bring their idea to life.

An exploration phases gives the team the opportunity to explore resources and explore solutions for progress.

1. Explore resources external to the team - "getting a common card to the staff and to the patient, getting it used by staff and patients ... So, we ... invited key influencers as well as ground level staff... to encourage uptake" (G1); “… we engaged the staff and that
is really one of the reasons we did see improvements as well as changing the chart” (G3); and “[Person] would see a lot of the people that we would need, so she is working away in the background, so it definitely helps to raise [the profile]” (G4).

2. Explore resources within the team, their knowledge, skills, and abilities - "we are in the process of developing that ... we will tailor it" (G2); “... now we start to design it, it is an outline design ... we start to draw it out and put costs against it” (G6); “we are just looking for ideas or used cases” (G7); “at the moment [we are] scoping that” (G8); and “you can say this is like a funnel, initially it is very broad, you have a lot of options and you try to narrow it more and more and before we move we believe the outline design is not all the way through the funnel but based on all the discussion you say, this is not, this is not, and you still need to refine some of that further” (G9).

A phase of exploration in development is an opportunity for the team to explore their idea further. In exploring resources and solutions to help develop their idea, also raises questions and doubt. However, it is better that these questions and doubts are considered earlier rather than later in the process since the team are constantly strengthening the foundation of their idea with the more phases and stages they progress through.

Alternatively, during this phase the team may recognise issues or barriers for progress. Perhaps the resources are not available and not available in the timeframe available to them. Perhaps they have to revert to an earlier phase or stage to reconsider their idea or consider an alternative idea.

5.6.2.7. Switching between phases within development

Switching within development from a phase of exploration to exploitation is most typically value dependent, more so than time. The team has some momentum at this stage, they are clear about what they need to develop their idea and they have met those requirements,
or their requirements cannot be met. If their requirements cannot be met, they may have to revert to an earlier stage.

1. Switching - If their requirements are met, then switching to a phase of exploitation is decisive. For example, G1 were exploring resources which required them to network across the organisation. It was the reaction they got during their meeting with other people in the organisation that flicked the switch for them "...and interesting enough, it was the conversations that came out ..." (G1). The reaction they got from the staff in the organisation provided an endorsement for their idea which permitted them to proceed. This was also the case for G3 “… engaging them in what the solutions might look like and that I think was really effective in actually making improvements” and G4 “We just had a meeting with the Clinical Director ... we spent 20mins in his office talking it out”. For these four teams getting endorsement enabled them to progress by switching to exploitation. In another example, the team (G2) moved organically from exploring options to deciding to make changes – “we looked at the two tool-kits that are there - we are taking the more suitable tool-kit ... and tweaking that"

2. Intentional switch - However, for other teams the switch is more intentional. They have decided they have done enough in this phase and to progress they need to switch because in switching they can access other resources, for example, “so you haven’t finished out your feasibility you are kinda saying let’s take it to the next level at which point the planner drips in” (G6). Or the team has achieved their goal from this phase - “to date we are just building up a different variety of used cases, piloting, testing depending on our customer then we can target and say well we have done these three projects previously, are they meaningful to you?" (G7); and “That then means the protocol is done by the middle of May all the information sessions will be complete” (G8); and, “they would have taken the design to a certain level".
Either way exploration has its value and is complemented by switching to a stage of exploitation.

5.6.2.8. The exploitation phase of development

The exploitation phase of development is a huge step forward, in this phase the team are beginning to see the result of their efforts. Their idea is taking shape, it has its own identity now by way of features, size, and scale. The outcome of this phase is a product, service, or procedure the team can sense, work with it, describe and explain.

This is a phase for the team to exploit their individual, accumulative and collective knowledge, skills, and abilities to build on the foundation laid during invention. This is an opportunity for the team to learn more from each other, more from their working together, and more from their combined efforts to date.

The team have progressed to this phase either organically or intentionally. Either way they recognise the value in their being here. They recognise that the next stage is their going to the client or market with their idea and this generates a renewed energy to push forward with bringing their idea to proof of concept.

The teams used in this study define this phase as a time for refining and incorporating features to ensure stakeholder approval, as follows:

1. Refine: "review of the documentation with the steering group" (G2); “to date we have been developing used cases for internal business, so we have a broad spectrum of used cases which are very different some are very simple e.g. simple dashboards for sitting on top of existing data set” (G7); “We are starting with just 3 letters and at the moment we are taking bits from a couple of the different letters” (G8)

2. Incorporate feedback: “in relation to the staff saying, 'well do you know what we know would improve it” (G1); "getting staff involved ... and getting their feelings and what they think will work” (G3); “we did our driver diagram and that helped ... we had a meeting with all the consultants in ED first, I met up with a few
people individually with the process maps” (G4); “… and starts to talk about how this affects planning, what is likely to be approved, rejected, these are all things we have to take conscious decisions on for stepping forward” (G6); “we collated all those comments and presented an outline design at an outline design workshop and they bought some of their more pertinent issues to that workshop” (G9).

5.6.2.9. Switching between stages of the innovation process
Switching from development to implementation explicitly says that the team have developed an idea to the point at which they are comfortable presenting it their client or market. Their idea is still an idea. It becomes a product, service, or procedure when there is a market for it. Until then, it remains idea. Therefore, the learning continues and switching implies the team is ready to learn from a new audience, the customer or client. This event is marked by value or time:

1. Value: “we’ve got sign-off to include this in the report” (G4); “we got to the point where there are four products that we are offering…” (G7); and, “then in the weeks preceding that we closed out those comments and we are at the stage where it is frozen” (G9);

2. Time: "Next meeting is 2nd February and we hope to show a draft to the team" (G2); “we selected a preferred tender after a two-stage tender process, which was agreed with the client team” (G6); “they would like four weeks for proof of concept on one or two sites” (G8);

5.6.2.10. The exploration phase of implementation
Implementation is the third and final stage of developing an idea. This is the stage when an idea is presented to market, tweaked, refined, and polished. It is this stage that the team have to learn from their potential customer or client and incorporate that feedback into their idea. For the team, this means they can benefit from a phase of exploration. What does our idea need for it be accepted by the market/client? What more do we need to do?
A phase of exploration facilitates the team to receive new information and alternative views which is imperative for moving their idea closer to their client/market expectations. The teams in this study used this phase to explore various options and gather reactions from test users to enhance their idea.

1. Exploring options: “So we had meetings about what should go on the badges, you know first name, second name, and what people should be called and that was all agreed” (G1); “we are at the point of teasing out the flow-chart of how it willlogistically work, who sets what up, what triggers next” (G2); “…from that we brought Contractor to the table, and we have pushed on with and developed the design” (G6); “look at offering this as a service or to take on external customers as well. So that is kinda what we are exploring at this stage …” (G7); The 3rd piece is to provide training and developing around the protocol and we are in the design phase of the T&D programme” (G8); and, “we will go out to the market - we give a brief summary … it is a feeler to the market to see who would be interested in this project …” (G9).

2. Exploring reactions: “so at the moment, we are trialling this” (G4); ”we were monitoring to see wither we were achieving our standards or not, so we would plot those on a rung chart, so we could see where we were at” (G3)

5.6.2.11. Switching between phases within implementation

Like switching between phases within invention and development which was time/intentional or value dependent, switching between phases within implementation is either value or time dependent. The team must be confident that their idea is almost ready for the client or market or they have done as much as they can do in the time they have. Either way they must feel confident with what they learned during the exploration phase and that it can be incorporated into their exploitation phase. The team must be consciously aware of the value in taking the next step and therefore confident in the event that triggered this switch. Why did they switch, was it time or value?
1. Value dependent: “there were some really low results which we didn’t expect so we changed the chart” (G3); “but I think when I look at the reports we have a significant increase, a lot of the younger consultants are the ones who are taking this on and are very happy to do it” (G4); and, “… it was only when planning was approved were we able to say ‘right we can now put it on site’ did the building come from NI and start to appear on the building site” (G6)

2. Time dependent: “February 22nd & May and June for the 2nd walk arounds … the pilot should be completed by June, 2017” (G2); “Early Sept will be that” (G8)

5.6.2.12. The exploitation phase of implementation

The relentless learning throughout this entire process does not cease in this final phase and stage of the innovation process. Building on what they have to date, the team has a final opportunity to push their idea over the line. They know so much more than their exploring and exploiting throughout invention and development stages, but most importantly at this stage, they know so much more from their earlier phase of exploring in implementation. What more must they do for their client, for the first sale, or to end their role in this process?

Fleming (2007) refers to this phase as the ‘long tail’ of innovation because it takes so much time, effort, and resources to implement an idea.

For this team, this phase is an opportunity to exploit what they know, who they know, and available resources to push their idea over this line. Exploitation in this phase of the process will facilitate the team to garner their knowledge and skills, to synchronise their thinking, to merge as one force for the final push. Any divergence in thinking and actions could prolong this phase. Yet where there is divergence perhaps it is prudent that the team revert to an earlier phase to explore their thinking further and return to this phase to exploit that learning.

The teams in this study met this stage with mixed experience:
More work than expected: some teams were surprised that there was still so much work to do in this final phase - "... you know the levels of bureaucracy came in and it was like, oh sorry we can't get them cause ... well I will get my own badges set up so" (G1); "... the visits were busy ... there was a significant amount of work went into the documentation and administration of the visits" (G2); "so when we could see sustained improvement that was an indication of the chart being implemented ... so we are looking for those at the moment, we are auditing once a week ..." (G3); “our goal was just getting them to sign the endorsement box, so it was very hard to drive a personal change because they went from not doing it and looking at it, to doing that to doing it right” (G4); “ground works were December and the building structure only happened once we had planning ... final grant came through February 3rd ; “we are still doing things, we are snagging” (G6); “… and then it is open dialogue towards the end and their submissions” (G9)

Cases G5, G7 and G8 were in the exploration phase of implementation when data collection stopped so there are no data to describe what this phase looks like for these teams.

5.6.2.13. In the end
The end is determined by one thing, either the client or the team believe they have done enough to satisfy the demands of the project. These demands are measurable such as: the team has possession of a certain item "we still haven't got the badges, they are on the way, shocking how long this took" (G1); they have completed the necessary requirements associated with a task “the pilot should be completed by June 2017 ... but then we go into the actual doing of the visits and the actions that came from that or arose with that” (G2); the team are satisfied with their result "just a the end of May, we decided the project was complete, time to write up" (G3) or, “our goal was just getting them to sign the endorsement box, so it was very hard to drive a personal change because they went from not doing it and looking at it, to doing that to doing it right (points to page to show various
locations of signatures” (G4); they have reached the client’s requirements – “we are still doing things, we are snagging, we have handed over the inside of the building, the outside of the building is getting handed over today” (G6) or, “Before the end of the year Oct-Dec will be training” (G8).

5.6.3. **Things team members say**

Relationship behaviour, especially positive is thought to help “improve or patch up some relationship among members” (Schein, 1998:2). Across all nine teams, 73% of what members said in the context of relationships were positive and 27% negative. Therefore, the positive far outweighs the negative which could suggest at least two things - the teams tend to behave more positive than negative towards each other generally, or the teams used these meetings to patch up some previous negative behaviour. Individually, teams 1, 6 and 8 said more positive things about relationships than negative while, by comparison, three teams said only positive things (teams 2, 3, and 9), one team said nothing positive or negative (team 7), and two teams said more negative things than positive (teams 4 and 5).

Task behaviour is concerned with trying to get the team task accomplished (Schein, 1998). Across all nine teams, 43% of what members said in the context of task behaviours were diverging and 57% were converging (Table 15). Individually, by comparison, only two teams (teams 5 and 8) said more diverging things than converging. Team 5 were unable to progress beyond the invention stage because their project was not developed sufficiently for additional investment by their sponsor. Team 8 did make progress through the stages even though a lack of consensus on how to progress meant they did not fully complete development stage before proceeding to implement what was agreed.

Converging language achieves consensus in thinking, reduces variety of options, and eliminates doubt (Bales, 1950: Schein, 1998) which may facilitate decision making and progress. Alternatively, diverging
language facilitates deviation from current thinking, increases variety and raises doubt (Bales, 1950; Schein, 1998) which may facilitate disruptive thinking and progress. A ratio of 43 diverging: 57 converging implies more decision making than not, which may or may not support progression.

Looking only at the teams engaged with a formal program of change, three teams describe events rather than relations as being helpful whereas one team (G3) describe relations. All teams working on a client project describe relations as being most helpful and the two teams working on an innovation project are divided between relations (G7) and the other events (G5) as being most helpful. Looking at all five teams who put more value on relationships, they were also more successful in synchronising their thinking than not, except for one team (G8). Looking at all four teams who put more value on events, they were also more successful in synchronising their thinking than not, except for one team (G5).

6. DISCUSSION
This chapter of the thesis addresses four topics. (1) First the chapter discusses the findings of the study in response to the research questions. (2) Next, contributions to theory and practice are discussed. (3) Next, the limitations of study are highlighted because they are embedded in the findings. (4) Finally, future research questions are provided.

6.1. Discussion on findings
In this section of the report, the research questions are re-stated to structure the discussion. Throughout, reference is made to the nine unique innovation process profiles that are the findings of this multiple-case study (Chart 2). First, the main research question – ‘how do teams progress through the innovation process?’ leads a discussion on the sequential cycling of strategic phases of exploration and exploitation within and across stages of the innovation process. And continues by describing how the team simultaneously engages in
exploration and exploitation related activities nested within strategic learning phases. Finally, this section discusses stages of the innovation process. Next, question 1a – ‘What patterns of exploration and exploitation are associated with teams’ progress through the innovation process?’ leads a discussion on the visualisation of the multiple-case study profiles and the relevance of time and resources as factors influencing switching between strategies. Then, question 1b – ‘How do these patterns occur - what do teams say and do that enables these patterns of exploration and exploitation related activities and behaviours?’ leads a discussion on team members’ characteristics including social relations, roles and status as well as team dialogue as possible factors influencing team level concepts. Finally, the discussion moves to highlight the contributions of the 3DM.

The research question for this study was:

1. How do teams progress through the innovation process?

1a. What patterns of exploration and exploitation are associated with teams’ progress through the innovation process?

1b. How do these patterns occur - what do teams say and do that enables these patterns of exploration and exploitation related activities and behaviours?

6.1.1.1. How do teams progress through the innovation process?

The answer to this question was revealed by first coding then bracketing the data temporally which subsequently provided nine unique innovation process profiles, see Chart 2.

Teams progress through the innovation process by engaging in cycles of strategic learning phases of exploration and exploitation as well as activities that consist of elements of exploration and exploitation. Each stage of the innovation process (no matter how many stages nor what they are labelled) began with a strategy of exploration and concluded with a strategy of exploitation. These strategic learning
phases engaged the team to gather new information, knowledge, and resources and combine with existing information, knowledge, and resources for progress through one stage of the innovation process to another stage, backwards or forwards.

Strategic learning phases of exploration and exploitation within and across stages: To simplify this discussion, the strategic learning phases of exploration and exploitation are described with reference to three stages only because the pattern was the same (exploration then exploitation) across cases regardless of the number of stages, that is one or five. Appendix 4.5 provides extensive descriptions of the innovation process for each case supported by complete evidence gathered. Therefore, the proceeding discussion provides only pieces of evidence as examples.
**Exploration and exploitation in the first stage of the innovation process:** This stage is often referred to as creativity or idea generation (Anderson et al., 2014) because it is a time for fresh or new thinking. Beginning this stage with a phase of exploration directs the newly formed team to search for new ideas, new information, and new possibilities that will teach them more about the specifics of their project. Exploration related activities concern asking questions, seeking new information, and research. As such, this phase, more frequently than not, was most effectively achieved by trans-team communication. For example: "we did some initial data collection ... “(G1); "how we got there initially, was through a number of structured workshops, disruptive mind sort of workshops ... we had a good cross functional team from across the business, so we had a good diverse group” (G7).

The latter phase of invention was exploitation. This phase was a dialectic process of combining new information and resources with those that largely exist within the team. As such, this phase, requires teams to close the borders to external influences so they can reach consensus within the team for progress. During this phase, all ideas are considered but only one was chosen to take through to the next stage. Some ideas are binned, and some ideas can be put on hold for a later time or as alternative options to the preferred choice. Exploitation was therefore a phase which was most effectively achieved by intra-team communication. For example: "So we wanted to see everything together, in the same way so we could all speak a common language" (G1); “you actually got a project charter agreed ... so people weren’t trying to change the scope of the project as it was moving. There would be named responsibilities, project advisor, project sponsor, advisor ... “ (G8)

**Exploration and exploitation in the second stage of the innovation process:** During this stage, ideas are elaborated upon (Garud et al., 2013). Beginning this stage with a phase of exploration pushes the team to open their minds to learning ‘how’ they can do
what they want or need to do. What resources, knowledge, skills, and attributes do they need to make progress and how do they get them. For example: “so I have gathered samples from each of the sites involved” (G3); “we have been trying to get ourselves out there ... trying to spread the gospel ... and we are just looking for ideas or used cases try to help you get the value and benefit from the data you are sitting on” (G7).

After some time, teams switch to exploitation. Within exploitation, the objective was to share their learning once again, communicate their findings, and capitalise on the work of individual and team level efforts during the first phase of development. For example: “we are at the point of teasing out the flow-chart of how it will logistically work, who sets what up, what triggers next...” (G2); “we’ve got sign-off to include this in the report” (G4); “you can say this is like a funnel, initially it is very broad, you have a lot of options ...(G9).

Exploration and exploitation in the third stage of the innovation process: Typically, this stage was implementation or innovation (Van da Ven, 1987). Beginning this stage with a strategy of exploration allows the team to search for additional support to assist them with their project. That was in the form of materials or funding as was the scenario with case G1, or the first order for their product or service by way of endorsement to the market as was the scenario with case G7 – “to date we have a few contacts, they have shown interest but ... slow to materialise ... we need some international clients ... to give us a good testimony”. And, “the Dublin based design and construction team were visiting there every two weeks and towards the end every week -we were working with [contractor] to provide a suitable scope and to confirm that our concept for delivery works” (G6).

Later, teams switch to a strategy of exploitation to get their project over the line as far as they are concerned. However, this was often the biggest challenge for the team because full implementation is often
beyond the scope of the team involved in the original development of the respective innovation (Hagedoorn & Cloodt, 2003). For example, case G1 could only close when the order for their product was delivered - "we still haven't got the badges, they are on the way, shocking how long this took". For case G6, “… it was only when planning was approved were we able to say, 'right we can now put it on site' did the building come from NI and start to appear on the building site”. For case G8, their project will close when they complete the roll out of a training program - “Before the end of the year October-December will be training”. Alternatively, for case G9, their project was on hold because of a European Court ruling which has intervened in planning permission that affects they ability to complete the project. The other cases, G2, G3, G4, and G6 were able to close in the duration of the study because the teams were able to meet their overall objective.

The objective of a strategy of exploitation in the latter stage of implementation focuses the team on pushing for closure. In this phase, the team are motivated to combine resources and consolidate their efforts to reach their objective. For example: “we are going to be operational on the 29th September….” (G6); “our goal was just getting them to sign the endorsement box … they went from not doing it … to doing it right” (G4); "just at the end of May, we decided the project was complete, time to write up" (G3).

**Managing exploration and exploitation: activities nested within strategic phases**

It was found that teams also engage in phase-relevant activities that concern elements of both exploration and exploitation. Activities are mini projects such as producing a report or finding a piece of information and these activities are most typically conducted by the team. Although the data at this level of activity are scant there was evidence to show that teams will source expertise beyond the team as necessary. For example: "we went to the grandmaster of sphinx, also
the librarian, because she did a programme on adult literacy” (G1); “we will meet monthly as a group to look at the tool we are going to use and get that started and tested” (G2); “...so what we tend to do, as a team, when we identify a problem like this we will workshop it” (G6).

In line with March’s (1991), and Levinthal and March's (1993) discussions on organisation learning which conclude that both types of learning, exploration and exploitation, are relevant yet challenging because they compete for scarce resources, this study found that it was achievable for teams to do both when carried out in sequence. In addition, the team can do both simultaneously when one was part of an activity nested in a phase. In that instance, exploring and exploiting at activity level are differentiated from exploring and exploiting at phase level. Phase level was a strategic phase within a stage of the innovation process with the larger objective of reaching the goal of the stage. Alternatively, activity level was a single activity in pursuit of the goal of a phase.

This is a significant finding for the team innovation literature because it explains how teams make progress. This is also a significant finding for the organisation learning literature because it describes how teams balance exploration and exploitation for learning and performance. The added insight this study provides was the simultaneous evolutionary process of the innovation-project team for performance and the innovation project for progress. Evolutionary process theory considers change is a result of variation, selection, and retention and hence the driver or motor of change is the process itself (Poole et al., 2000).

**Stages of the innovation process.** The innovation process is often viewed through stage models which vary between two and five stages. Amabile’s (1988) seminal study of individual level creativity, which she generalises to group level, identified five stages - task presentation, preparation, idea generation, idea validation, and
outcome. Specifically, at team level, West (e.g., 2002) describes two fundamental stages of the innovation process, creativity and implementation. Creativity concerns the process of generating and developing an idea, and implementation concerns the process of implementing the idea.

There is no such study of the innovation process at team level, only those studies that generalise process research to the level of the team (West & Farr, 1990). Yet, it is interesting to learn that stage models of the innovation process at organisational level are somewhat relatable to team level. Meaning, unique stages were identifiable:

**Stage 1. Invention.** All projects have a start. Although stage models are poor at specifying when a project begins (Bagno et al., 2017) the cases investigated in this study described how and when their projects began for them. For example, “The drive is from our CEO who was instrumental in putting this forward as a project with the RCPI” (G2); “... we met at the Hackathon” (G5); and, “May 2016 is when we were handed the project as a team and told to deliver it” (G7). Overall, the innovation project was typically authorised by a client or senior management who would begin the process by describing key features of the outcome of the innovation project as well as dictate time and resources but often provide limited or no direction on how to achieve the desired outcome, implicitly or explicitly delegating this task to the innovation team.

Invention was the first stage of the innovation process and provides the opportunity for the newly formed innovation-project team to discover more about each other and more about the project. For example – “...we are the nucleus team and the other members on the invite who are not here (come and go)”; “And you need the wider team, which is why you have the organisation chart which shows the wider team, we set that up”; “We have all been involved in all of those phases but in inception phase it would have been quite tight,
...” (G6). It was also a stage for searching for more information about the project beyond the scope of the information already made available to them and making decisions about the exact features of the idea the team will choose to develop further. For example - "in the beginning we were quite enthusiastic ... we defined what the key standards were..." (G3); and, "how we got there initially, was ... so we had a good diverse group ...” (G7).

Stage 2. Development. The second stage of the innovation process was development. The innovation project has progressed beyond an idea and scoping stage to beginning to produce a solution or at least design the solution to meet the overall project objective. There was one team (case G8) who did not fully complete the invention stage before moving in to the development stage, but they felt confident that any outstanding work in the invention stage would had no viable effect on the development stage. Elsewhere, the project becomes less about the team and more about performance. For example: "We redesigned the chart ... middle to end of January .... we got an example from the NHS ...they liked certain elements of it" (G3). “The focus for this stage is to [develop]...” (G8); “there is a planning process that sits along-side that as well, ...” (G9).

Stage 3. Implementation. There remains a significant amount of work to do, if not more than the previous stages to get the project over the line. It is often the most difficult stage for the innovation-project team because their ability and power only goes so far, meaning that often conditions external to the ‘team engaged in the innovation process’ determine whether the innovation project is accepted or rejected (Fleming, 2007; West, 2002a). For example: “you have external stakeholders as well, statutory authorities, county council, the EPA, Irish Water, and they bring an external influence on the project as well” (G9); “Now we did develop that part of the project and then we changed CEO and our new CEO has a difference of opinion in terms of how we should develop it” (G8).
In conclusion, teams progress through the innovation process via unique stages that provide purpose and focus. These stage models are comparable to stage models of organisational level innovation.

6.1.1.2. What patterns of exploration and exploitation are associated with teams’ progress through the innovation process?
This question leads a discussion on the various geometric diamond shapes that is the result of this multiple-case study. It discusses the varying dimensions of the geometric diamond shapes that represent durations of time and resources. Further, switching between strategies is also discussed.

Patterns of exploration and exploitation: discussing Chart 2

Across nine cases, teams progressed through the innovation process by engaging in sequential strategic learning phases of exploring and exploiting, within and across stages. Their progress created a pattern of geometric diamond shapes. The diamonds lie along the x axis that represents progress. There are two types of geometric diamond shapes – blue-lined diamond shapes and shaded grey diamonds. Chart 2 displays all nine cases.

The blue-lined diamond shapes represent strategic learning phases of exploration (<) and exploitation (>). Together, the sequencing of exploration followed by exploitation represent a stage of the innovation process. Mostly these diamond shapes were aligned end to end except for two cases (G1 and G8). For case G1, there was a stage happening behind the scenes that consisted of strategic learning phases of exploration and exploitation as represented by a dotted blue line. For case G8, two of their geometric diamond shapes overlapped between stage one and two, representing their progress to another stage of the process before completing an earlier stage. Across teams, there is at least one geometric diamond shape, case G5 that ended their process at one stage, and a maximum of four and a half (case G9) diamond shapes. The half diamond represents the process ending during a stage.
The shaded grey diamond shapes represent exploration and exploitation activities in pursuit of strategies. All teams described some activity, for example, weekly team meetings. However, this study did not allow for collecting data at this level of analysis, that is, hourly level activities. The focus here is discussing the patterns of exploration and exploitation at the strategic phase level, that is the blue lined diamond shapes.

The dimensions of the geometric diamond shapes vary: The width of the geometric diamond shape represents the duration of time a team spent in either a phase or stage for progress. The height of the geometric diamond shape represents reach for innovation project relevant knowledge and resources in pursuit of the strategic phase - within the team, outside the team, or outside the organisation.

The varying dimension of the geometric diamond shapes: time and resources as factors

The duration of time a team spends in a strategic learning phase of exploration or exploitation depends on the value of their learning and/or budgeted time. Value defines the teams’ ability to reach a qualitative and/or quantitative goal that reflects a return on their time and energy invested in a strategic learning phase. Budgeted time defines the time target set for the team to proceed to the next strategic learning phase and use what they have learned in the current phase.

Some teams working on similar projects will spend different durations of time in each stage even though their projects have similar start and end dates. For example, cases G1, G2, G3, G4 all started early September 2016 and finished July/August 2017, yet their profiles (see Chart 2) show the duration of time they spent in each stage was different, if only marginally. While the beginning and end dates for these projects was determined by their academic programme, there were also implicit schedules to support progress. For example, cases G1 and G4 spent longer in invention than cases G2 and G3. While these teams were aware of the duration of time
they had for their project, they had no instructions for how to make progress. Their progress through the innovation process was one of revolutionary phases based on team learning. Yet in all four cases, the teams cycled between at least six phases of exploration and exploitation.

The process model for case G6 shows this team spent the same duration of time exploring as exploiting in the first two stages of their process. Equally, case G9 shows the team spent a similar duration of time in strategic learning phases of exploring and exploiting across their first four stages of the process model. Alternatively, cases G1, G3, G4, and G5 spent considerably more time in the exploration phase of invention than they did in any other phase or stage. Case G7 spent considerably more time exploring within the development stage of their process relative to their other phases across the model so far. Cases G2 and G6 spent almost half their project time in the implementation stage of their project, giving the same time exploring and exploiting as they did during the first two/three stages of the project. Cases G1, G2, G3, G4 and G6 give less time to the development stage than they did to other stages in their process. Apart from case G9, teams vary in the time given to strategic learning phases of exploration and exploitation across the innovation process. However, what all cases in this study have in common was that they have the capacity to explore and exploit. The findings also show us that each case was unique.

The height of each blue-lined geometric diamond shape also varies within across stages and cases. Case G2, for example, resources appear to be reached within the team during the first two stages of the innovation process. However, the team then moved outside the organisation for implementation. Alternatively, the reach for resources for all other teams extended beyond the team and organisation before reducing back to team level. Interesting, for some cases (G1, G2, G6, G7) the exploration phase of implementation generated the tallest geometric diamond shape signalling that the
teams had to exert considerable effort to help bring the project to a close. That is, they had to reach beyond the organisation for relevant resources. Alternatively, for case G3, that happened in the development stage when the team required most support from beyond the team.

Overall, teams tend to sequence strategic phases by completing one phase before beginning the next. This finding contradicts claims by Gebert, Boerner, Kearney (2010) who argue that it is more effective for the team to simultaneously implement opposing strategies to mitigate the negative effects of only one or the other while reinforcing the positive effects of both.

**Switching between strategies of exploration and exploitation**

A seminal study of team development found teams switching their approach to the task only once during the duration of their project, that is half-way between the first meeting and official deadline (Gersick, 1988). While Gersick’s (1988) study was more concerned with group development than how groups progressed through the innovation process, the finding concerning task focus has relevance to this study. This study found that, rather than teams exhibiting two distinctive approaches to their task for the duration of the project, that teams exhibit two distinctive strategic learning phases, exploration and exploitation, in cycles of at least three pairs. Meaning that teams move through at least six evolutionary phases of development to make progress through the three stages of the innovation process.

Gersick (1988) describes ‘groups’ development as a punctuated equilibrium” (p. 17). The concept of punctuated equilibrium has been discussed at length as a strategy for balancing exploration and exploitation at the level of the organisation (see, Gupta et al., 2006; Lavie et al., 2010). This study concurs with the punctuated equilibrium theory to the extent that teams make a revolutionary switch in their strategic focus. However, in contrast to Gersick’s (1988) study, this revolutionary switch does not happen at mid-point
in the project, rather teams switch between strategies, within stages, for the duration of their project.

Alternatively, if we focus only on case G5 which consists of one stage, invention, this team’s progress was more in line with Gersick’s (1988) finding. The members of this team met by chance and quickly forged a team to work on a new idea. The sponsors of the project dictated a date for the team to revert with a clearer proposal of their idea for a decision on whether to proceed to development or shelve. Just past the half-way point between their first meeting the date for them to present their proposal, the team switched from considering various ideas to narrowing their focus to present only one idea. While that was still only one stage in the ideal model of the innovation process and not the entire project, it was still a project with boundaries of time.

Whether time, or value, or time and value determine switching between strategic phases of exploration and exploitation, teams can make the switch but there was not enough evidence in this study to explain how they switch. Team reflexivity is the social-cognitive capacity of the team to reflect and adapt for progress (Konradt et al., 2016). In a review of the reflexivity literature, Konradt et al. (2016) describe an episodic cycle in team performance as consisting of a phase of action and transition. Therefore, team reflexivity could explain how teams are effectively able to switch from one strategic learning phase to another, and indeed between stages.

6.1.1.3. How do these patterns occur - what do teams say and do that enables these patterns of exploration and exploitation related activities and behaviours?

This question leads a discussion on team members’ characteristics including social relations, roles and status, and team dialogue as factors influencing team level concepts. Patterns of exploration and exploitation occur when teams recognise unique project demands that they can satisfy as a team or they need to access via their social
network. Recognising unique project demands and responding to them may depend on the quality of team dialogue.

**Social relations:** The extant research on social relations provides evidence for contradictory social-structural arrangements (e.g., Baer et al., 2015) and intra-team and inter-team communication (Ancona & Caldwell, 1992; Tushman, 1977) supporting innovation. For example, Ancona and Caldwell (1992) found that the amount of external-to-team activity (inter-team communication) the team engages with is less relevant than type of external engagement. Alternatively, Myers and Marquis (1969, in Tushman, 1977) argue that extra-communication (inter-team) is relevant during the first stage (idea generation) or invention, intra-communication (intra-team) is more relevant in the second stage (problem solving) or development, and both are relevant during the final stage (idea implementation) or implementation. Finally, in a recent paper by Perry-Smith and Mannucci (2017) the authors combine these arguments by claiming that an entity working on an innovation project must adapt their communication and engagement with specific network relations in alignment with the specific innovation phase needs of the project in order to meet project requirements. This study found support for that claim. Innovation teams must adjust the structure of social relations depending on the value inherent in those relations as appropriate to the phase and stage of their innovation project at any one time. A learning strategy of exploration was supported by inter-team communication. A learning strategy of exploitation was facilitated by intra-team communication.

This study also found that team vary in their attitude to social relations. Some teams initially found social relations a hindrance to their project where the teams were more task focused (G1, G2, G3, G4, G5, G7). For example: "but really a lot of it ... is convincing people to see things in this light, is actually a much harder thing" (G1); "... it is really learning that getting staff involved early, that whole engagement piece, and getting their feelings and what they
think will work, even if it is the same thing that you would have come up with, that you are much better getting buy-in" (G3)

Alternatively, other teams were innately aware of the power of social relations (G6, G8, and G9) and invested early in social relationships for influencing progress. Eventually, other teams learned the lesson and adapted. For example: "yeah, we got the highest leadership role in the department and they said this is about you [to the ground staff]!"; "...and it was GREAT because that was an immediate, strong, latch on, show of support that this culture needs to change, and THAT one burst, probably went ALONG way to getting you know things done" (G1); "we identified who we felt the key players are, who could support us, again, these are the people from places we feel need to come together to correct the disjointed situation we have.

There are 13 on the steering/project team...they have experience and impact” (G2); “We have such a wide community interested in what we do, people want to have a say in what we do we are under a lot of scrutiny” (G9).

That finding draws attention back to the claim that innovation is a social process (e.g., Henttonen et al., 2014; Kijkuit & Van Den Ende, 2007; Obstfeld, 2005; Ohly et al., 2010). The innovation-project team is a team engaged on an innovation project. The innovation project is the reason for their being a team and therefore the project becomes the focus of their working relationship. The team creates the internal context for the innovation work. However, team members may be working on more than one project and therefore have competing demands for their time or attention which can distract them (Shin & Grant, 2019). In addition, the number of team members working on the innovation project may expand and contract depending on project needs or exogenous factors, for example, “...we are the nucleus team and the other members on the invite who are not here (come and go)”; “And you need the wider team, which is why you have the organisation chart which shows the wider team, we set that up”; “We have all been involved in all of those phases but in inception phase it
would have been quite tight, in design it would have opened up and
percentages would have changed, and then you get into the outline
design it would have opened up again because of the modular
contracts, then we go into design and construct and it opened up
again, do you know what I mean, so like it changes depending on
what phase you are in” (with reference to the size of the team)” (G6).
Therefore, the innovation-project team is a complex arrangement of
individuals assigned to work on a specific innovation project with
typically limited guidelines on individual roles and insight to
individual knowledge, skills, and attributes. So immediately, the
innovation process is not just about the innovation process but also
about the team, intra-team and inter-team relationships.

Roles and status: are important for the innovation-project
team, especially recognising the role of the leader or the hierarchy for
directing focus, mobilising activity, and fostering a climate of
learning (Ibarra, 1993; Kahn, 1990; Mahoney, 2004; Sanner &
Bunderson, 2018). There were two teams that struggled in this regard.
In one team (G5), a member assumed the role of leader, but it was not
endorsed by the other members because the behaviours of the
assumed leader were damaging to project progress. This team did not
progress beyond the invention stage. In another team (G4), two
members were vying for the leadership role and as a result the team
struggled to make timely progress in the invention stage. This team
had to cycle back and forth between exploration and exploitation until
one member asserted his authority, based on his role outside the team,
and make a decision that enabled the team to move forward on his
recommendation.

The extant literature reports status has a significant effect on change
by providing some form of insurance in a risky situation (Pearce,
2011). For example, an endorsement of an idea by a leading expert in
the field provides credible justification for authorising funds to
develop the idea further. Alternatively, role status within the team can
have both positive and negative effect depending on how accurate an
individual perceives their status through the eyes of others (Anderson, Srivastava, Beer, Spataro, & Chatman, 2006). Generally, it is preferable that individuals show humility (Salicru, 2017) in their influencing of others. Alternatively, where individuals seek to increase their status they can face group rejection (Anderson et al., 2006). It is possible that within the two groups mentioned here that those vying for the leadership role lost credibility in the eyes of others owing to low status endowed upon them.

**Dialogue:** Owing to data gathered at time two, non-participant observation it was found that members say things during team meetings to each other that are either task focused, or relationship focused. Within each category of what members say, it was found that, like competing strategies of exploration and exploitation, members use contradictory language. Members say things, about relations, that have both negative and positive connotations for example, something sarcastic to a team member, or something complimentary about a team member. Equally, members say things about the task, that will both challenge current thinking and align with current thinking, for example, ‘no, I don’t agree that we should do that’, or ‘yes, I agree we should do that’.

Language and communication in general helps us make sense of knowledge and information as in perspective taking, and communicate new knowledge as in perspective making (Boland & Tenkasi, 1995). Perspective taking and perspective making is dependent of individual cognition but at the level of the team, it is in during team discussions that the team can reach consensus on the perspective they choose to take to facilitate innovation progress. A common or shared vision of each the overall objective and part-objectives owing to each stage would help align perspectives and drive progress. Indeed, a shared vision of objectives was one of the things frequently communicated to me that supported progress.

Fostering a climate that accepts positively challenging language was found to enhance team learning by permitting team members to
question the status quo, diverge from the norm, and challenge thinking (Edmondson, 1999).

Chart 2 provides quantitative data on the language used by cases during time two observation. Across cases, things members said with reference to person/relational was to the ratio of 73:27 positive/negative (mean). Things members said with reference to task/project was to the ratio of 43:57 divergent/convergent (mean).

*Relationship data:* Cases G2, G3, and G9 only used positive language. Cases G1, G6 and G8 used positive language most of the time (92: 8, 88:12 and 82:18 respectively). Case G7 never said anything personal, positive or negative, to each other during their meeting. Cases G4 and G5 said more negative things than positive (47:53 and 41:59 respectively).

*Task related data:* All cases, except G5 and G8, used language that challenged the task less than used language that facilitated convergence (range 33:67 – 45:55). Alternatively, case G5 had a ratio of 66:34 and G8 58:42 divergent/convergent. G5 never made it beyond the first stage of the innovation process. G8 was the only team to overlap strategic learning phases of exploration and exploitation.

In summary, the study gathered data on social relations, roles and status, and dialogue that may have a significant effect on team learning for progress through the innovation process. Whilst these data are insufficient to make any claim for findings, they merely draw attention to factors.

### 6.1.1.4. The contributions of the 3DM model.

The 3DM is an ideal type model of the innovation process. It describes how teams could progress through the innovation process as opposed to stage models which are normative and describe how organisations should progress through the innovation process. The 3DM makes the following contributions:
Theoretically – the premise of the model has empirical support. That is, the theoretical assumptions of the model (see Section 3.4) are supported by the study. Teams have a definitive project start date and end date. They engage in patterns of exploration and exploitation for progress. There is no telling how long a team will remain in a phase or stage, nor how often they cycle backwards and forwards before progress is made.

Practically – the model describes how a team could progress through the innovation process by graphically structuring the temporal pattern of exploration and exploitation as strategic phases. In representing the 3DM to all teams (including prospective and pilot teams) following the study, the reaction was positive. People were comfortable with the simplicity of the graphical representation because they could locate themselves within a stage and phase.

**Conclusion**

This study found that teams progress through the innovation process in stages constructed with learning strategies of exploration and exploitation. Exploration allowed the teams to gather information and resources and exploitation allowed teams to exploit these for progress. Exploration is achieved by inter-team communication, and exploitation is achieved by intra-team communication. The start and finish of a project is clear for the team, and the duration of time a team spends in stage or strategic learning phase is determined by the team. Further, the extent of inter-team and intra-team communication is also determined by the team. Therefore, teams are “information-processing systems” (Edmondson, 1999: 350).

6.2. **Contributions**

This study offers important contributions, theoretically, practically and empirically.

First, extant research on the innovation process is limited. The vast amount of research on innovation has taken a variance approach which does not explain progress. Those who took a process
perspective, for example, Amabile (1988; Amabile & Pratt, 2017) generalise their model to the level of the team and organisation. Alternatively, process research is inclined to focus on only one stage of the process, e.g., idea generation or idea implementation, for example, West (1990) (Anderson, Potočnik, & Zhou, 2014). There is one major project by the Minnesota Innovation Research Program (MIRP) (Van de Ven & Poole, 1990) that investigated how and why innovations develop over time. This research informed the three-stage model of the innovation process used in this study, the 3DM. However, the Minnesota study did not investigate the innovation process at the level of the team, rather their research gathered data at organisation level, across multi-party networks, and within communities (Garud et al., 2013).

This study responds to the call for a process approach to research that includes “real-life observation, and validation across multiple case studies” (King & Anderson, 1990b: 97). Further the study provides a 3DM model of the innovation process at team level. In doing so, this study provides a theoretical, empirical and practical contribution to the innovation process literature; that is an explanation of how teams progress through the innovation process. The 3DM is a practical tool that can help teams plan their journey by budgeting for resources at particular points in time and in response to project demands and challenges. The 3DM gives teams permission to adapt their learning depending on the phase they are in. The 3DM is also a tool for management. Management can use the 3DM to diagnose performance and intervene for progress.

Second, there is some confusion about the role of two categories of social relations for innovation. There is evidence to suggest weak ties (brokerage) have value (Fleming et al., 2007; Fleming & Waguespack, 2007; Hansen, 1999). There is evidence to show that strong ties (closure) has value (Levin, Walter, Appleyard, & Cross, 2016). But mostly there is evidence that highlights the benefits of both (brokerage and closure) for innovation depending on project
requirements (Byosiere, Luethge, Vas, & Salmador, 2010; Cassi & Plunket, 2015; Fliaster & Spiess, 2008; Jack, 2005; Kijkuit & van den Ende, 2010; Zhou et al., 2009). More recently, the literature has moved from measuring which category of social relations has more value to considering context, namely the innovation process (Bob Kijkuit & Van Den Ende, 2007; Perry-Smith & Mannucci, 2017).

Earlier, Ancona and Caldwell (1992) speculated that “cycles may play a role in team behaviour, so that a strategy that works in the early life of a group may not support positive performance over time” (p. 660). Therefore, rather than focusing solely on characteristics of social networks, this study links the objectives or social networking, social capital and intellectual capital to organisation learning concepts, exploration and exploitation.

There is relatively little research on exploration and exploitation beyond the level of the organisation (Gupta, et al., 2006). In much the same way as researchers considered roles for conflicting social structures for innovation, this study investigated roles for competing learning strategies in the context of the innovation process. This study makes two further empirical contributions, to the social networking literature and the organisational learning literature by highlighting roles for conflicting social network structures and competing learning strategies in the innovation process. In addition, this study makes a theoretical contribution to the organisation learning literature in three ways: it highlights roles for exploration and exploitation at different stages of the innovation process; it highlights the role of competing yet complementary learning within strategic phases, at activity level; and perhaps most significantly it explains how exploration and exploitation cause innovation.

Finally, this study seeks to complement current literature on punctuated equilibrium and ambidexterity in two ways. This study compares and contrasts their application to team level innovation by finding evidence for punctuated equilibrium at a strategy phase level for switching between exploration and exploitation, and
ambidexterity within phase level for simultaneously exploring with in exploitation phase. This study found that teams engage in activities at two levels of the project. A strategic phase level defines a part-objective of a stage of the innovation process, for example, exploration within invention stage. However, within a strategic phase are nested activities, for example, a report. Here, activities also consist of elements of exploration and exploitation learning behaviours at a micro level. Therefore, a team will engage in exploitation learning in pursuit of meeting the objective of their exploration goal. Rarely have studies compared these concepts or investigated their appropriateness in different contexts (Gupta et al., 2006). This study provides a theoretical contribution to the literature by considering punctuated equilibrium and ambidexterity as mechanisms for teams balancing exploration and exploitation for innovation.

6.3. Limitations
As with every study, this study has limitations that need to be considered in evaluating the study contributions and affect the formulation of the implications drawn from its findings.

A larger number of cases would provide richer data, especially if the cases represented a wider range of organisations, such as small or medium sized enterprises (SME) owing to their organisation structure, or industry sectors, especially IT or pharmaceutical owing to their reputation for innovation. Organisation structure refers to “the formal arrangement of tasks, transformation processes, communication arrangements and authority relationships that influence and control how people ordinate and conduct their work” (Martin & Fellenz, 2017: 285). The organisation structure of SMEs is much flatter than large organisations (Grimaldi, Quinto, & Rippa, 2013). Flatter structures facilitate knowledge exchange through more open lines of communication which is a key factor for innovative behaviour (Nieves & Osorio, 2013; Stadler et al., 2014). Alternatively, large organisations and those with a matrix organisation structure can
facilitate knowledge exchange in their policies, practices, and culture (Edmondson & Harvey, 2017; Hopp & Zenk, 2012), or as Sanner and Bunderson (2018) say, “the right hierarchy can help teams become better innovators and learners”. Separately, at industry level change can happen as much as overnight (Drucker, 2012). Therefore, certain industry sectors, namely the IT and Pharmaceutical industries are constantly innovating for survival (Johansson & Lööf, 2014). Comparing and contrasting data across various types of organisations and industry sectors would provide richer analysis and increase the generalisability of the findings from the research setting.

The level of analysis does not capture all exploration and exploitation behaviours. For example, team members affiliations with those external to the team, the nature of these relationships and the influence those relations had on facilitating exploration learning strategies external to the team. A social network analysis would capture 360-degree data on these relationships and measure their role in facilitating exploration learning strategies. In addition, data that describe individual team members personalities or personal characteristics could provide insights on how individual level variables influence team level behaviours, in particular, how the team switches between strategies or effectively manages competing learning strategies. Data that describe how team members (who, simultaneously, are also members of other teams) are able to effectively adapt to this additional, new team and immediately make progress. Such data, in this context, would provide insights on what enables cross-boundary teaming (Edmondson & Harvey, 2017), or data that describes not just why they switch but how.

The addition of quantitative data on exploration and exploitation, social networks and psychological safety climate could complement the study. Especially if these data were gathered over time. Causal inference using qualitative data explains why correlations exist, however testing these correlations bring the added value of measuring the empirical irregularities between variables (Mahoney, 2001). For
example, it might be useful to test the relationship between exploration and exploitation activities and networking activity to measure the value relations have for learning activities. It would also be useful to test the relationship between exploration and exploitation learning activities and the psychological safety climate to measure the strength of climate on learning activities. Finally, it would be useful to compare and contrast data over time, across cases and within cases to test the utility value of the 3-Diamonds Model.

Hypothesis testing is a priority for variance theory (Edmondson & McManus, 2007). However, there are examples of studies that stopped at hypothesis generating such as Gersick’s (1988) study. Alternatively, Ancona & Caldwell's (1992) study was both, first they conducted a hypothesis generating study and followed with a hypothesis testing study, both discussed in their 1992 paper. Testing the strength of correlations between variables using quantitative data on exploration and exploitation, social networking and psychological safety climate would complement the study.

Gathering data on cases from inception to completion could offer additional insights that might further explain how teams make progress even from the crucial beginning to slow implementation. However, with innovation projects it is very difficult to define when they become a project because their starting point is often rather vague and can at times only be determined ex post facto. Projects are discussed and talked about before any formal work begins. Equally, it is difficult to determine which projects would make it all the way to formal completion. The projects chosen were those thought to present the greatest opportunity to gather data from as close to the beginning as possible, and projects that were most likely to be pursued for a sufficient period of time, so that it was highly likely to track team progress through the innovation process.

Although the data was collected over time, it is not longitudinal data and therefore most likely excludes data on some team events. A team
engaged in the innovation process exists in an open system, yet the study does not include multilevel data. The dynamic nature of innovation (West, 2002) demands longitudinal, multi-level data for a more comprehensive model of the innovation process at the level of the team (Anderson et al., 2014).

6.4. Future Research Questions
This study raises several questions that deserve further research attention. Key questions are discussed in turn below.

How significant is it that teams are explicitly aware of the stages of the innovation process that facilitate progress? How important is a roadmap? The argument is that a roadmap, regardless of its exact nature or origin (e.g., industry standards; project management structures; academic supervision and reporting structures; etc.), can serve as an influential guide for cases included in this study, allows the innovation-project team to plan for project relevant knowledge, skills, and resources. Supports temporal decision making by highlighting when they may benefit from networking with relevant entities that may supply knowledge, skills, and resources for progress. Networking is a time-consuming activity for at least two reasons. You may have to network with several entities to gain direct access to the primary source of interest. Also, relationships are based on trust which also takes time, credibility needs to be established and some sort of reciprocal arrangements needs be clarified. The outcome of many of the innovation projects included in this study were dependent on the innovation-project team changing behaviours of end users. Therefore, the outcome of the project was dependent on social relations.

What is the relationship between team reflexivity and exploration and exploitation as strategic learning phases in the innovation process? This study touched briefly on team reflexivity as part of a review of the literature on team learning. While definitions characteristic of exploration and exploitation were used to analyse the data, there
remains a curiosity about the relationship between reflection and exploration and exploitation, and adaptation and exploration and exploitation. This thesis is not the place to elaborate on these relationships, but this section of the thesis provides the opportunity to raise this promising question. For example, reflection could require elements of both exploration and exploitation. Exploration opens the mind while exploitation encourages sense-making through narrowing and justifying options. Adaptation requires elements of openness to adapt. To adapt you need to explore new possibilities, yet to adapt, you also need to close previous chapters. Perhaps reflexivity may be a combination of both exploration and exploitation and therefore be the concept that fits the switching point in the 3DM? Referring to the 3DM, switching occurs at points labelled with the odd numbers (i.e., 1,3,5,7,9,11, and 13). The even numbers presents strategic learning phases of exploration and exploitation (i.e., 2,4,6,8, and 10). If reflexivity defines the capacity of the team to switch, then these points are appropriate for that switch because these points also represent the core team. Meaning these narrow points are definitive points when the core team meet.

Time two data collection, non-participant observation, is a snapshot of what team members say to each other during a team meeting, but it begs the question - how representative are these behaviours (task and relationship-based dialogue) of the team for the duration of the innovation project? These data are treated as supplementary data in this project, yet dialogue is considered a significant factor on the psychological safety climate and team learning Edmondson’s (1999). A psychological safety climate permits positively challenging questions and modes of enquiry, but what effect does expressing negative personal opinions, concerning relationships, have on the psychological safety climate? To what degree is it appropriate or productive that the team gets to express their personal opinions concerning relations? The results show a 70:30 (positive: negative) split across cases and where teams expressed more negative than
positive, it appears that this may have had a negative effect on progress based on the teams circling within a phase (for example, see case G4).

Staying with dialogue, is there an optimum balance of converging/diverging dialogue for progress? This study showed an approximate 60: 40 splits in converging: diverging language. Meaning that the teams were able to challenge each other’s thinking on task related discussion. March (1991) argues the benefits in balancing exploration and exploitation and the challenges. Likewise, how does the team balance divergence and convergence in their discussions for progress. If the team were in total agreement with each other on all matters progress may happen but it could be short-term, or the outcome may not be productive. Equally, if the team were unable to ever converge on matters concerning the project then progress would simply be impossible.

7. REFLECTION

The impetus for my doing a PhD is my relentless hunger for learning. The progressive nature of research allows me to gradually build knowledge while continuing to identify, explore and exploit opportunities for continuous learning. I am also innately curious about people, specifically how they learn and combine knowledge in the context of work to improve performance.

This study began with social relations as the conduit for knowledge innovative performance and ended with a process of team learning within the process of innovation for progress through the innovation process. The SLR was instrumental for gathering and analysing data on the innovation process and exposing roles for contradictory learning behaviours, e.g., search and combine (Nahapiet & Ghoshal, 1998), relations beyond the team and within the team (Ancona & Caldwell, 1992), and explore and exploit (March, 1991).

The real shift in progressing with the hypothetical conceptual framework happened when I pivoted from focusing on innovation as
an outcome to innovation as a process. The innovation process provides context for team learning. I wanted to investigate if, how and why teams engage in contradictory activities for performance, more specifically progress through the innovation process.

Engaging with teams during the data collection meetings was fascinating. Teams are eager to progress even though they may not recognise their learning in making progress. Sometimes teams learn that their actions have not provided the outcome they expected, still this is progress because they have progressed by learning that it did not work. They have progressed by deciding to either stop the process or take an alternative route.

Observing interactions between team members was also fascinating. The various dynamics happening at an interpersonal and intra-team level. It was quite obvious, to me, the behaviours that were influential in a positive, and negative way on the team and on the project.

Analysing the data was a real challenge in this study because of the amount of data, the different types of data, and data across nine cases. Transcribing voice recordings was useful for bringing me closer to the data and building possible themes in my mind that might explain progress through the innovation process. The analytical approach of abduction and retroduction was extremely useful for two reasons. Abduction did not confine me to the initial theoretical conceptual framework and therefore allow me to consider all data. Retroduction allowed me to use all the data in reconceptualising a theory on how teams progress through the innovation process.

My personal journey through the PhD was a learning process. One akin to the innovation processes pursued by the teams that I studied, cycling through stages and phases of exploration followed by exploitation to make progress. I am happy with the learning but recognise that this is only the beginning of the next stage.
8. REFERENCES


Creswell, J., & Clark, V. P. (2007). Choosing a mixed methods design. In J. Creswell & V. P. Clark (Eds), *Designing and*


Ertug, G., & Castellucci, F. (2013). Getting what you need: How reputation and status affect team performance, hiring, and


Kostopoulos, K., & Bozionelos, N. (2011). Team exploratory and exploitative learning: psychological safety, task conflict and


qualitative, and mixed methods. 3rd Ed. Thousand Oaks, CA: SAGE.


Schippers, M. C. (2014). Social loafing tendencies and team performance: The compensating effect of agreeableness and


9. APPENDICES

1. Systematic literature review appendices

1.1. Frequency of each word by author

![Frequency of each word by author](image)

<table>
<thead>
<tr>
<th>Database</th>
<th>About the database</th>
<th>Words</th>
<th>Results</th>
<th>Saved based on title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABIInform Global (2013)</td>
<td>This database is one of the most comprehensive business databases on the market. It includes in-depth coverage for over 3,000 publications, with more than 2,000 available in full text and the latest business and financial information for researchers at all levels.</td>
<td>&quot;innovation process&quot; AND &quot;knowledge&quot; AND &quot;networks&quot; 2nd attempt after one below (5138)</td>
<td>&quot;innovation process&quot; AND (&quot;brokerage&quot; OR &quot;closure&quot;) AND &quot;knowledge management&quot; OR &quot;social networks&quot; AND &quot;knowledge&quot; AND &quot;innovation&quot;</td>
<td>66</td>
</tr>
<tr>
<td>ABIInform Global from 1886</td>
<td></td>
<td>&quot;innovation&quot; AND &quot;networks&quot; AND &quot;knowledge&quot; = yield 215.145</td>
<td>Peer reviewed: Peer reviewed Subject: Innovations OR social networks Language: English Database: ABR/PSDM Atom = yield 5138 Even though this number is very large, I went through the first 200 articles and found only 10 relevant papers. A list of this search covers open innovation, networked innovations, knowledge management, regional level innovations, new firms, so I changed the search terms to make them more specific. See ABIInform (2013)</td>
<td>0</td>
</tr>
<tr>
<td>Business source complete</td>
<td>Provides full text access to approximately 2,900 academic journals covering accounting, agriculture, banking, economics, finance, human resources, information/business, law, management, marketing, psychology, and sociology. 11.9m of titles are peer-reviewed (210) data back to 1960 or the first date of issue. 180 also provides access to 3,000 full text Industry Reports and 10,000 Company Profiles.</td>
<td>&quot;innovation&quot; AND &quot;networks&quot; AND &quot;knowledge&quot; yield = 1999</td>
<td>Limiters: Scholarly peer-reviewed journals Narrow by Subject: network analysis (communication) Narrow by Subject: innovations in business Narrow by Subject: social networks Narrow by Subject: network analysis (social science) Narrow by Subject: social network theory (communication) Narrow by Subject: social capital (networks) Narrow by Subject: knowledge transfer (communication) search modes - Boolean/Phrase = yield 132</td>
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1.3. Database search reduced

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<th>Limitors and yield</th>
<th>Final saved to refworks</th>
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<td>66</td>
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<td>JSTOR</td>
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<td>Emerald</td>
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<td>EconLit with Full Text from 1989</td>
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<td>EBSCOHost (Academic Search Complete (1,186)) AND Business Abstracts with Full Text (H.W. Wilson) (192)</td>
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<tr>
<td>PsycInfo (1993-present)</td>
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<td>7</td>
</tr>
<tr>
<td>Sage (from 1847-)</td>
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<td>91</td>
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<tr>
<td>Social Science Index</td>
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<td>1029</td>
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</table>

1.4. Categories and sub-categories of literature excluded based on title

- Independent of the organisation: Innovation networks; Open innovation (e.g., Christina Öberg, "Let’s talk about innovation: Is there a hidden potential of knowledge exchange between open innovation and IMP?" IMP 10(3): 540 - 560); Industry level networks; Social media; Regional networks; Cluster networks; Scholarly networks; Community; Social innovations (see for example, Bhatt & Altinay, L. 2013; Cavalli, 2007);
- Beyond the organisation: Interfirm, alliance (or coalition) networks, interorganizational (Inkpen and Tsang, 2005); Supply chain; Entrepreneurial; Customer orientated networks (e.g., Eric (Er) Fang because it is going external like innovation networks) or Grabher, G., Ibert, O. & Flohr, S. 2008, "The Neglected King: The Customer in the New Knowledge Ecology of Innovation", Economic Geography, vol. 84, no. 3, pp. 253-280; Geographical network situation (e.g., Helsey, R. W., & Strange, W. C. 2002. Innovation and input sharing. Journal of Urban Economics, 51(1): 25-45); Innovation diffusion because it is beyond the organisation, based on social system e.g. Huarng, K., Yu, T.H. & Lai, W. 2015, "Innovation and diffusion of high-tech products, services, and systems", Journal of Business Research, vol. 68, no. 11, pp. 2223-2226.
1.5. SLR, data extraction sheet

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Hemp2012CIM</th>
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<tr>
<td>Author</td>
<td>HempHIA, Jens &amp; Magnusson, Mats</td>
</tr>
<tr>
<td>Journal</td>
<td>Creativity and Innovation Management</td>
</tr>
<tr>
<td>Title</td>
<td>Networks for innovation - But what networks and what innovation?</td>
</tr>
<tr>
<td>Keywords</td>
<td>The structure-innovation relationship is dependent upon whether the innovation is of radical or incremental nature.</td>
</tr>
<tr>
<td>Topic</td>
<td>Purpose for both structures - type of innovation</td>
</tr>
<tr>
<td>Why</td>
<td>Two conflicting hypotheses have been raised in previous research: Burt’s structural hole hypothesis and the density hypothesis. In brief, the former of these hypotheses builds upon arguments for open network structures in the acquisition of innovation, the latter one upon arguments for closed network structures for innovation.</td>
</tr>
<tr>
<td>How</td>
<td>22 pharmacies, cross-sectional study. Two general sources of data: self-report data from a balanced scorecard questionnaire, SNA openness and density.</td>
</tr>
<tr>
<td>Outcome</td>
<td>Both formal and informal interactions are of importance for incremental and radical innovation (p. 12). This finding is in line with Kjeld and Van den Enden’s (2007) argument that open structures should be beneficial for idea generation, while the realization of ideas is facilitated by dense structures (p. 12). After the least, the results of the present study suggest that open and dense networks work in parallel.</td>
</tr>
<tr>
<td>Relevance to SLR</td>
<td>Hence, moderating or mediating effects of trust and coordination in the relationship between network structure and innovation (p. 4)</td>
</tr>
<tr>
<td>Relevance to SLR</td>
<td>Nevertheless, there is still only limited consensus on the specific inter-relationships between network structures and innovation (p. 4)</td>
</tr>
<tr>
<td>Search words</td>
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</tr>
<tr>
<td>Times words appeared</td>
<td>Times words appear: social capital x2; knowledge networks x0; networks x65; networking x6; social networks x16; closure x8; strength x8; brokerage x0; diversity x1; density x39; centrality x8; knowledge x14; information x14; knowledge sets x0; ideas x26; implementation x8; innovation x30; innovation process x5; creativity x13; problems x5; learning</td>
</tr>
<tr>
<td>Relevant terms</td>
<td>Both qual (data relevant to the SLR) and quant (mod and med) for social network constructs. See discussion</td>
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<td>Citation</td>
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<tr>
<td>Baer, M. &amp; Oldham, G.R.</td>
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<td>Baer, M.</td>
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<td>Baer, M.</td>
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<tr>
<td>Baer, M., &amp; Frase, M.</td>
<td>2003</td>
</tr>
</tbody>
</table>

1.6. SLR: brief review of paper
1.7. SLR, number of authors per paper

![Number of authors on papers](image)

1.8. SLR, publishing trend per decade

![Publishing trends: volume per decade](image)

1.9. SLR, year and quantity of papers published

![Year and number of papers published](image)
1.10. SLR, journals which appear most frequent

<table>
<thead>
<tr>
<th>Most used Journals (highest - lowest)</th>
<th>Times cited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academy of Management Journal</td>
<td>22</td>
</tr>
<tr>
<td>Administrative Science Quarterly</td>
<td>12</td>
</tr>
<tr>
<td>Organization Science</td>
<td>12</td>
</tr>
<tr>
<td>Journal of Applied Psychology</td>
<td>8</td>
</tr>
<tr>
<td>Journal of Organizational Behavior</td>
<td>7</td>
</tr>
<tr>
<td>Creativity and Innovation Management</td>
<td>6</td>
</tr>
<tr>
<td>Academy of Management Review</td>
<td>4</td>
</tr>
<tr>
<td>Journal of Knowledge Management</td>
<td>4</td>
</tr>
<tr>
<td>Journal of Management</td>
<td>4</td>
</tr>
<tr>
<td>Journal of Product Innovation Management</td>
<td>4</td>
</tr>
<tr>
<td>Management Science</td>
<td>4</td>
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<tr>
<td>European Journal of Innovation Management</td>
<td>3</td>
</tr>
<tr>
<td>Research in Organizational Behavior</td>
<td>3</td>
</tr>
<tr>
<td>Strategic Management Journal</td>
<td>3</td>
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1.11. SLR, publishing trends for most cited journals

[Bar chart showing publishing volume per year for the top three journals]
1.12. SLR, final selection of literature by topic
### 1.13. Social networking terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actor</td>
<td>A socialised entity (Coleman, 1988)</td>
</tr>
<tr>
<td>Alter</td>
<td>A contact with whom a social entity has a connection (Zou &amp; Ingram, 2013)</td>
</tr>
<tr>
<td><strong>Boundary spanners</strong></td>
<td>Network members who have the capacity to communicate effectively both internally and externally (Hsu, Wang, &amp; Tzeng, 2007)</td>
</tr>
<tr>
<td>Bridge</td>
<td>The path(s) that connects two networks (Granovetter, 1973)</td>
</tr>
<tr>
<td>Brokerage</td>
<td>Connecting, otherwise, disconnected actors (Fleming &amp; Waguespack, 2007)</td>
</tr>
<tr>
<td>Brokers</td>
<td>Connecting social entities across structural holes (Burt, 1992)</td>
</tr>
<tr>
<td><strong>Closure</strong></td>
<td>A network where people communicate regularly to the extent that they develop norms about others’ behaviours (Coleman, 1988)</td>
</tr>
<tr>
<td><strong>Constraint</strong></td>
<td>A social entity with few ties within which members are closely connected to each other (Burt, 1992)</td>
</tr>
<tr>
<td><strong>Density</strong></td>
<td>A network whose members communicate regularly and intensely (Granovetter, 1973)</td>
</tr>
<tr>
<td>Diversity</td>
<td>Functional, tenure, demographic variance within a social entity (Joshi, Pandey, &amp; Han, 2009)</td>
</tr>
<tr>
<td><strong>Network</strong></td>
<td>Contacts with whom a social entity has access (Shea, Menon, Edward, &amp; Emich, 2015)</td>
</tr>
<tr>
<td><strong>Network size</strong></td>
<td>The number of social entities within a network</td>
</tr>
<tr>
<td><strong>Nodes</strong></td>
<td>Reciprocal tie connections (Tortoriello &amp; Krackhardt, 2010)</td>
</tr>
<tr>
<td><strong>Small World</strong></td>
<td>Networks with high density and short average path lengths (Brands, 2013)</td>
</tr>
<tr>
<td><strong>Social entity</strong></td>
<td>An individual, team, community, unit, organisation, industry, country, other....</td>
</tr>
<tr>
<td><strong>Strong ties</strong></td>
<td>Ties which frequently communicate (Jack, 2005)</td>
</tr>
<tr>
<td><strong>Structural holes</strong></td>
<td>The absence of a connection between social entities (Burt, 1992)</td>
</tr>
<tr>
<td><strong>Tie</strong></td>
<td>A connection between social entities (Granovetter, 1973)</td>
</tr>
<tr>
<td><strong>Tie strength</strong></td>
<td>The nature of the relationship measured in time, intensity, reciprocity (Granovetter, 1973)</td>
</tr>
<tr>
<td><strong>Weak ties</strong></td>
<td>A bridge connection (Granovetter, 1973)</td>
</tr>
</tbody>
</table>
1.14. References for the SLR


Organizations and Institutions: Sociological and Economic Approaches to the Analysis of Social Structure), S95–S120.


Kilduff, M., & Brass, D. J. (2010b). Organizational social network research: Core ideas and key debates. The Academy of Management Annals, 4(1), 317–357.


2. **Methodology appendices**

2.1. **Letter of proposal to sample companies**

I am the lead researcher and Co-Principal Investigator (with Prof Martin Fellenz) of a large research project entitled ‘Managing the Innovation Process’ conducted by the Trinity Business School at Trinity College Dublin. As part of this project I am currently seeking access to teams engaged in any form of organisational, administrative, procedural, technical, product or service innovation to investigate relevant innovation-related activities, structural arrangements, and team member experiences.

The outcome of this stage of this project will provide important insights into the constellations of relevant factors that drive innovation from invention over development to implementation – or help identify factors that hinder such progress. To collect the relevant data, I expect to work with the participating team lead and/or team sponsor to gather information about the context of the teams’ innovation work and spend some time with each team to collect data. I would then re-engage with the team at a later stage to follow up on
the initial data collection. I can include single or multiple teams from
the same organisation in our research.

In return I would be able to provide teams and their sponsors with
feedback about our observations in the context of comparative data
gathered in participating teams across all participating organisations.
This process is likely to lead to insights about the team’s way of
dealing with their innovation stage challenges. This feedback can be
provided in the form of a brief report or an interactive workshop, and
this will provide an informative rather than judgemental exercise to
support learning, reflection, and improvement.

The data I collect will remain confidential, and any use of the
collected data for research and publication will protect the anonymity
of the participating individuals, teams, and organisations. Collected
data will only be used for research purposes.

I would greatly appreciate the opportunity to discuss this proposal
with you further to explore how I can collaborate in this exciting and
important area of research. For your information, I have attached
brief biographies for the Co-Principal Investigators Martin Fellenz
and Michelle MacMahon. I will contact you in the next days to
follow up on this initial query or you may get back to me via email or
phone 087 1204545. I look forward to discussing this opportunity
with you.
2.2. A multiple-case study: team profiles

<table>
<thead>
<tr>
<th>Team ID</th>
<th>Team profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team One (T1)</td>
<td>A core team of three members, plus a silent member, all with relevant and specialist knowledge and training, working on a system for meeting and maintaining a national Health Charter driven by a formal program for change and supported by executive management. The biggest challenge appears to be influencing front line personnel to engage with the project. Most helpful was progress was the influence of executive management on front line personnel.</td>
</tr>
<tr>
<td>Team two (T2)</td>
<td>A core group of three members piloting a process for improving service user HES, experience, and organisation communication, driven by a formal program for change, supported by CEO and complemented with a Steering Committee with relevant resources. Most helpful was the commitment of the team to a common goal. The pilot achieved approval for a company wide roll-out.</td>
</tr>
<tr>
<td>Team three (T3)</td>
<td>A core team of three members with relevant medical training working a project for improving prescription administration and improving safety. The team describe their working relationship as good based on shared work load and standards, good energy, similar writing style, good psychological safety as well as being highly motivated and having role status within the organisation to influence others. The project is driven by a formal change program that dictates time, a methodology, momentum, and techniques for influencing change. The biggest challenge for the team was influencing front line personnel with whom the team rewarded with cupcakes when positive change was noted.</td>
</tr>
<tr>
<td>Team four (T4)</td>
<td>A core team of three members, plus a silent member, professionally trained, with diverse, yet complementary skills motivated to learn how to make improvement in quality in their organisation. Their team believes their ability to create a project charter. The biggest challenge for the team was managing waiting lists in hospitals as commissioned by the Department of Health. The team believes their experience, reputation, and knowledge for opportunities to piloting their service within the organisation and generate sales leads beyond the organisation using their network of connections.</td>
</tr>
<tr>
<td>Team five (T5)</td>
<td>A core team of four members, with dotted lines to an extended team of contractors and stakeholders working together for the exclusive purpose of constructing a stand to facilitate the parking of twelve aircrafts as commissioned by their client. The biggest challenge was managing the requirements of multiple stakeholders both on the client site and beyond, into the surrounding community and environment. The team who considers themselves more problem solvers than innovators; they believe their ability to define and maintain focus on the ultimate goal helped them navigate the process. Most helpful was the team's ability to manage all stakeholders through effective communication, specifically listening skills, and building a reputation as effective managers.</td>
</tr>
<tr>
<td>Team six (T6)</td>
<td>A core team of five people situated within an innovation unit with extended lines to a network of personnel across this multi-national organisation working on developing a data analytics service to fulfil an organisation level goal. The team trades their reputation for opportunities to piloting their service within the organisation and generate sales leads beyond the organisation using their network of connections.</td>
</tr>
<tr>
<td>Team seven (T7)</td>
<td>A core team of five people situated within an innovation unit with extended lines to a network of personnel across this multi-national organisation working on developing a data analytics service to fulfil an organisation level goal. The team trades their reputation for opportunities to piloting their service within the organisation and generate sales leads beyond the organisation using their network of connections.</td>
</tr>
<tr>
<td>Team eight (T8)</td>
<td>A core team of five people situated within an innovation unit with extended lines to a network of personnel across this multi-national organisation working on developing a data analytics service to fulfil an organisation level goal. The team trades their reputation for opportunities to piloting their service within the organisation and generate sales leads beyond the organisation using their network of connections.</td>
</tr>
<tr>
<td>Team nine (T9)</td>
<td>A core team of four members, plus a silent member, professionally trained, with diverse, yet complementary skills motivated to learn how to make improvement in quality in their organisation. Their team believes their ability to create a project charter. The biggest challenge for the team was managing waiting lists in hospitals as commissioned by the Department of Health. The team believes their experience, reputation, and knowledge for opportunities to piloting their service within the organisation and generate sales leads beyond the organisation using their network of connections.</td>
</tr>
</tbody>
</table>

2.3. Application for Research Ethics Approval.

Application for Research Ethics Approval
School of Business Research Ethics Committee, TCD

The School of Business Research Ethics Committee is a Level One Committee. It reviews research projects that are of low to moderate risk to participants, as follows:

- Anonymous surveys of a non-intrusive personal nature.
- Unrecorded and anonymous observation of individuals in public areas.
- Analysis of irrevocably anonymized and appropriately collected data.
- Interviews (consensual) with non-vulnerable adults.
- Action research
- Surveys where respondents can be identified and where respondents have given appropriate consent.
Research that carries with it a moderate to high risk to participants, as described below, should be reviewed by a Level Two Committee.

- Surveys asking questions of a sensitive or private nature
- Questionnaires or observational studies involving children or vulnerable adults.
- Research where there is a risk of a participant feeling undue pressure to participate by his/her relationship with the researcher (e.g. student/supervisor; patient/clinician).
- Projects involving a justifiable degree of deception.
- Analysis of archival irrevocably anonymized human tissue samples for which consent for research was not originally given and was not acquired in the course of clinical treatment. Research involving invasive procedures (other than those listed above).
- Research involving vulnerable persons.
- Research where identifiable information obtained may have legal, economic or social consequences for research subjects.
- Research that may identify illegal activity.
- Projects where each subject is paid (over and above token gestures).
- Research that may potentially endanger the subjects/researchers/3rd parties, the environment.
- Research involving the collection of human tissue.
- Research that may have a direct military role.
- Research conducted outside Ireland.
- Research involving psychological intervention.
- Research where a potentially beneficial or harmful treatment, information or learning method may be withheld from some participants.

Please complete the checklist below before submitting your application

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>If you are a student, has your supervisor signed this completed form?</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td><em>If appropriate to your study, have you attached the following:</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any data collection tools (e.g. questionnaire, interview schedule)</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>The consent forms you propose to use</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>The participant information sheet you propose to use</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

Name of Applicant: Michelle MacMahon

248
<table>
<thead>
<tr>
<th><strong>Academic Supervisor/ Lead Researcher</strong></th>
<th>Martin Fellenz</th>
</tr>
</thead>
<tbody>
<tr>
<td>For students this is the name of your supervisor. For staff this is the PI if different from the applicant</td>
<td></td>
</tr>
<tr>
<td><strong>Discipline</strong></td>
<td>Organisation Behaviour</td>
</tr>
<tr>
<td><strong>Title of project</strong></td>
<td>The role of social network constructs in the organisation innovation process</td>
</tr>
<tr>
<td><strong>Timeframe of research</strong></td>
<td>Currently in yr. 3 of my PhD, I hope to collect data in Q1 &amp; Q2, 2017. I recently completed a systematic literature review and a first draft methodology, informed by the literature. I plan to begin data analyses in Q3 &amp; Q4, 2017, start final drafts of the chapters of my thesis in Q1 2018 for submission Aug, 2018.</td>
</tr>
<tr>
<td><strong>Funder</strong></td>
<td>n/a</td>
</tr>
<tr>
<td>Where research is funded, give details of the funder and indicate whether the funder requires that ethical approval is secured for this project</td>
<td></td>
</tr>
<tr>
<td><strong>Requirement for Ethical Approval</strong></td>
<td>n/a</td>
</tr>
<tr>
<td>Where another party has explicitly required ethical approval for this project, please provide details. If you are required to seek further ethical approval from another committee after this application, please provide details.</td>
<td></td>
</tr>
<tr>
<td><strong>Purpose of research</strong></td>
<td>This research project will investigate factors that influence a team's ability to switch between exploration activities and exploitation activities within each stage of the organisation innovation process (invention, development, and implementation).</td>
</tr>
</tbody>
</table>
### Justification for the research
Indicate the contribution that the research is anticipated to make.

- Theoretical contribution: the role of social network constructs (brokerage and closure) in facilitating exploration and exploitation activities for innovation.
- Empirical contribution: factors that influence exploration and exploitation activities for innovation.
- Practical contribution: a model of the innovation process that positions teams for appropriate coaching or management style.

### Participants in the research
Provide details of the population to be studied, and sampling procedures to be used.

- Individuals and teams (approx. 30) across two or more organisations, (currently ESB and HSE) engaged in innovation projects.

### Recruitment procedures
Include an explanation of any incentives and/or compensation (financial or otherwise) to be offered to participants.

- I plan to provide teams and their sponsors with feedback about my observations in the context of comparative data with the aim of generating insights about the team’s way of dealing with their innovation stage challenges.

### Informed consent
Outline the information that will be provided to potential participants, and procedures for gaining consent (if this will be in printed form, please supply a copy of it).

- With sponsorship approval, I will meet team members for an informal and brief introduction. I will describe the steps for data collection and plan my attending team meetings for observation. Their consent will be in the form of their completing a questionnaire on social networks which is the first step.

### Methods
Outline the methods that will be used for data collection and analysis and provide interview or survey questions where these are being used.

- Quantitative data: Social network relations, social status, and psychological safety climate.
- Qualitative data: Observation points, and semi-structured interview questions
- Questionnaire and analyses – see attached appendix.

### Confidentiality, anonymity, and data storage
Provide an explanation of any measures that will be put in place to preserve confidentiality and anonymity, including an explicit explanation of secure data storage.

- Data collected on individuals and teams will be anonymized and used solely for research purposes only.
- Data will be stored on a one-drive account with a back-up file on a USB key which will be stored in a secure location in my home study.
and disposal plans. Note that there may be a need to store data for 5 years (and sometimes more) after completion of the project.

<table>
<thead>
<tr>
<th>Ethical considerations and potential risks to participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where potential risks to participants may be present, explain any steps that will be taken to minimize these and any additional support that might be used should the need arise.</td>
</tr>
<tr>
<td>I don’t envisage any risk to participants</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Published ethical guidelines to be followed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify professional code(s) of practice and/or ethical guidelines relevant to the research.</td>
</tr>
<tr>
<td>British Psychological Society of which I am a member as a test user <a href="http://www1.bps.org.uk/">http://www1.bps.org.uk/</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Travel outside Ireland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide information on any travel to be undertaken outside Ireland. Any travel planned for countries with heightened risk should be given detailed explanation and justification.</td>
</tr>
<tr>
<td>n/a</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Self-care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify any significant risk issues to yourself as researcher and any self-care planning that you will use to address these.</td>
</tr>
<tr>
<td>I don’t foresee any risk</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Signature of applicant:</th>
</tr>
</thead>
<tbody>
<tr>
<td>I declare that I have read the TCD Ethics Policy and will follow the guidelines therein.</td>
</tr>
<tr>
<td>Signature: [A typed name is acceptable as long as it is submitted from applicant’s TCD email address, as verified by Chair of Ethics Committee below]</td>
</tr>
<tr>
<td>Date: Date: 15th December 2016</td>
</tr>
</tbody>
</table>
2.4. Letter of proposal to prospective pilot teams

It was lovely to meet you all briefly on Thursday 1st December in the RCPI. Further to Martin’s introduction to our research I would very much like to organise to meet with you in your individual teams as soon as possible.

Our meeting will last approximately one hour during which time I will ask you questions about your programme project, what stage you are in, and your approach to the task. In return this is an opportunity for you to reflect on your project and, together, I can discuss your approach. Please note there is no preparation required from you for this meeting nor are you obligated to participate. The data collected by me is strictly for research purposes only and will not be shared with anyone other than Martin Fellenz who is a co-researcher on this project.

Please email suggested dates and location for our meeting and note that I am happy to commute to your place of work. I look forward to meeting with you.

Yours sincerely,

Michelle MacMahon
Trinity Business School, Trinity College Dublin

---

1 This application form was adapted from that used by the School of Social Sciences & Philosophy, TCD.
2.5. Observation and outcome from pilot study

<table>
<thead>
<tr>
<th>Team ID</th>
<th>Interest in participation</th>
<th>Meeting date</th>
<th>Observation/learning</th>
<th>Next steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>D11 T1</td>
<td>yes, expressed via returned mail</td>
<td>January 9th, 2018</td>
<td>Main questions were appropriate. Some probing questions could be leading.</td>
<td>I shared the 3DM and closed this team with expression of gratitude for my learning opportunity.</td>
</tr>
<tr>
<td>D11 T2</td>
<td>yes, expressed via returned mail</td>
<td>January 9th, 2018</td>
<td>Group was a little guarded so ensure team members do not feel judged in their approach.</td>
<td>I shared the 3DM and closed this team with expression of gratitude for my learning opportunity.</td>
</tr>
<tr>
<td>D11 T3</td>
<td>yes, expressed via returned mail</td>
<td>January 13th, 2018</td>
<td>Feeling confident now and focused on gathering evidence to support explanations.</td>
<td>Keep this team open for inclusion in multiple-case study.</td>
</tr>
<tr>
<td>D11 T4</td>
<td>yes, expressed via returned mail</td>
<td>January 18th, 2018</td>
<td>Testing my new confidence and practicing asking questions in a non-judgmental way and gathering evidence.</td>
<td>Keep this team open for inclusion in multiple-case study.</td>
</tr>
<tr>
<td>D11 T5</td>
<td>yes, expressed via returned mail</td>
<td>January 25th, 2018</td>
<td>Practicing my new confidence and practicing asking questions in a non-judgmental way and gathering evidence.</td>
<td>Keep this team open for inclusion in multiple-case study.</td>
</tr>
<tr>
<td>D11 T6-T9</td>
<td>no expression shown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D11 T10</td>
<td>yes, expression via returned mail</td>
<td>Jan 26th, 2018</td>
<td>Meeting never happened, no further communication from the team.</td>
<td>Cease communication</td>
</tr>
<tr>
<td>D10 T1</td>
<td>yes, expressed via returned mail</td>
<td>30th Jan, 2018</td>
<td>I went too far with practicing and perhaps started coaching this team.</td>
<td>I shared the 3DM and closed this team with expression of gratitude for my learning opportunity.</td>
</tr>
<tr>
<td>D10 T2</td>
<td>yes, expressed via returned mail</td>
<td>9th Feb, 2018</td>
<td>This meeting felt good, the questions flowed and so did the teams description of their process.</td>
<td>I shared the 3DM and closed this team with expression of gratitude for my learning opportunity.</td>
</tr>
<tr>
<td>D10 T3</td>
<td>yes, expressed via returned mail</td>
<td>21st Feb, 2018</td>
<td>This meeting felt good, the questions flowed and so did the teams description of their process. Confidence back.</td>
<td>I shared the 3DM and closed this team with expression of gratitude for my learning opportunity.</td>
</tr>
<tr>
<td>D10 T4</td>
<td>yes, expressed via returned mail</td>
<td>23rd Feb, 2018</td>
<td>This meeting felt good, the questions flowed and so did the teams description of their process.</td>
<td>Keep this team open for inclusion in multiple-case study.</td>
</tr>
<tr>
<td>D10 T5</td>
<td>yes, expressed via returned mail</td>
<td>26th Feb, 2018</td>
<td>This meeting felt good, the questions flowed and so did the teams description of their process.</td>
<td>Keep this team open for inclusion in multiple-case study.</td>
</tr>
</tbody>
</table>

2.6. Protocol

A protocol outlines how to collect data for replication as in multiple-case studies, and therefore supports reliability, that is, getting the same result when repeating the study (Yin, 2014). Yin (2014) outlines four sections of the protocol to guide the researcher: an overview of the case study; data collection procedures; data collection questions; and a guide for the thesis.

Overview of Case Study. The research questions are: How does the team progress through the innovation process? Does the team engage in strategies of exploration and exploitation? Is there a pattern to their exploration and exploitation strategies for innovation progression, and if so, how, and why do they do this? I chose to respond to the research question, using a multiple-case study relying on a qualitative...
approach. A qualitative approach can allow meaning and purpose for the activities an entity engages with as well as uncover theories or concepts that could otherwise be overlooked (Ref).

Cases are selected for inclusion in the study if they meet the following criteria – regardless of organisation or industry sector, team size is two members or more working on a specific innovation project such as generating new ideas, or solutions for organisational products, procedures, processes, and service offerings; of developing, testing, and refining these ideas for use; and of implementing them in a specific context. The project is in the early stage of the innovation process and team members have responsibilities towards other types of work outside this team, so the focus of our study is gathering data on strategies, activities, and behaviours on this team’s specific innovation project.

A pilot study was conducted for three reasons: to gain experience meeting teams to build confidence; to develop a criterion for inclusion in actual study; and to validate the order and fit of interview questions.

**The theoretical framework.**

Invention is the first stage where an idea or ideas are accepted. Exploration in the invention stage typically invites external search, individual and collaborative creativity, intuition, non-rational thought processes, and lateral thinking; and often requires playful and non-judgmental approaches all of which are necessary for creativity and innovation (Amabile, 1988; West, 2002). After some time exploring it is advantageous for the team to switch to a strategy of exploitation to direct creative urges towards internal recombination and synthesis in service of maximizing efficiencies and gaining value from exploration (Andriopoulos & Lewis, 2009; W. K. Smith & Tushman, 2005).

Development is the second stage of the innovation process where ideas are elaborated. Exploration during the early part of the
development stage typically involves a team to focus outwards for new perspectives and, additional information and resources. An exploitation strategy in this latter phase of development is an opportunity for members to narrow their focus and mobilize the team towards a valid concept in preparation for presentation and implementation.

Implementation is the third stage in the innovation process, the ‘long tail’ of innovation. In the initial phase of implementation, a strategy of exploration enables the team to learn how to best implement their idea. Other requirements in this early phase of implementation may include additional resources such as a marketing budget, plant equipment, time, or simply learning more about their ideas’ readiness for the market or practice setting it is aimed at. At some time or because of some event, the team will exploit these resources bringing the idea to a close.

For any given innovation process, the actual shapes of the diamonds representing different innovation stages may differ significantly. In fact, across stages of innovation for any given project there are a variety of diamond shapes, representing the variances in time and effort given to periods of exploration and exploitation activity within and across stages. In addition, strategies of exploration and exploitation contain numerous activities that may contain elements of each other. Such activity-level exploration/exploitation sequences are represented through smaller diamonds within the main three diamonds. Such sub-diamonds may represent a thought, an idea, an initiative, a problem, or a task, considered and dealt with in the context of the relevant stage. Given the indeterminacy and often random, circular, or chaotic nature of such processes exploration activities may begin and remain open without receiving any attention for a while and may in fact never be returned to at all. Innovation is full of such unfulfilled departures and cul-de-sacs.
Relationships play a large role in everyday work especially with complex and often highly interdependent tasks such as innovation and team contexts. Embedded in relationships is a set of social resources or social capital that facilitates certain actions by those involved. The concepts of exploration and exploitation are related with two structural categories of relationships both with unique advantages found to support innovation, trans-team, and intra-team relationships. Effective trans-team relationships that offer access to external resources, knowledge, and opportunities will be valuable if constructively coupled with close intra-team relationships that enable collective and collaborative work to progress the innovation tasks by capitalizing on such information variety through effective refinement, selection and joint action.

Research propositions. Research propositions being examined follow a conceptual framework (captured by the Three/3 Diamonds Model (3DM/3DM) of the innovation process and are captured in the following summary of the theory: All three stages of the innovation process (invention, development, and implementation) (Garud et al., 2013) contain a complex set of social processes where progress is made by exploring opportunities derived from gaining new knowledge and exploiting opportunities derived from refining and using current knowledge. This creates a logical pattern for sequencing the strategies, with exploration occurring first in each stage to generate increased information variety, and exploitation following in each of the three stages to extract value and refine the available information to a point where the stage can be completed. In other words, this pattern reflects the requirement of each stage to begin with a strategy of exploration to obtain new knowledge and increase informational resources, and end with the competing, yet complementary strategy of exploitation to capitalize on earlier efforts.

Collecting the data. During discussions with the team sponsor about gaining access to a team for inclusion in the study the researcher should agree on how to arrange data collection meetings.
Gather names and email addresses for all team members or at least the name and email address for a convenor. Rather than the researcher defining the team, allow the sponsor or the team to determine who makes up the team, and who is included in the data collection meetings. Schedule dates and times for collecting data on three occasions with either the sponsor, convenor, or team members, as applicable, as early as possible so that all teams are accommodated in the researcher’s diary. Create a schedule of all team meetings including time to prepare for each meeting and time to organise and file the data following each meeting.

Create a filing system for all data with back-up options as follows: an electronic file both in the cloud and a portable hard-drive; and, a hard-copy file, for example, a lever-arch file with dividers for each case or individual files. Organise your filing system so that each case has its own file and you have the necessary stationary. In addition, ensure you have a safe place to store the data, a lock and key if necessary, for ethical reasons as well as practical reasons.

Prepare for each meeting by ensuring you have the correct date, time, and location. Also prepare for each meeting by packing relevant materials, including: a voice recording device, a note book, pen(s), laptop computer, and mobile phone. Ensure electrical devices have sufficient battery power to last the duration of the meeting and bring an extra battery, power lead(s) as back-up. Bring with you names and telephone numbers for people you should contact in emergency, for example, if you were delayed due to traffic, or if you got lost in a building when trying to find the meeting room, or any other unforeseen.

During the meetings maintain the essence of a real-world setting. Limit your engagement with the team, as much as possible, to matters concerning data collection. For each interview-based meeting, arrive on time, maintain formality by reminding participants of the purpose and agenda for the meeting, finish at the scheduled time and reframe
from discussing the project with the team or offering views and opinions. The team meeting at time two, non-participant observation, is a real-world meeting therefore, it is imperative that the researcher stays in the background of this meeting and maintains a silent role.

Following each meeting save data from the voice recording device to electronic and hard files. Delete the recording from the voice recording device should the device get lost or stolen, the data are safe. If you collected artefact take a picture of the artefact and save to electronic and hard files.

Data collection questions. Collect data on three occasions as follows: time one and three are interviews. At the scheduled time and with the scheduled team members use a voice recording device to record the questions asked and the answers given from beginning to the end of the interview. As team members refer to documentation and artefacts ask permission to include this data in the study. You may ask for a copy, for example, of a document or ask to take a picture of the item, for example, of an artefact. At time two non-participant observation, ask permission to do the following three things: that the team ignores your being in the room; to use a notepad or computer to record commentary about your observations throughout the team meeting; and, to use a voice recording device to record the team conversation.

**The interview questions are as follows:**

- What are you working on? The main objective of this question is to generate a description of ‘what’ the team is doing and why, both retrospectively and currently the team frames the innovation.
- Where is your focus right now? This question also has two objectives: the first is to locate ‘the team engaged in the innovation process’ in a stage of the innovation process (invention, development or implementation) to track progress over time. But also, to gather descriptive data on ‘the team engaged in the innovation process’ activities and behaviours.
• What are you doing that helps? Following on from question two, this question aims to gather data on more specific phase relevant activities and behaviours.
• How are you doing that? This question is asked in the context of the answers to questions two and three, and therefore often elaborated upon – for example, how did/will [you] get the information you need to make that decision?

During the non-participant observation meeting, take notes on seating arrangement, room layout; comment on tone and body language. Summarise your observations on how individual and team behaviours in general.

A guide for the case study report. The case study will be reported in two ways. For the participating teams, I will prepare a brief report of the team to include a summary of the analysis and results across all teams with an individual report on each team sent separately. For the thesis I will provide a brief report on each team first and then describe the innovation process by including evidence from across all teams. Both reports will present three categories of data. First, the report will address the context for each innovation process, that is the team and innovation content, then the report will describe how the teams progressed through the innovation process, and finally the report will comment on things members said. The results for each team and across teams will be discussed through the lens of the 3-Diamonds Model. Each report will include abstract representations of the innovation process for each team and an overall idealised model, that is, the 3-Diamonds Model.

2.7. Letter of proposal to prospective participants
I am the lead researcher and Co-Principal Investigator (with Prof Martin Fellenz) of a large research project entitled ‘Managing the Innovation Process’ conducted by the Trinity Business School at Trinity College Dublin. As part of this project I are currently seeking access to teams engaged in any form of organisational,
administrative, procedural, technical, product or service innovation to investigate relevant innovation-related activities, structural arrangements, and team member experiences.

The outcome of this stage of this project will provide important insights into the constellations of relevant factors that drive innovation from invention over development to implementation – or help identify factors that hinder such progress. To collect the relevant data, I expect to work with the participating team lead and/or team sponsor to gather information about the context of the teams’ innovation work and spend some time with each team to collect data. I would then re-engage with the team at a later stage to follow up on the initial data collection. I can include single or multiple teams from the same organisation in our research.

In return I would be able to provide teams and their sponsors with feedback about our observations in the context of comparative data gathered in participating teams across all participating organisations. This process is likely to lead to insights about the team’s way of dealing with their innovation stage challenges. This feedback can be provided in the form of a brief report or an interactive workshop, and this will provide an informative rather than judgemental exercise able to support learning, reflection and improvement.

The data I collect will remain confidential, and any use of the collected data for research and publication will protect the anonymity of the participating individuals, teams and organisations. Collected data will only be used for research purposes.

I would greatly appreciate the opportunity to discuss this proposal with you further to explore how I can collaborate in this exciting and important area of research. For your information,

I have attached brief biographies for the Co-Principal Investigators Martin Fellenz and Michelle MacMahon. I will contact you in the next days to follow up on this initial query or you may get back to me
via email or phone 087 1204545. I look forward to discussing this opportunity with you.

2.8. **Letter of invite to results presentation**

Thank you for expressing an interest in our research project, ‘Managing the Innovation Process’, conducted by Trinity Business School. Martin and I would like to share the results of our study, collectively, with all participating teams and their sponsors on Tuesday 24th April 2018 at 5pm in Trinity College Dublin.

During this time, I will describe our insights about how the teams’ navigated their innovation project, the strategies, and activities they adopted, and behaviours that positively and negatively challenged progress. This will be an informative rather than judgemental exercise to support learning, reflection, and improvement. All data are anonymised to protect the identity of participating individuals, teams, and organisations. Separately, I will provide individual teams with a short report of their results for additional information and comparison.

I look forward to hearing from you,
<table>
<thead>
<tr>
<th>Group #</th>
<th>Group ID</th>
<th>Ownership</th>
<th>Industry</th>
<th>Members</th>
<th>Innovation</th>
<th>Data collection dates</th>
<th>Time1 data</th>
<th>Time2 data</th>
<th>Time3 data</th>
<th>Data totals per group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<td>1</td>
<td>G1</td>
<td>Public</td>
<td>Healthcare: acute G.Hospital</td>
<td>4</td>
<td>Improve customer services</td>
<td>18th Jan; 28th March; 20th June</td>
<td>33</td>
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<td>2</td>
<td>G2</td>
<td>Public</td>
<td>Healthcare: intellectual disability +steering committee</td>
<td>3</td>
<td>Change the auditing protocol</td>
<td>18th Jan; 12th April; 20th June</td>
<td>45</td>
<td>5</td>
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<tr>
<td>3</td>
<td>G3</td>
<td>Public</td>
<td>Healthcare: hospital</td>
<td>3</td>
<td>Improve prescribing admin</td>
<td>26th Feb; 5th May; 7th July</td>
<td>28</td>
<td>8</td>
<td>2</td>
<td>41</td>
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<tr>
<td>4</td>
<td>G4</td>
<td>Public</td>
<td>Healthcare: hospital</td>
<td>3</td>
<td>Improve patient safety</td>
<td>24th Feb; 7th April; 30th June</td>
<td>37</td>
<td>9</td>
<td>1</td>
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<tr>
<td>5</td>
<td>G5</td>
<td>Semi-state</td>
<td>Service industry</td>
<td>3</td>
<td>Create new software product</td>
<td>1st Feb; 15th March; 24th May</td>
<td>0</td>
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<td>8</td>
<td>103</td>
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<td>6</td>
<td>G6</td>
<td>Semi-state</td>
<td>Service industry</td>
<td>9</td>
<td>Design/build a new building</td>
<td>5th July; 9th Aug; 26thOct</td>
<td>40</td>
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<td>7</td>
<td>G7</td>
<td>Semi-state</td>
<td>Service industry</td>
<td>5</td>
<td>Develop a new service</td>
<td>3rd May; 3rd July; 12th Oct</td>
<td>35</td>
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<td>8</td>
<td>G8</td>
<td>Public</td>
<td>Service industry +steering committee</td>
<td>4</td>
<td>Improve waiting lists</td>
<td>14th March; 22nd June; 11th August</td>
<td>35</td>
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<td>1</td>
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<tr>
<td>9</td>
<td>G9</td>
<td>Semi-state</td>
<td>Service industry</td>
<td>6</td>
<td>A new building</td>
<td>12th July; 16th August; 18th Oct</td>
<td>49</td>
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<table>
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<td>13</td>
<td>35</td>
<td>3</td>
<td>133</td>
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</table>

2.9. Tracking data collection across cases
3. Data analysis appendices

3.1. Induction, pre-coding the data
## 3.2. Codebook

<table>
<thead>
<tr>
<th>Labels and sub-labels</th>
<th>Code</th>
<th>Definition</th>
<th>Description</th>
<th>Example from transcripts</th>
<th>Exclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group Content</strong></td>
<td>GC</td>
<td>What makes the team and why they are a team.</td>
<td>Using group rather than team because when I code as G it distinguishes it from time (T) which could otherwise be confused with T for team. Teams are defined as a group of people “whose members take individual and collective responsibility for their shared objectives and interactively coordinate their interdependent activities through role and specific assignments” (Martin &amp; Fellenz, 2017: 192)</td>
<td></td>
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</tr>
<tr>
<td>Membership</td>
<td>GCmem</td>
<td>Data which identifies that they are a member of the team or not</td>
<td>Data which responds to - ‘Why are they in the team or not? How did they become a team?’</td>
<td>G2 - “for me this project started with a new Director of Dept in March 2016”:</td>
<td></td>
</tr>
<tr>
<td>Individual KSA</td>
<td>GCksa</td>
<td>Data which identifies individual knowledge, skills, and attributes</td>
<td>Data which responds to - ‘Why are these KSA relevant? How do these KSA influencing innovative progress?’</td>
<td>G1 - [person] deals with complaints and risk in [organization]:</td>
<td></td>
</tr>
<tr>
<td>Group process @ time2 observation</td>
<td>GP</td>
<td>How the group performs</td>
<td>“When a member says something, is he primarily trying to get the group task accomplished, to improve or patch up some relationships among members, or self-oriented?” (Schein, 1983). Also, Bales (1950) research on group task and group relationships dictate the labels where he considered these behaviours as soci-emotional.</td>
<td>G1 - “don’t go starting a process until, give us a couple of days of using it, and then we can say, it may be a total flop”</td>
<td></td>
</tr>
<tr>
<td>Relationship behaviour - Positive</td>
<td>GPrp</td>
<td>Things members say (implicit in tone, explicit in words) which suggests positivity, enthusiasm, support (Schein, 1998)</td>
<td>for example: jokes, laughs, small talk, satisfaction, offers help, compliments, acknowledgments, support(s)…</td>
<td>G2 - “anyway, were there other things” (frustrated):…?</td>
<td>Commentary about the project experience</td>
</tr>
<tr>
<td>Relationship behaviour - negative</td>
<td>GPrn</td>
<td>Things members say (implicit in tone, explicit in words) which suggests stagnation, tension, or withdrawal (Schein, 1998)</td>
<td>for example: sarcasm, remarks, dis-satisfied, closes to help, grievances, unco-operative, defensive, withdrawing, withholds, …</td>
<td>G3 - “…and not really making it clear that he wasn’t part of the group any more”:</td>
<td>Commentary about the project experience</td>
</tr>
<tr>
<td>Task behaviour - diverging</td>
<td>GPhd</td>
<td>Things members say (implicit in tone, explicit in words) about the project that deviates from current thinking, increases variety of options, or raises doubt</td>
<td>for example: initiating: proposing, suggesting; seeking: requesting, soliciting, presenting, asking, questioning (Schein, 1998)</td>
<td>G2 - “we want email”:</td>
<td>Commentary about the project experience</td>
</tr>
<tr>
<td>Task behaviour - converging</td>
<td>GPhf</td>
<td>Things members say (implicit in tone, explicit in words) about the project which achieves common thinking, reduces variety of options, or eliminates doubt</td>
<td>for example: stating, informing, offering, providing, stating, excluding, announcing: clarifying, elaborating, interpreting, defining, reducing, steering; summarizing: restating, concluding (Schein, 1998)</td>
<td>G2 - “is there anything you would like to add to that”</td>
<td>Commentary about the project experience</td>
</tr>
<tr>
<td>Label</td>
<td>Code</td>
<td>Definition</td>
<td>Description</td>
<td>Example from transcripts</td>
<td></td>
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<td>--------------</td>
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</tr>
<tr>
<td>Innovation</td>
<td>IC</td>
<td>What the team is working on and why.</td>
<td>Innovation is idea invention, development, and implementation (Garud et al., 2013)</td>
<td></td>
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</tr>
<tr>
<td>Innovation</td>
<td>ICen</td>
<td>Data that describes what the team is inventing, developing or implementing (Garud et al., 2013)</td>
<td>- &quot;the delivery of a national protocol.&quot; - GB - Improving the quality of the service and the experience for the patient.</td>
<td></td>
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<tr>
<td>Context</td>
<td>ICcon</td>
<td>Data that describes the purpose, direction and pace of the innovation</td>
<td>- &quot;So the delivery of these 3 requirements was signed to... and this then initiated the project...&quot;</td>
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<tr>
<td>Innovation</td>
<td>IP</td>
<td>New innovation progress</td>
<td>Thesis research explains how a sequence of events leads to an outcome – it describes the temporal patterns between events, actions, and activities, and how ability to highlight factors that influence decisions and drive change (Langley, 1999; Mole, 1982; Front &amp; Van de Ven, 2004).</td>
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<tr>
<td>Exploration</td>
<td>IPra</td>
<td>An exploration strategy is the plan for increasing variety and options, acquiring new or additional information, resources, knowledge, or capability (McGrath, 2000).</td>
<td>- &quot;we are getting our baseline for the project.&quot; - GB people were invited to attend a hackathon to create new business ideas.</td>
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<tr>
<td>Exploration</td>
<td>IPra</td>
<td>An exploration strategy is the plan for gaining consensus, decreasing variability, and limiting options to capitalise on existing potential (Beckham, 2006).</td>
<td>- &quot;After the workshop the Cloud Command Team will be required to re-process the original comment card data against the health charter so that we are asking questions about all aspects of the health charter.&quot;</td>
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<tr>
<td>Exploitation</td>
<td>IPAa</td>
<td>Exploration activities concern single tasks and actions members engage with to increase knowledge, skills, and resources, for example: assessing, testing, producing, troubleshooting, designing, testing, analyzing, experimenting, convening, exploring...</td>
<td>- &quot;we are commissioning a consultancy to help us with that.&quot; - GB &quot;so I have gathered samples from each of the sites involved&quot;</td>
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<tr>
<td>Exploitation</td>
<td>IPAa</td>
<td>Exploration activities concern single tasks and actions members engage with to capitalise on opportunities and exploit existing potential for innovation (Ancona &amp; Caldwell, 1992; Cross, Yet, &amp; Louis, 2000; Cunningham &amp; Harney, 2012).</td>
<td>- &quot;we re-processed the original comment card data against the health charter so that we are asking questions about all aspects of the health charter.&quot; - GB &quot;And then we set up weekly meetings, so we met every week to work on it.&quot; - GB &quot;they took away all the worksheets from the day and analysed the data and gave it back to us.&quot;</td>
<td></td>
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</table>
## 4. Results appendices

### 4.1. Data inventory

<table>
<thead>
<tr>
<th>Case #</th>
<th>Team Content</th>
<th>Team Process</th>
<th>KSA</th>
<th>Member</th>
<th>Team Relationship</th>
<th>Task Behaviours</th>
<th>Innovation Content</th>
<th>Innovation Process</th>
<th>Strategies</th>
<th>Activities</th>
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<th>Definition</th>
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Summary: Total Sources: 18   Average Sources: 2
Total Data: 66   Average Data: 2
# Analysis and results, data that describes the innovation team and project

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<th>Code summary</th>
<th>Category of data summary</th>
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<tr>
<td>Team one, references imported from NVivo and ordered</td>
<td>1st Order - informant centric terms</td>
</tr>
<tr>
<td></td>
<td>2nd Order - researcher centric terms</td>
</tr>
<tr>
<td><strong>ICex</strong></td>
<td>Implementing the system used in the emergency department for the patient(s); “a system to keep track of what works”</td>
</tr>
<tr>
<td></td>
<td>because we had this project kind of going anyway but it was not formal. So that would be a BIG point...</td>
</tr>
<tr>
<td></td>
<td>“one is almost cottage, not cottage, but one is already quite a positive environment and it is easy to implement change sometimes, but the other one is a massive ogre of a machine that is very difficult”</td>
</tr>
<tr>
<td></td>
<td>During the project: “yeah, we got the highest leadership role in the department and they said this is about you [to the ground staff]”, and it was GREAT because that was an immediate, strong, ‘itch on, show of support that this culture needs to change. And THAT one burst, probably went ALONG way to getting things done”</td>
</tr>
<tr>
<td></td>
<td>This project made the orange zone and outcome to improve health of patients projects...</td>
</tr>
<tr>
<td></td>
<td>“I don`t think the creative space and resources to improve health of patients projects...”</td>
</tr>
<tr>
<td></td>
<td>“Our original one was that we were going to try and get double the compliments and half the complaints”, so one of the things we did was increase that capability for regular feedback in both hospitals”...</td>
</tr>
<tr>
<td></td>
<td>“...based on pillars of the national health charter, therefore... we should also be judging compliments and comments against that charter”</td>
</tr>
<tr>
<td></td>
<td>Outcome: “so we came in thinking we would have a lot of ways to do the department but we learned... we see ourselves as helpful agents of change but...it is convincing people to see things in this light is actually a much harder thing, but once that is done it cascades into a genuine class of people doing the same thing”</td>
</tr>
<tr>
<td></td>
<td>All team members have the motivation to do the project, knowledge of the problem and solutions, their biggest challenge appears to be influencing the personnel who they need to implement the system.</td>
</tr>
<tr>
<td></td>
<td>“doctor”, “We are excited about making change”...”on behalf of all three we are all committed to an ideology of good health”; “the idea was easy but the reality is the data collection is not”... “changing thinking and keeping in mind our aim... it is so taxing when you move from project idea to the amount of time and attention required to actually implement it. It becomes a lot less fun”; “but really a lot of it is getting people, so it is convincing people to see things in this light, is actually a much harder thing”...</td>
</tr>
<tr>
<td></td>
<td>“...the yanks will find interesting”</td>
</tr>
<tr>
<td></td>
<td>“PM then approached Nigel because she felt she could talk to him, and he works in ED. PM submitted the project with PK because she works has a tie with Nigel and PK...</td>
</tr>
<tr>
<td></td>
<td>“I was given the creative space and resources to explore research...”</td>
</tr>
<tr>
<td></td>
<td>the biggest conference in the world for emergency medicine, its in America, I want you to make Org go there, no Irish person has ever presented there and try to think of something the yanks will find interesting”</td>
</tr>
<tr>
<td></td>
<td>“yeah, we got the highest leadership role in the department and they said this is about you [to the ground staff]”, and it was GREAT because that was an immediate, strong, ‘itch on, show of support that this culture needs to change. And THAT one burst, probably went ALONG way to getting things done”</td>
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<td>“Our original one was that we were going to try and get double the compliments and half the complaints”, so one of the things we did was increase that capability for regular feedback in both hospitals”...</td>
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<td></td>
<td>All team members have the motivation to do the project, knowledge of the problem and solutions, their biggest challenge appears to be influencing the personnel who they need to implement the system.</td>
</tr>
<tr>
<td>Team Two</td>
<td>2nd Order - researcher centric terms</td>
</tr>
<tr>
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<tr>
<td>IC inn</td>
<td>Pilot: “We need to pilot this current tool to test its suitability.” <strong>H&amp;S</strong>: “Improving the safety culture in our organisation. . . to ensure our service users have an improved experience.” “We ultimately want to enhance the safety culture,” Comm: “. . . It is the engagement of the front line staff and service users themselves around what they want, what is important to them,” “I suppose the project really was to improve communication between front line staff and senior management, to give front-line staff and local managers an opportunity to showcase what they are really proud of!” <strong>Outcome:</strong> “I suppose what we are looking at now, at our last meeting, everyone</td>
</tr>
<tr>
<td>IC con</td>
<td>Sr Management: “The drive is from our CEO who was instrumental in putting this forward as a project with the RCPI.” <strong>As Director [i] felt it was important to put quality on the agenda.”</strong> The HSE developed this document back in 2012/13, they never really implemented it.” There are challenges, there are resource challenges, but I have no doubt that to implement this is going to be challenging going forward but we have commitment from the top which makes it easier for everyone to try and get on with the process”; “There are challenges, there are resource challenges, but I have no doubt that to implement this is going to be challenging going forward but we have commitment from the top which makes it easier for everyone to try and get on with the process”; <strong>Informal comms:</strong> “I think the informal grape vine has done our group a lot of good as well. It is the conversations you have on the corridor or at the water cooler where people say, I heard you were doing these visits and I heard really positive</td>
</tr>
<tr>
<td>Gmem</td>
<td>“Now, 25th CEO identified a project team even though we are the project team we wanted the project to be seen to be driven from the top to deliver a clear message”; “We developed a steering committee to support the three of us in the project, and CEO sits on the steering committee” <strong>Person A</strong> created a proposal for the RCPI and included <strong>[Person two]</strong> because <strong>[Person three]</strong> felt the needed someone from a training background. <strong>[Person] asked CEO who else would be suitable. [Person]</strong> was joining the organisation at the time and CEO felt [they] would be suitable.</td>
</tr>
<tr>
<td>GCKSA</td>
<td>Experience: <strong>[Person one]</strong> “has 20yrs H&amp;S experience.” <strong>Status:</strong> <strong>[Person three]</strong> is a company Director who is new to the organisation”; “the fact that Person Three is the senior director and new. . . is a big advantage as well because [he] didn’t come with any preconceived ideas, [he] was coming fresh to it.” Also, Company CEO is a member because they believe in this project, “I want it to be part of our strategic plan in the organisation and I am interested to see if this is a suitable tool for the entire organisation’. <strong>Additional resources:</strong> Steering Committee - “we identified who we felt the key players are, who could support us, again, these are the people from places we feel need to come together to correct the disjointed situation we have. There are 13 on the steering/project team”, . . . have experience and impact”; <strong>Commitment:</strong> “I think we are committed to it, I think we have spent a lot of time together, so we have invested in it together, we would say a lot into it to try and keep momentum”; [we] “are very much committed to continuous quality improvement, very on for participation and engagement, acknowledging good practice, learning from mistakes, I think we are all singing from the same hymn sheet” <strong>[common goal]</strong></td>
</tr>
<tr>
<td>Team Three</td>
<td>2nd Od</td>
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<tr>
<td><strong>Gcksa</strong></td>
<td>Professional training: Head Pharmacist, Nurse &amp; Clinical Audit Facilitator; Consultant in Emergency Medicine; “the fact that [Person] is a consultant and he is a prescriber then he obviously is well used to what should be done and he is a senior consultant and he would know how doctors think and work. [another Person] is a pharmacist and so knows about fluids, and [a third Person] is a nurse by background so I could see from an administration side how I would perceive that and also from a quality side the data piece, I like that.” Working relationship: “we would have worked together previously ... we had a good working relationship”; “we don’t feel as if someone is not pulling their weight because we are all doing our own bit”; “and we have a lot of energy when we do meet as a group”; “In the beginning then I guess there were times when we were a bit more enthusiastic and more energy”; “we get on really well, even we found when we wrote the project we were saying our style of writing was quite similar so it would be easy to edit. We knew we were the kinda people who would get along and I think that is way we formed a group. We were very lucky”; “yeah, and high standards”; “and I think none of us were overpowering, none of us were in charge really”; PaySafety: “when the 3 of us used to sit together, we never felt any comment was silly. We would all be brainstorming and saying ‘yeah’ mightn’t necessarily agree with what someone said but we could talk around it and say actually maybe it is that. But if you felt you had to have the answer you might not brainstorm as much.” Motivation: “It is making sure we meet standards within the hospital!” “medication is very important” “prescription administration and improving safety. The project is driven by a formal change program that dictates time, a methodology, momentum, and techniques for influencing change. The biggest challenge for the team was influencing front-line personnel with whom the team rewarded with cupcakes when positive change was noted.”</td>
</tr>
<tr>
<td></td>
<td>A core team of three members with relevant medical training describing the project for improving prescription administration and improving safety. The team describe their working relationship as good based on shared workload and standards, good energy, similar writing style, good psychological safety as well as being highly motivated and having role status within the organisation to influence others.</td>
</tr>
<tr>
<td></td>
<td>A team of three</td>
</tr>
<tr>
<td><strong>Goment</strong></td>
<td>Diploma: “So we have actually had to ... rather than go for a re-print ... that takes time and we don’t have time because we are within the confines of a diploma”; “I think if we just decided to do this project without doing it as part of the diploma I think ... we would have jumped into it much quicker. So I think it was good as it allowed us to focus we did the engagement and we probably would not have done as much engagement but because the process was there for us to follow it really made us think”; following the methodology we engaged the staff and that is really one of the reasons we did see improvements as well as changing the chart”. “having those diploma meetings every month really focused us, prevented us from falling there [valley of death]”; Alongside day job: “and that is one of the challenges really was working with the day job, and of us are involved in other change projects as well so maintaining that momentum is not always easy”; Staff engagement: “I think we did have a good idea of what the solutions were, but what we probably did differently using the methodology is that dictates time, a methodology, momentum, and techniques for influencing change. Otherwise the team motivated staff with rewards for changes made and found staff engagement was beneficial for change.”</td>
</tr>
<tr>
<td></td>
<td>The project is driven by a formal change program that dictates time, a methodology, momentum, and techniques for influencing change.</td>
</tr>
<tr>
<td><strong>ICorn</strong></td>
<td>Hypert and not because we would lack as something of medication around prescribing”; “we are looking at IV fluid prescribing in the context of medication safety for prescribing, and we decided to narrow our focus down to one type of medication”; “We know that medications are not prescribed very well within the hospital... and we feel that it is an area of high risk in the hospital”; “we know from audits in hospitals that we have an issue”; “the whole thing is building a system so that we don’t need to be there... the only thing that was going to make the ‘thing’ work was changing the chart” “initially we have made</td>
</tr>
<tr>
<td></td>
<td>Changes to a chart for improving prescription administration and improving safety.</td>
</tr>
</tbody>
</table>
**Team Four**

<table>
<thead>
<tr>
<th>2nd Order - researcher centric terms</th>
<th>Researcher centric aggregated interpretation one</th>
<th>Researcher centric aggregated interpretation two</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional roles: Histopathologist &amp; Chair of the Faculty of Pathology; National Histopathology Programme; Clinical Specialist Physiotherapist (quality improvement); Quality and Accreditation Manager</td>
<td>-</td>
<td>Three professionally and mutually trained members, with diverse yet complementary skills and opportunities to meet and influence key personnel that will help the project, and who are motivated to learn how to make improvement in quality in their organisation.</td>
</tr>
</tbody>
</table>

**Glda**

2nd Order - centric terms

Motivation: “I have an interest in the lab and quality, I signed up for the diploma without recognising there was a problem to be fixed”; I would know the tools around quality improvement but... it’s the hearts and minds stuff that I am interested in; “I did the diploma... for the data and presentation”; “I am a physio so you need see that world... so to see that other world is definitely... even the volume of reports... you cannot get over, it is enormous. And the challenge...”

Team: “working as a group we all bring different things to a project, so that is good because you have different ways of working and different ways of processing and that moves me down a bit, you are kinda like come-on, let’s get it going, and that slows me down a bit, to think about the data collection, and that important kinda piece and for me that has been good”; “I didn’t work with Person before, but as you get to know somebody their contribution becomes more apparent... you don’t know the potential if people until you get to know them, is what I mean”.

Personal knowledge/skills: “The hearts and minds are probably what I do a lot of in the roles I have come from and the influencing power of getting people to work along with you. Both team members are good at the data whereas I need to focus myself. I get a lot of opportunities with the clinical directors, non-threatening but to bring them around to ideas”; “We just had a meeting with the Clinical Director so I just take the opportunity to start the conversation without bringing them into a meeting without...”

**Qcem**

Recruitment: “The Director of quality and patient safety introduced the team members in June 2016; “There needs to be a consultant on the team” (a team member approached a consultant). “[Consultant Person] is not part of the team, but he would come in at our meetings and sponsor some of the...”

Membership: “the two guys have already left”, “it was hard because the two guys left just as we were getting the data back”; “obviously there would have been more opportunities there to react to what we were understanding the system... and really thought at some stage that we had a handle on them and I still don’t have a handle on them”; “...and I don’t either because the last month I have been down there, I don’t know if you noticed, but the four documents we picked, I couldn’t find out how many reports per month there were meant to be getting. They are coming down in waves, they are being held up somewhere in the system and often times you are looking at a report that was endorsed it is 2x2s before it comes down to medical records”; “I feel we have been doing a lot of the same things over and over again”.

Diploma: “I signed up for the diploma without recognising there was a problem to be fixed”; “[it] just taking off now I guess, our first POSA meeting next week” (end Feb 2016); “and we are kinda now under a bit of pressure to get this thing done by May”.

Endorsements: “He is a Clinical Director but... has the respect around the organisation... so it is probably just the ‘It back you off you go’.”; “we want to be 100% certain we are not threading on anyone’s toes... I don’t want to get blinded by some memo by CB that he had clinicians come up to him down the corridor so it is more for information we knew he would support us”, “if were sitting in the quality and patient safety executive with all the big hitters we probably could have made a bigger change back in the day whereas this we feel will go towards that which is coming up in the future”; “I had to get buy-in from the scientists and colleagues and everybody in the lab”. Project changes direction: “we did the process mapping with one department then we realised it was too much, we couldn’t get buy-in, that engagement thing was just beyond us”; “but nobody had ‘skin in the game’ really (referring to the first idea for a project) everybody was agreeing there was a problem and that we could do all this but... I don’t think anybody would have been the driver”; “the three of us didn’t work in the ED - I wanted to do something outside the lab and so I am delighted with this, it is very useful for me, but we should respect that it would be really difficult to fix something in the ED when none of us worked there”.

**Icsm**

Recruitment: “I signed up for the project, but two members left the organisation before the project was complete”.

Understanding the system: “...firstly thought of at some stage that we had a handle on them and I still don’t have a handle on them”; “...and I don’t either because the last month I have been down there, I don’t know if you noticed, but the four documents we picked, I couldn’t find out how many reports per month there were meant to be getting. They are coming down in waves, they are being held up somewhere in the system and often times you are looking at a report that was endorsed it is 2x2s before it comes down to medical records”; “I feel we have been doing a lot of the same things over and over again”.

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**Kcm**

Recruitment: “I signed up for the project, but two members left the organisation before the project was complete”.

Understanding the system: “...firstly thought of at some stage that we had a handle on them and I still don’t have a handle on them”; “...and I don’t either because the last month I have been down there, I don’t know if you noticed, but the four documents we picked, I couldn’t find out how many reports per month there were meant to be getting. They are coming down in waves, they are being held up somewhere in the system and often times you are looking at a report that was endorsed it is 2x2s before it comes down to medical records”; “I feel we have been doing a lot of the same things over and over again”.

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**Csm**

What: “So it was to improve the endorsements or the signing off of histopathology reports by the clinicians. It was actually at zero percent when we looked at it in terms of our definition of a complete endorsement meaning a legible signature, medical council number, and a date, it should be 100% really and so that was our aim 100% by the 1st June”; “we can shoulder those four first areas (current plott) to 100% then we can go to the bigger pie of everybody...”

Why: “...we have an accreditation system here... we have processes in place to be able to ensure the right patient is identified and that a critical test result will be followed up on, so they would be the two main drivers of this”; “Effective communication as well”; “It comes from our accreditation system. There are 6patient safety goals and the second goal is about communication... it focuses on critical test results, handover, and so much more right or wrong. It doesn’t happen in a structured way or a consistent
Three strangers worked on an idea to build an IT platform for incident and crisis control. Their award winning idea was generated at a hackathon event sponsored by an MNC who will also sponsor workshops for the team to develop their idea. Team trust and commitment were their biggest challenge.

The knowledge and skills of the members of this team were not described. However, in the interview at time three, the two members who attended the interview said that the third member lacked trust in their ability to progress and that this third person saw themselves as the leader of the group. This third person was described as ‘moody’.

Three members of the team had left, but the two team members who attended the interview felt that the third member did not trust their ability to work on the project and that this person would spend more time and effort with those outside the team. “And, you’re not going to be able to do it if he was kind of like that! It was very kinds aggressive, like I am not going to do it, you won’t be able to do it. We are like, we have to do it, and we are going to do it.”

Communication: About one team member joining group meetings “[he] was by Skype sometimes, and sometimes he would travel”;

Relationships: “Depending on his (team member) mood, if he was in a good mood we all got along well, we got a lot done and then sometimes... if he wasn’t feeling it, that was it, no one would get any work done. So it was quite hard.” “He was great, it is just his personality, he is more, what do you call it, alpha male or whatever - he definitely saw himself as the leader of the group.” “Well we had to get to know each other, sigh. Because we actually didn’t know each other previously... and it was probably one of the most difficult things actually.” “[Person X] worked quite well together throughout the entire process and if we were still working on it with [other]. I would have no idea how we could progress.” “So sometimes he would come in and it would be just problems, problems, no solutions at all, and like we are not really, it is a terrible, so that was happening more towards the end and the more the pressure...

Communication:

Winners of the recent Big Energy Hack. The team have been invited to a day-long workshop to develop their idea and it was actually selected by the adjudication panel as being the best idea won.

Sponsors

The project was initiated and sponsored by an MNC who organised and managed workshops for the team in support of them developing their idea.

Platform that would allow incident and crisis control for industrial and manufacturing facilities...with emergency services”
2nd Order - researcher centric terms

Gtech

Experience: …if we go back to the start and we look at the team that was put together, you have the [2] members who have worked with both [2] members very closely in the past, and I think a lot of that experience has been drawn on here because a lot of the main protagonists know each other already from previous experiences; "And you need the wider team, which is why you have the organisation chart which shows the wider team set that up"; "and they all know how to work together and to get large projects done on this job"; "one of the things that was identified is we need a team that will hit the ground running, we need a team that knows the [space], that know each other"; "having two dedicated PMs is unusual here;".

Communication: You have got the core and we communicate within ourselves and each person delegates further out for e.g., [Person] tends to look at the consultancy and engineering side; [Person] is very much on the project delivery programme. [Person] work with architects, … I take the client side, … You must rely on the nucleus. But it is the nucleus that must come together once a week co-ordinate, communicate, and make sure who is doing what, what are the priorities? You have to rely on the nucleus and that has always been there, and I would say the success of the project and the drive of the project comes from the nucleus but productively is different (that is all the people out on site, doing the work, doing the drawings); "I came in…, with about 31 people along a table but there was no delineation who client, designer, and who was… everybody seemed to be on the same team, that was very difficult for us to group, there was no walls between different people, everyone somehow he has a shared goal"; "We had bring everyone external with the end goal back into the way we wanted them - we have very decisive characters on the outside that had to be ‘moulded’ and we managed to get out of them what we needed".

Relationships: "…and they all know how to work together…", "one of the things that was identified is we need a team that know each other"; you can’t say that one person made all the decisions, everyone’s input was important and for having everybody at those meetings; "the relationship amongst the team, you can’t underestimate how important that was, how the relationship building as well was critical…", "as the group of us, here, the core of us, the relationships between all of us we have one common goal, there is no in-fighting - everyone kinda gonna along with each other, we are all just knuckled down and got it done".

Collaboration: there was a collaborative approach too if you make a change what is the impact?…, "it was not just the guys learning from me, I was learning from them as well. It was about collaboration, about understanding each other’s role, and listening as well… so having these weekly meetings was critical", "it has been a good learning experience but I think the difference between this project and any other is normally we manage ahead of ourselves… whereas in this project I think it is fair to say we as a team have fire fought… I think we have had a challenge every day… everyone has had challenges and this team has overcome each one".

Core team: of 3 members, with dotted lines to representatives of tender companies, business units, and consultants. The team contracts and responds as the project demands. Team members were chosen based on availability, skill, or past relationships.

Gummet

Core team: of 3 members on the main project who are not here (come and go); "And you need the wider team, which is why you have the organisation chart which shows the wider team, we set that up"; "I came into the project from outside the team, we came in later", "…so if we go back to the start and we look at the team that was put together, you have the [2] unit and [2] unit who have worked with both A company and B company very closely in the past; sometimes it is resource availability, sometimes it is your role and that is your job, Person is our planning company very closely in the past, and I think a lot of that experience has been drawn on here because a lot of the main protagonists know each other already from previous experiences; "And you need the wider team, which is why you have the organisation chart which shows the wider team set that up"; "and they all know how to work together and to get large projects done on this job"; "one of the things that was identified is we need a team that will hit the ground running, we need a team that knows the [space], that know each other"; "having two dedicated PMs is unusual here;".

Core team: of 3 members with dotted lines to representatives of tender companies, business units, and consultants. The team contracts and responds as the project demands. Team members were chosen based on availability, skill, or past relationships.

ICeem

It has been a very complex project, it has given us a lot as well; "I suppose the problem started before that - we were short on bus lounges to bus passengers to the aircraft"; [The client] proposed an idea where they wanted a satellite building where they could have passengers sitting waiting for the flight and then they could walk directly on to the plane; "We kept it a landslide site to make it easier for workers to come in and complete the project…", "it was the delivery time-line that dictated pretty much everything from the design even the location to a certain extent, and even the detail design it only finished a couple of months ago it was being designed as it was built;", "And that is what is different about this project and that is where the innovation comes in because everybody around this table would have said that is unachievable, that’s physically impossible… it is only with the help of the team we have managed to deliver a process and a procedure where we thought we may actually achieve this;", "we have had a couple of delays from 3rd parties which were unavoidable so we are actually not going to deliver for the summer as planned but we are not too far off;", "the constraints on the site are.

A complex building construction project with time restrictions, limited space, and multiple stakeholder requirements.

ICom

A modular build, a fast-tracked project in order to avoid closure during to provide additional resilience and service for non-stop stands for their European flights.

Building construction
Team Seven

Corporate award: "we won the overall prize (Organisation Innovation Award) last October/November 2016"

Recruitment: "... we had an external company to help us with that"

Success: "... we have a good body of contacts..."

Network: "... we had a representative from nearly all the different areas of the business..."

 Analytics: "... we had a number of options to talk to people..."

Tools: "... we had a number of options to talk to people..."

Data Analytics as a service: "... this is the minimum number of people we would need..."

Corporate sales: "... we have a representative from nearly all the different areas..."

Marketing: "... we have a representative from nearly all the different areas..."

Recruit expertise: "... we have a representative from nearly all the different areas..."

Customer: "... we have a representative from nearly all the different areas..."

Project: "... this is the minimum number of people we would need to make something of it..."

Marketing: "... we have a representative from nearly all the different areas..."

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Team Eight

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<th>Researcher centric aggregated interpretation one</th>
<th>Researcher centric aggregated interpretation two</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Roles:</strong> “I was brought in as the Project Development Manager to establish the Project Development Office and meet the requirements as set out by the Dept. of Health”</td>
<td>“This team sourced and engaged with a core team of four members with extended line to numerous personnel, including senior stakeholders, within the industry for relevant knowledge, skills, and attributes as required for implementing a new process for managing waiting lists in hospitals as commissioned by the Department of Health. The team believes their experience, reputation, network, ability to build relationships and communicate effectively, collaboration across stakeholders was instrumental to the project.”</td>
<td>“A core team of four members with extended line to numerous personnel, including senior stakeholders, within the industry for relevant knowledge, skills, and attributes as required for implementing a new process for managing waiting lists in hospitals as commissioned by the Department of Health. The team believes their experience, reputation, network, ability to build relationships and communicate effectively, collaboration across stakeholders was instrumental to the project.”</td>
</tr>
<tr>
<td>“There were two things: one was the steering group (very high-level people who would necessarily be doing the day to day processes: a high-level decision body) which had the national representatives... we also decided last August that we would run a workshop and that we would invite 48 people from around the country to come together and share their knowledge, experience within waiting list management”</td>
<td>“A small team (I met 4 people) who extends the team when necessary to acquire knowledge, skills, and attributes.”</td>
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<tr>
<td>“we also pulled in influencers in that we needed more senior representatives”;</td>
<td>“This project was commissioned by a national body to solve a national problem. The project was managed according to predetermined terms of reference and a charter. All relevant senior level stakeholders from across the country were involved in the project. There was a delay further into the project due to a change in the senior management of the team.”</td>
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<td><strong>Outsourcing skills:</strong> “We actually got a Blackbelt in healthcare to facilitate the day”; “Yes, they took away all the worksheets from the day and analysed the data and gave it back to us”, “we are a very small team, and something like this needed dedicated resources which we don’t have at the moment... there is an identified consultancy with a proven record in this area...”</td>
<td>“In addition, the team believe a key contributing factor to reaching targets was their managing the project in accordance with a predetermined ‘terms of reference’ and ‘project charter’. A delay in one aspect of the project was due to a change in senior management within the organisation.”</td>
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<td><strong>Experience:</strong> “...my experience would be quite confined to a couple of hospitals and some of the networks [in Dublin]”. There is one very important thing that myself and [Person] have that some of our colleagues don’t have and that is we have been there we have done it and we have the 15th, we both worked in operations in hospitals. We have been around tables where clients have said why don’t they just do it”</td>
<td>“Networking: “So the communication, networking, relationship development would be very important”; [Person] &amp; [Person] have so many links and connections, they</td>
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<td><strong>Reputation:</strong> “...I also think reputation is a big part of this. I do think that people want to be associated with a project that is going to be successful... then people are going to buy into it, but they are buying into the reputation”. “My reputation would have been well known in the HSE and I would have been involved in national projects over the years at a steering group level and then when I went to the Mater I had a massive platform...”</td>
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<tr>
<td><strong>Building trust:</strong> “I find sometimes with the HSE hospitals there is an element of trust before they would start to speak – does that make sense?”. “...there is nothing like face-to-face, particularly in relation to... gaining that trust. Being able to have that difficult conversation, for someone being able to tell you about a practice or process that is going on in their hospital that they are aware of, or don’t know what to do about it”.</td>
<td>“A core team of four members with extended line to numerous personnel, including senior stakeholders, within the industry for relevant knowledge, skills, and attributes as required for implementing a new process for managing waiting lists in hospitals as commissioned by the Department of Health. The team believes their experience, reputation, network, ability to build relationships and communicate effectively, collaboration across stakeholders was instrumental to the project.”</td>
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<td><strong>Recruitment:</strong> “...we are an independent statutory entity”; “I was brought in as the Project Development Manager to establish the Project Development Office”; “The office was established in March 2016”; “I don’t have a project management team, I work on my own”;</td>
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<tr>
<td><strong>Other members:</strong> “There were two things: one was the steering group which had the national representatives... [and] a workshop that we would invite 48 people from around the country to come together and share their knowledge, experience”, “we are a very small team, and something like this need dedicated resources which we don’t have at the moment... there is an identified consultancy with a proven record in this area...”</td>
<td>“This team sourced and engaged with a core team of four members with extended line to numerous personnel, including senior stakeholders, within the industry for relevant knowledge, skills, and attributes as required for implementing a new process for managing waiting lists in hospitals as commissioned by the Department of Health. The team believes their experience, reputation, network, ability to build relationships and communicate effectively, collaboration across stakeholders was instrumental to the project.”</td>
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<td><strong>Commissioned project:</strong> “...we are an independent statutory entity...[to] meet the requirements as set out by the Dept. of Health. Those requirements were set out prior to me arriving, negotiated, and discussed and the need identified for the delivery of a national protocol for in-patient day-case planned procedure waiting list management: “I actually have the Terms of Reference...”</td>
<td>“This project was commissioned by a national body to solve a national problem. The project was managed according to predetermined terms of reference and a charter. All relevant senior level stakeholders from across the country were involved in the project. There was a delay further into the project due to a change in the senior management of the team.”</td>
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<td><strong>Management:</strong> “I actually have the Terms of Reference... to outline the objective of the group”; “a project charter agreed before that even started which was very important to people weren’t trying to change the scope of the project as it was moving. There would be named responsibilities, project advisor, project sponsor, advisor, so you really had to free up your time for this project and make decisions or it would delay the project”; “I think the overall project structure has been one of the keys to successful communication.”</td>
<td>“This project was commissioned by a national body to solve a national problem. The project was managed according to predetermined terms of reference and a charter. All relevant senior level stakeholders from across the country were involved in the project. There was a delay further into the project due to a change in the senior management of the team.”</td>
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<td><strong>Influence:</strong> “The big support is the fact that we have developed, delivered, and launched a protocol that is fit for purpose, that is recognised nationally and really the protocol is informing everything else”; “The launch was huge (phased), it put it on the roadmap (senior). That was a huge to have the Minister there, to have 50 clinicians to support the PC at national level. So basically, for the first time for the accountable department of Health. The team believes their experience, reputation, network, ability to build relationships and communicate effectively, collaboration across stakeholders was instrumental to the project.”</td>
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<tr>
<td><strong>Stakeholders:</strong> “It is very much a collaborative project approach bringing all</td>
<td>“This team sourced and engaged with a core team of four members with extended line to numerous personnel, including senior stakeholders, within the industry for relevant knowledge, skills, and attributes as required for implementing a new process for managing waiting lists in hospitals as commissioned by the Department of Health. The team believes their experience, reputation, network, ability to build relationships and communicate effectively, collaboration across stakeholders was instrumental to the project.”</td>
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<tr>
<td><strong>National In-Patient Day Case and Planned Procedure Waiting List Management Project</strong>: “...the need identified for the delivery of a national protocol for in-patient day-case planned procedure waiting list management Phase 1, as well as a supporting tool-kit Phase 2, as well as a training and development programme Phase 3. So the delivery of these 3 requirements was signed to the PMO and this then instigated the project – the project title is ‘2017 National In-Patient Day Case and Planned Procedure Waiting List Management Project’. Within that project there are 3 components, they each impact on each other”; “The project for us was about introducing large-scale change within the hospitals particularly within the area of scheduled care. Some of the changes were new, new processes, but some of the</td>
<td>Implement a new process for managing waiting lists in hospitals.</td>
<td>Implement a new process for managing waiting lists in hospitals.</td>
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### Problem solvers:

As engineers we are problem solvers, making issues go away rather than bringing innovation to the project, we are there to steer the project through the process rather than come up with a new strategy or new innovation; "we had a lot of research/thinking, finding ways, risk analysis, assessment, weighing up the pros and cons before deciding the way we are going," “you listen to them and map them out, just present the different issues and prioritise through a matrix or table form and it is the pros and cons against the issues and hopefully you will get it narrowed down to an extent that ultimately everybody will buy in to a final layout"; "so it was getting them all together into one set and then putting them into smaller groups of issues that you can then resolve and then those meetings would be very targeted for a specific issue that requires inputs from three or four stakeholders." Then we present both sides and regardless of the disagreement or conflict it is not like meetings end up in a big chaos but keep it at a level where we can agree or disagree and allow someone else to decide.

**Goal focused**:  
"you have to have your eye on the ultimate deliverable, ultimately you have to be able to see to that end goal, that end target and that is to say your focus right the way through regardless of what obstacles come your way or how innovative or creative you get in getting over those obstacles, that is what I see as the day to day job of an engineer just getting over those obstacles whatever guise they come in." "in that process you can call it innovation, you can call it creativity, I don't know, I mean we have to find solutions some how to navigate through it.

**Managing stakeholders**: "There is so much a challenge in delivering what the brief says as there is a melding between the likes of what the brief is actually saying and what the client actually wants"; it is holding workshops, early doors, getting as many people around the table, having open discussions and capturing input and you see it from, everyone has a different agenda because they are all managing departments and that brings its own complication." "Try to avoid is someone completely losing out, you need to develop options at different levels of compromise for different parties and find which one is most palatable for everybody again through everybody getting what they need and then what wants can be provided on top of that and it is finding that solution" "often (person) says, "I can't give you that," it may not be what number one but maybe they can accept the alternative." "you have to make them feel important, if you dismiss someone from the off they are going to be difficult, if you hear their problem and you put it on the table, it will elevate and escalate and maybe try to understand their ultimate goal and if you reciprocate that concern you are going to get quicker buy-in.

**Expert skills**: "having a feasibility study done by external consultants (helped the project)" so three team members are engineers and [person] is a planner, so we have different;  
Communication skills: “I think our communication would probably tick that box as well, we have a huge amount of people we have to present to on almost all kinds of matters of technical topics - so we have to tailor the way we write, the way we present the solution we have come up with to make it understandable to everybody.

### Team Nine

<table>
<thead>
<tr>
<th>2nd Order - researcher centric terms</th>
<th>1st Order - informant centric terms</th>
<th>Researcher centric aggregated interpretation</th>
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### 4.3. Things team members said were helpful/challenging to the process

Lack of focus on four members with an individual focus of contractors and stakeholders working together for the process; This is the first time we have worked as an extended team of contractors and stakeholders working together for the process; This group has not worked together before but because they have good working relationships, we are dealing as one construction group (comprised of our own which affects multiple stakeholders both on the site and around the area), into the surrounding community and environment as well as national and international organisations; things they have to deal with is the complexity of the problem as it effects the ultimate goal; they recognise the value in managing all stakeholders expectations and being able to clearly communicate effectively with all involved; the team has a range of expert skills, but they recognise the value in building a good reputation through their collaborative working nature.
<table>
<thead>
<tr>
<th>Team #</th>
<th>Genem</th>
<th>ICcon</th>
<th>ICinn</th>
<th>GC - Challenge</th>
<th>GC - Helpful</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>Executive Management approval</td>
<td>Change program project: Improving customer service</td>
<td>Influencing ground personnel</td>
<td>Formal change programme</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>Executive management approval &amp; steering committee</td>
<td>Change program project: Piloting a H&amp;S procedure</td>
<td>Finding time for the project in the day job</td>
<td>Formal change programme</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Sr.Consultant</td>
<td>Change program project: Improve prescription safety</td>
<td>Engaging ground personnel in the changes</td>
<td>Team relationships, shared values, the timeline and teachings from the program</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>Sr.Consultant</td>
<td>Change Program Project: Safety procedure</td>
<td>Two of three team members changing employment and changes in project focus</td>
<td>Narrowing and localising their focus</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>Executive Management</td>
<td>Innovative hub idea: IT Platform</td>
<td>team trust and commitment</td>
<td>Sponsored workshops</td>
</tr>
<tr>
<td>6</td>
<td>13</td>
<td>Sr Management</td>
<td>Client project: construction</td>
<td>Tight deadlines, limited working space, and managing multiple stakeholders’ requirements.</td>
<td>Experience, professional skill, positive working relationships, collaboration, common goal, respect, and trust.</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>Executive Mang Team</td>
<td>Innovation hub idea: Data analytics service</td>
<td>Generating external sales</td>
<td>Reputation and personal network</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
<td>HSE</td>
<td>Client project - a national protocol for waiting lists</td>
<td>Non mentioned</td>
<td>Experience, reputation, network, ability to build relationships, effective communication, preparation and collaboration.</td>
</tr>
<tr>
<td>9</td>
<td>4</td>
<td>Executive mang team</td>
<td>Client project: construction</td>
<td>Managing multiple stakeholders requirements</td>
<td>Team’s ability to manage all stakeholders through effective communication, specifically listening skills, and building a reputation as effective managers</td>
</tr>
<tr>
<td>Aggregate 5</td>
<td></td>
<td>All projects have the support of a senior manager or executive representative</td>
<td>Four projects are driven by a college change program; three are client projects; two are from an innovative hub</td>
<td>Key challenges include: influencing ground personnel; time constraints; changes in employment and project focus; team trust and commitment; managing stakeholders; and generating external sales leads</td>
<td>Helpful include: skills learned during the project; team relationships, shared values, narrowing the focus, experience, relationships, collaboration, respect, trust, reputation, personal network, communication, listening skills, and preparation.</td>
</tr>
</tbody>
</table>
4.4. Analysis and results, the innovation process

<table>
<thead>
<tr>
<th>Team one, references imported from NVivo and ordered</th>
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</thead>
<tbody>
<tr>
<td>2nd Order - researcher-centric terms</td>
</tr>
<tr>
<td><strong>Researcher-centric data reduction one</strong></td>
</tr>
<tr>
<td><strong>Key strategies for increasing variation, options, new or additional information, resources, knowledge, or capability include:</strong></td>
</tr>
</tbody>
</table>
| **Acquiring baseline data:** "...we are not very good, we are getting our baseline for the project. "we did some initial data collection for 'broader'..." we had a patient satisfaction survey in the hospital but not in the Emergency Department (ED), so we hadn't got a tool that would suit the ED in both hospitals and define a time-period for the data, so our project has been about getting a common card to the staff and to the patient, getting it used by staff and patients, so we can establish a baseline and start monitoring changes."
"We were still seeing the feedback that was coming in through other channels anyway but it was to get this set up so there were comments cards in both departments." "Baseline data Oct-Nov = end Jan2017" | **Increasing awareness with frontline personnel:** And then the second thing was actually getting the comment card out," getting a common card to the staff and to the patient getting it used by staff and patients," so we presented the data at different forums, we engaged people (a meeting) without the other we created our own (meeting) and invited key influencers as well as ground-level staff. Attention was given," dealing with the reception staff to...to encourage uptake, and for the card to be given out at registration by the admin staff." "We didn't literally in their environment, not in a meeting room" | **Increasing awareness with frontline personnel:** "...so one of the things we were doing to get to the next phase or whatever it was..." "We had the informal ones, whereas [other team members] did make them more formal, it was in a meeting in May...we had similar to what we did in Apr27, we had the informal ones..." | **Increasing awareness with frontline personnel:** "...so one of the things we were doing to get to the next phase or whatever it was..." "We had the informal ones, whereas [other team members] did make them more formal, it was in a meeting in May...we had similar to what we did in Apr27, we had the informal ones..." |
| **Resource idea implementation:** "...so one of the things we were doing to get to the next phase or whatever it was..." "We had the informal ones, whereas [other team members] did make them more formal, it did give us a list of what we had to do for ourselves at those meetings in relation to facilitating what they (the staff) need." | **Key strategies for gaining consensus, decreasing variability, limiting options to capitalise on existing potential include:** | **Key strategies for gaining consensus, decreasing variability, limiting options to capitalise on existing potential include:** | **Focused on baseline data to identify gaps in the service - this umbrella progressed with a strategy of gathering data across the two hospitals over a period of three months and ended with the team calculating and analysing what little data they could find. Within this phase of the process the team found:** |
| **Comment card design:** like the team told me about which was the card design. "the team told me about which was the card design. "the team told me about which was the card design."
"We wanted to use everything in a way that the team could go into and allow all the stakeholders to contribute and give their input."
| **Like strategies, the key activity described by the team consists of an element of exploitation in line with meeting the National Health Charter. So, the team decided to develop and distribute a new comment card for continuous data collection (see activities) and in line with meeting the overall project objectives. As soon as the baseline data collection period ended, a new period of data collection began so the team could monitor any changes in the quality of service in response to any intervention.** | **Comment card design:** "So the first thing we had to do was write a meeting and agree on the language that should be used in the comment card," "we need to incorporate a lot of that (grandmaster) of options recommendations into the comment card." **Team meetings:** so we had the informal ones, whereas [other team member(s)] did make them more formal, it did allow us a lot of what we had to do for ourselves at those meetings in relation to facilitating what they (the staff) need." | **Comment card design:** "So the first thing we had to do was write a meeting and agree on the language that should be used in the comment card," "we need to incorporate a lot of that (grandmaster) of options recommendations into the comment card." **Team meetings:** so we had the informal ones, whereas [other team member(s)] did make them more formal, it did allow us a lot of what we had to do for ourselves at those meetings in relation to facilitating what they (the staff) need." | **Comment card design:** "So the first thing we had to do was write a meeting and agree on the language that should be used in the comment card," "we need to incorporate a lot of that (grandmaster) of options recommendations into the comment card." **Team meetings:** so we had the informal ones, whereas [other team member(s)] did make them more formal, it did allow us a lot of what we had to do for ourselves at those meetings in relation to facilitating what they (the staff) need." |
### Researcher centric aggregated interpretation one

- **IRPS**
  - **Planning:** The project started with the commencement of the course.
  - **Developing:** We developed a steering committee to support the three of us in the project, and CEO sits on the steering committee.

- **IPoS**
  - **Planning:** We now need to meet the 4 services and brief them on what and why of our plan.

- **IPRA**
  - **Planning:** We met with the service managers over the areas of the pilot sites. We met with them individually and collectively, and we took them through what the purpose of the walk-abouts were about, some awareness of what the project was going to be.

### Researcher centric aggregated interpretation two

- **IPoS**
  - **Planning:** We now need to meet the 4 services and brief them on what and why of our plan.

- **IPRA**
  - **Planning:** We met with the service managers over the areas of the pilot sites. We met with them individually and collectively, and we took them through what the purpose of the walk-abouts were about, some awareness of what the project was going to be.

- **IPOA**
  - **Planning:** We met with the service managers over the areas of the pilot sites. We met with them individually and collectively, and we took them through what the purpose of the walk-abouts were about, some awareness of what the project was going to be.
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<thead>
<tr>
<th>Team Three</th>
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<tr>
<td><strong>2nd Od</strong></td>
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<td><strong>IPRS</strong></td>
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<td><strong>IPOS</strong></td>
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<td><strong>IPNA</strong></td>
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<tr>
<td><strong>POA</strong></td>
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Two key exploration and exploitation activities across stages: engagement meetings and chart revisions. Plus there are weekly team meetings but they have no further data on these.
### Team Four

<table>
<thead>
<tr>
<th>2nd Order - researcher centric terms</th>
<th>1st Order - informant centric terms</th>
<th>Researcher centric aggregated interpretation one</th>
<th>Researcher centric aggregated interpretation two</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Defining the problem/solution:</strong> &quot;I have the sense that we didn’t have a plan, yes?&quot;; &quot;we were doing the project and then it changed&quot;; &quot;yeah so that was the Sept to Dec, that was what we did and then Jan started again, back to process mapping&quot;; &quot;over Christmas I was thinking ...ok let’s just focus on my lab reports&quot;; &quot;this is where it can be kinda confusing with this iteration where we started being in different areas, with multiple components, so we have been collecting data, doing process maps, ...so, I feel we have been doing a lot of the same things over and over again&quot;; &quot;it suppose agreement on some of the problems, coming back to the primary drivers, I think as a group we talked a lot and didn’t really come up with nailing colours to the mask on one thing and trying that and failing, and trying the next thing and failing&quot;.</td>
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<tr>
<td><strong>Communicating the project:</strong> &quot;It is not the big bang approach ...things come up ...you build to this meeting&quot;; &quot;I have been in other meetings where this can be discussed in another forum, our patient safety meeting I brought this up. (Person) had presented a clinic audit in relation to some of this from last year so again using that opportunity to start that conversation, so just trying to find those opportunities, not to find them but they present, to recognise them and use them when they present</td>
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<tr>
<td><strong>Defining the problem/solution:</strong> &quot;yeah, when we realised that none of us worked in A&amp;E ...we really couldn’t do the things we wanted to do, and it was very, very complex, it was too much for the scope in the year we had so that’s early January&quot;; &quot;well, starting end of January we have data and rung charts&quot;; &quot;We collected baseline data and we realised that the baseline standards are not being met&quot;; &quot;this is where it can be kinda confusing with this iteration where we started being in different areas, with multiple components, so we have been collecting data, doing process maps, ...so, I feel we have been doing a lot of the same things over and over again&quot;; &quot;yeah, we learnt a lesson&quot;, &quot;we took on too much initially, so we just had to make it smaller and smaller and smaller&quot;; &quot;it’s a shifting set of where we are, I suppose. So, I think we finally formalised our aim&quot;; &quot;We have come up with a main solution that we are going to start trial (Feb 24th 17)&quot;; &quot;we thought about it a little more in terms of the scope, it was the A&amp;E we looked at their ...It was way too complex, we did spend a couple of months at that ...our original project was a wider scope in the A&amp;E ...so we narrowed it down, so that is essentially it.&quot;.</td>
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<tr>
<td><strong>Communicating the project:</strong> &quot;we did our driver diagram and that helped&quot;; &quot;we had a meeting with all the consultants in ED first, I met up with a few</td>
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<td><strong>Survey:</strong> &quot;And we are also going to start on a survey of both the consultants and the administrative staff to try and get their feedback or input into the process itself&quot;; (person) has a few questionnaires we are going to send out next week, some surveys, so we will run those by some clinicians as well&quot;; &quot;we sent out questionnaires in Feb/March&quot;; &quot;so we are just feeding back there, just collecting the data&quot;; &quot;and feedback the survey&quot;</td>
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<td><strong>Data collection:</strong> &quot;so physically we are asking them to hang onto the reports before they send them for filing and we are just checking them and seeing if they were being endorsed or not&quot;; &quot;yes, we have asked clinics to hold reports, ...and we will continue to check them.&quot;; &quot;(yeah, but January I was</td>
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<td><strong>Survey:</strong> the feedback we got is that they would like another column there with actions, outpatient appointment but we felt that was for the healthcare record we have been trying to bite off too much, just keep it simple&quot;.</td>
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<tr>
<td><strong>Data collection:</strong> &quot;but I think when I look at the reports we have a significant increase, a lot of the younger consultants are the ones who are</td>
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This project can be described as consisting of three stages or three strategies: defining the problem/solution; communicating the project; and piloting. Each stage begins with a strategy of exploration to increase knowledge and resources. Within Defining the solution/problem the team explored current processes to increase their knowledge and identify a specific problem or solution; within Communicating the project the team explored various avenues to connect with frontline personnel who would be responsible for endorsing the project and making changes; within Failing the team explored the data to gather information on whether frontline personnel were making prescribed changes or not.

This project consists of three key stages: defining the problem/solution; communicating the project; and piloting. Each stage begins with a strategy of exploration and finishes with a strategy of exploitation before moving to the next stage.

The team described two key activities both of which had elements of exploration and exploitation: a survey and data collection to monitor changes on how frontline personnel are completing the relevant paperwork.

Within Defining the solution/problem the team switched strategies: defining the problem/solution; communicating the project; and piloting. At some time within each stage the team switched from a strategy of exploration to a strategy of exploitation to capitalize on potential. Within Defining the solution/problem the team sought to exploit opportunities to meet with frontline personnel and influence others to seek consensus on changing behaviours; within Piloting the team explored the data to gather information on whether frontline personnel were making prescribed changes or not.

Exploration activities include: a survey and data collection. The survey starts with distribution which is coded as exploring: since the aim is to collect information. The data collection comprises on-going auditing during the pilot stage to collect information.

Exploration activities include: a survey and data collection. The survey activity ends analysing the results. The data collection activity ends with results on the audit.
<table>
<thead>
<tr>
<th>2nd Order - researcher-centric terms</th>
<th>1st Order - informant-centric terms</th>
<th>Researcher-centric aggregated interpretation one</th>
<th>Researcher-centric aggregated interpretation two</th>
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<tr>
<td>Generate new ideas: <strong>Iprs</strong>: “So over the course of the weekend the cloud command team proposed their idea and it was actually selected by the adjudication panel as being the best idea that was there at that point in time”</td>
<td><strong>Ipos</strong>: Generate new ideas; Develop idea</td>
<td>In the context of this project there is one distinct stage, that is the exploration of ideas and exploitation of one idea. This idea did not progress to the development stage.</td>
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<td>Develop idea: <strong>Iprs</strong>: “We are kicking off a new initiative with the winners of the recent Big Energy Hack. The team have been invited to a day-long workshop exploring the Value Proposition and the early Business Model Canvas. In a way this workshop will serve 2 purposes: it will allow [Company] to see how committed the remaining members of the [team] are and it will also enable them to better understand what will be involved in developing out their new business proposition”</td>
<td><strong>Ipos</strong>: Generate new ideas; Develop idea</td>
<td><strong>Ipra</strong>: Workshops and weekly team meetings.</td>
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<td>Develop idea: <strong>Ipos</strong>: “he (sponsor) just sent us the email to see if we wanted to take the idea further and then the workshop was organised for February, and then we set up weekly meetings, so we met every week to work on it”; “the final run through was the 27th April”</td>
<td><strong>Ipra</strong>: Workshops and weekly team meetings.</td>
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<td><strong>Ipra</strong>: Workshop: “The brainstorming we did at the start was very good in the initial meeting when we sat down in DogPatch with OBC” (Workshop); “the sessions with OBC were great, to be honest. It gives you someone to bounce ideas off, you really kinda end up in your own bubble and for someone external to come in...and just pick it apart...”; <strong>Weekly team meetings</strong>: “And then we set up weekly meetings, so we met every week to work on it”</td>
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**Team Seven**

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<tr>
<th>2nd Order - researcher centric terms</th>
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<th>Aggregate dimension one</th>
<th>Aggregate dimension two</th>
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<tbody>
<tr>
<td>Ipos: Investigative: “I am on the team, nearly two years now but when I joined there were four key areas the business wanted to target, this is around ‘Big Data’, so I recall that one on, mmm, and this kinda lobed out of that”; “how we got there initially, was through a number of structured workshops, disruptive mind-set workshops, so we worked with an external facilitators called XX they initially held about three or four meetings with us. So, we had a good cross functional team from across the business in all the different business areas were included, so we have 30 people in total from IT, EE, Networks, Marketing, so we had a good diverse group. And the whole idea of the disruptive mindset was we had to first kind of look at not focus on [the Organisation] but look at what the world thinks about Big Data, but also the analytical bit was important to get the value out of Big Data.”</td>
<td>Development: “initially targeting [the organisation], these are customers in various parts of the world who are involved in power and utilities sector and possibly energy sector too”; “we have been trying to get ourselves out there ... that part of my role for the past year has been trying to spread the gospel ... and we are just looking for ideas or used cases to try to help you get the value and benefit from the data you are sitting on”; Implementation: “around a 5yr horizon, ... might look at offering this as a service or to take on external customers as well. So that’s kinda what we are exploring at this stage”; So I suppose until we get a bit of traction with customers we don’t know which area to focus on yet ....... we hope the portfolio is broad enough; “one of the activities on the road map was to investigate white space opportunities” ... down the line but I guess when we saw that demand was there it meant we could accelerate, there was obviously an opportunity to we could group now rather than later on. So, it meant that maybe a smaller team than we would like or less resources, but we may as well start now and take advantage because we can see the competitor is out there and it is increasing so we are trying. We don’t have first mover advantage, but we have an advantage in terms of looking at other customers in the power/utility sector.</td>
<td>Team engaged in three distinct exploration and exploitation strategies: exploring the viability of the project, developing the project using internal company cases, and bringing the product to market.</td>
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<td>IPoa: Investigative: “we did a Big Data strategic roadmap for [the organisation], that was delivered June 2016 and that confirmed Big Data as an area [we] want to move into but what we don’t have is analytic capability, data scientists essentially. So, we started to address that”; “the road map kinda took from Oct/2015 to June 2016... at the time we didn’t have a product”... “... We came to the conclusion that we need to be more active in this analytical capability space, so hence, we set up the team on the basis of that road map then, so that was set up after that. So it has been a reaction to the road map that we have been active in space to date”. Development: “through the used cases we have done with the business,” 15-20 potential used cases that we can display to clients and say would you be interested in this? “to date we are just building up a different variety of used cases, piloting, testing depending on our customer then we can target and say well we have done these three projects previously, are they meaningful to you?” “the team have been developing internal and used cases within [the company], and some companies here ... and charging internally as a business unit so we are able to generate money”, “to date we have been developing used cases for internal business so we have a broad spectrum</td>
<td>The team engaged in two distinct exploration and exploitation strategies: defining the purpose or focus of the project, and gathering sample cases.</td>
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<td>IPha: Investigative: “we did a few roadshows too where we would give a presentation and try to bit a little more”... “... I am on the team, nearly two years now but when I joined there were four key areas the business wanted to target, this is around ‘Big Data’, so I recall that one on, mmm, and this kinda lobed out of that”; “how we got there initially, was through a number of structured workshops, disruptive mind-set workshops, so we worked with an external facilitators called XX they initially held about three or four meetings with us. So, we had a good cross functional team from across the business in all the different business areas were included, so we have 30 people in total from IT, EE, Networks, Marketing, so we had a good diverse group. And the whole idea of the disruptive mindset was we had to first kind of look at not focus on [the Organisation] but look at what the world thinks about Big Data, but also the analytical bit was important to get the value out of Big Data.”</td>
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<th>Team Eight</th>
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<tr>
<td><strong>2nd Order - researcher centric terms</strong></td>
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<td>1st:</td>
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### Team Nine

#### 2nd Order - Researcher centric terms

The process - the stages of the project were: the feasibility design phase, the tendering and appointment of the consultant to get it to validation/feasibility stage and outline design. The stages of the process were: the feasibility design, tendering process for a consultant to do the design phase, outline design phase; detail with the design; the procurement process for the contractor to build the works.

#### 1st Order - informant centric terms

- **Lpr/os**: The feasibility design, tendering process for a consultant to do the design phase, outline design phase; detail with the design; the procurement process for the contractor to build the works.

#### Researcher centric aggregated interpretation one

**Outline design 30%**: “you can say this is like a funnel, initially it is very broad, you have a lot of options and you try to narrow it more and more and before we move we believe the outline design is not all the way through the funnel but based on all the discussion you say, this is not, this is not, and you still need to refine some of that further, but now you know more precisely what way the water is running - you are getting down to that one route forward”.

- **Detailed design**: “around 12th-Sept we had that outline presentation - we did a presentation on the outline design to all stakeholders and following that we released all outline design drawings, documents, technical notes and memos to the stakeholders for comment, we collated all those comments and presented an outline design to all stakeholders and they bought some of their more pertinent issues to that workshop and then in the weeks preceding that we closed out those comments and we are at the stage where it is frozen”.

#### Researcher centric aggregated interpretation two

**Workshops**: “I think what has been a major part of the project so far has been these workshops, I mean we can come up with suggestions and then we present them... and then we try to collect all that input...” “the process ends up being: the first step is probably these workshops where you are trying to gather as much information as possible... we put them on Sharepoint so everyone has access and give feedback to one location”.

**Planning**: “there is a planning process that operates alongside that as well” “there will be a design freeze that will culminate in a planning submission of sorts and from that point we will have clarity of knowing what we have proposed can go forward in that guise and then it will be refined further into an operable design so there are some key milestones, design and end of design for me to complete my side of things and then once I complete I hand back to the team to say go forward to final design and build”.

#### 2nd Order - aggregated interpretation

Table: Team Nine

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#### 3rd Order - aggregated interpretation

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4.5. How teams progress through the innovation process

4.5.1. Team one

4.5.1.1. Team and innovation context

Case one consists of three members plus there is a team sponsor who is available for advice but does not get involved in the process. All team members have relevant and specialist knowledge and training. This team is working on a system for meeting and maintaining a national Health Charter – “So one of the things we did was increase that capability for regular feedback in both hospitals”; "...based on pillars of the national health charter .... we should also be judging compliments and comments against that charter". Their project is driven by a formal program for change and supported by executive management - “... a new Director of Dept said that anyone on the Group could put a project together. ... I began to get a team together”. The main challenge for this group was influencing front line personnel to engage with the project thing - "but really a lot of it ... is convincing people to see things in this light, is actually a much harder thing". Most helpful to the project was the influence of executive management on front line personnel the extensive contribution by one team member - "yeah, we got the highest leadership role in the department and they said this is about you [to the ground staff]!"; "...and it was GREAT because that was an immediate, strong, latch on, show of support that this culture needs to change, and THAT one burst, probably went ALONG way to getting you know things done".

4.5.1.2. The innovation process

Team one’s project was achieved across three key stages as described by the team but interpreted by the researcher: baseline data; develop solutions; implement a new system. Details below:

1. Baseline data: In the beginning the team was focused on baseline data to identify gaps in the service – this stage progressed with a strategy of gathering data across the two hospitals over a period of three months "we did some initial data collection for
3 months"; "We had a patient satisfaction survey in the hospital but not in the Emergency Department (ED), so we had to get a tool that would suit the ED in both hospitals and define a time-period for the data, so our project has been about getting a common card to the staff and to the patient, getting it used by staff and patients so we can establish a base-line and start monitoring changes". This stage switched to a strategy of exploitation as the team collated and analysed what little data they could find ("So we wanted to see everything together, in the same way so we could all speak a common language"); "And then we used that same comment card as a lens through which to view the unsolicited feedback we were getting which was the complaints and the compliments".

Within this phase of the process the team found that the comment cards for gathering feedback were not relevant for gathering the type of data that the team believed was aligned with the National Health Charter. So, the team decided to update and distribute a new comment card for continuous data collection (see activities) and in line with meeting the overall project objective. As soon as the base-line data collection period ended, a new period of data collection began so the team could monitor any changes in the quality of service in response to any intervention - "We were still taking in other feedback that was coming in through other channels anyway but it was to get this set up so there were comments cards in both departments".

2. Develop solutions: The team's second focus was increasing awareness of the National Health Charter to frontline personnel and their project to meet the Charter so that the team could increase resources for distributing the comments cards to collect the data to improve customer service. This stage progressed with a strategy of seeking additional resources from across the department to engage in the process of improving customer service - "And then the second thing was actually getting the comment cards out"; "getting a common card to the staff and to the patient, getting it used by staff and patients"; "So we presented the data at different forums,... we
piggybacked [a meeting] and then the other place we created our own [meeting] and invited key influencers as well as ground level staff. ..."; "... to encourage uptake, and for the card be given out at registration by the admin staff".

This stage ended with the team refining ideas for improving the service - "We had loads of ideas but when we went to the staff to let them know we realise even they had loads of good ideas, perhaps we should have started with them? "...and interesting enough, while they were down (meetings with front line personnel) it was the conversations that came out of it, in relation to the staff saying, 'well do you know what we know would improve it? ’. During this phase the new comment card was accepted, and it was agreed that a name badge was one solution for improving communication - "so one of the things we were going to do here was bring out 'hello, my name is ...’ (badge)"

3. Implement a new system: When this third stage began the process of continuous data collection was already underway "the second data extraction was 1st Feb – 31st May". Separately the team initiated the process of sourcing name badges which was more than a single task “so the process of the badges has been in itself a task...";"So, we had meetings about what should go on the badges, you know first name, second name, and what people should be called and that was all agreed"

This stage will close when the name badges are sourced and a system of collecting and reporting customer feedback is established - " we still haven't got the badges, they are on the way, shocking how long this took BUT.... people know the whole idea behind the badge! - any time I go down there, they would be like, any idea on our badges, where are our badges?".

The successful completion of key activities also enabled progress in the innovation process. However, the team only elaborated on one key activity which was the design and distribution of the card design.
For this activity the team sought expert advice before redesigning the cards - "we went to the grandmaster of sphinx, also the librarian, because she did a programme on adult literacy"; and, "So the first thing we had to do was have a meeting and agree on the language that should be used in the comment card"; "we tried to incorporate a lot of her (grandmaster of sphinx) recommendations into the comment card".

The team implied there were other tasks or 'to do' items which came out of their regular team meetings, but the team did not go into these tasks in any detail although the implication is that each to-do item requires a follow-up – "so we had the informal ones (team meetings), whereas [other team member] did make them more formal, it did give us a list of what we have to do til the next time we meet. And so, we would create lists of what we had to do for ourselves at those meetings in relation to facilitating what they (the staff) need."

Overall, the closing of one strategy enabled the beginning of another and like strategies, the key activity described by the team consists of an element of exploration followed by exploitation for completion.

4.5.2. Team two

4.5.2.1. Team and innovation context

Team two consists of a core group of three members - "... We developed a steering committee to support the three of us in the project", piloting a process for improving health and safety for the service user, overall service user experience, and which is also expected to influence organisation communication - "we need to pilot this current tool to test its suitability"; "improving the safety culture in our organisation ...to ensure our service users have an improved experience"; "I suppose of the project really was to improve communication between front line staff and senior management, to give front-line staff and local managers an opportunity to showcase what they are really proud off". The project is driven by a formal program for change, supported by CEO and complemented with a
Steering Committee with relevant resources – “The drive is from our CEO who was instrumental in putting this forward as a project with the RCPI”; "we identified who we felt the key players are, who could support us, again, these are the people from places we feel need to come together to correct the disjointed situation we have. There are 13 on the steering/project team...they have experience and impact”.

The team described their commitment to a common goal as being most helpful for the project - "I think we are committed to it, I think we have spent a lot of time together, so we have invested as three people, I would say a lot into it to try to keep momentum"; “are very much committed to continuous quality improvement, very on for participation and engagement, acknowledging good practice, learning from mistakes, I think we are all singing from the same hymn sheet”, as well as communication – it is really communication and collaboration, because you take people with you rather than (demonstrates aggressively dragging people) and you are not making progress anyway without those people”; " I think the informal grape vine has done our group a lot of good as well. It is the conversations you have on the corridor or at the water cooler where people say I heard you were doing these visits and I heard really positive feedback, so I think they are always good indicators.”; “…it was a great to see their expression of their experience in the meetings as they each in turn took visits, that was helping to persuade and help change attitudes with their colleagues and peers and seniority”. The pilot achieved approval for a company-wide roll-out – “... everyone agrees it would a positive thing to implement across the organization”.

4.5.2.2. The innovation process

Team two’s project was achieved across three key stages as described by the team but interpreted by the researcher: planning for piloting a document; developing the pilot document; and piloting the document. Each stage contains a strategy for exploration followed by a strategy of exploitation:
1) Planning: In the beginning the team was focused on planning for the pilot. This stage began with a strategy of acquiring additional resources by way of recruiting various stakeholders from across the organisation onto a Steering Committee - “We developed a steering committee to support the three of us in the project, and CEO sits on the steering committee”, and progressed with a strategy of consensus by selecting and communicating the pilot program to chosen sites - “We now need to meet the four services and brief them on what and why of our plan”; "we met with the service managers over the areas of the pilot sites. We met with them individually and collectively, and we took them through what the purpose of the walkarounds were about, some awareness of what the project was going to be”. The team described one key activity during this stage which was the distribution of a questionnaire via the human resources department to gather data on the current culture of health and safety - "The other thing we did was send a questionnaire through HR to assess corporate culture which is currently being analysed”; “We hope to send out 10 questionnaires a week or month and hope to see improvements”; "we are rolling out the results of it (questionnaire) now.” (June, 2017).

2) Developing the pilot document: The second stage of the project focused on the development of an existing document to one which would meet the needs of their organisation. This stage began with a strategy of increasing options for an amended document by reviewing the existing document, visiting other organisations, and soliciting ideas from team members - "that is the next big piece of work that we have agreed on, ... adopt a different approach to the HSE format”; “we looked at the two tool-kits that are there, the questions piece and the model - we are taking the more suitable tool-kit and changing the HSE approved model from HIQUA for acute services and tweaking that for [org.]”. This stage continued with a strategy of gaining consensus for the amended document and getting sign-off by the Steering Committee for production and trial - "review
of the documentation with the steering group”; “we are at the point of teasing out the flow-chart of how it will logistically work, who sets what up, what triggers next…”; ”Well we did a significant amount of it ourselves and then we presented it to the steering group”; ”Next meeting is 2nd February and we hope to show a draft to the team”. During this phase the team took the opportunity to engage in tasks related to visiting two organisations who implemented a similar process to gather ideas and learn from them – “visit Beaumont and Crumlin who have already used the tool and see how it worked for them during their pilot”.

3) Pilot: The final stage of the project concerned the actual pilot study. This stage began with a strategy of acquiring new information about the suitability of the proposed document as the team conducted ‘walk-arounds’ of pilot sites - We will "start the pilot in next few weeks - February 22nd & May and June for the 2nd walk arounds...”; ”the pilot should be completed by June, 2017”; ”I think it was a process of testing”; ”the visits were busy, ...the prep for the visits, the actual visits...”. This stage progressed with a strategy of reviewing observations and learning outcomes as well as completing follow up actions which came from the visits – “... there was a significant amount of work went into the documentation and administration of the visits”; ”but then we got into the actual doing of the visits and the actions that came from that or arose with that”; “each visit has three actions set for people so obviously the whole purpose is to actually get to the completion of the actions”. There is no data available on the follow-up actions since these were not part of the innovation process.

Throughout the project the team engaged in regular team meetings to explore ideas and make decisions about their project – “we will meet monthly as a group to look at the tool we are going to use and get that started and tested”; “the main decision that was made was to adopt a different approach to the HSE format”; ”before the walkarounds we went through the mapping process at that meeting.

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We signed off on the questions, the opening statement, the questions that were going to be asked and the template for the action plan and then the closing statement, we did the process map and mapped out what a visit would look like, so that was in one meeting.

4.5.3. Team three

4.5.3.1. Team and innovation context

Team three consists of a core team of three members with relevant medical training working a project for improving prescription administration and improving safety - "the fact that [Person] is a Consultant and he is a prescriber then he obviously is well used to what should be done and he is a senior consultant and he would know how doctors think and work. [another Person] is a pharmacist and so knows about fluids, and [a third Person] is a nurse by background so I could see from an administration side how I would perceive that and from a quality side the data piece, I like that"; "we are looking at IV fluid prescribing in the context of medication safety for prescribing, and we decided to narrow our focus down to one type of mediation". The team describe their working relationship as good based on shared work-load and standards, good energy, similar writing style, good psychological safety as well as being highly motivated and having role status within the organisation to influence others - "we would have worked together previously ..."; "we don’t feel as if someone is not pulling their weight because we are all doing our own bit"; "we get on really well, ... We knew we were the kinda people who would get along "; "and I think none of us were overpowering, none of us were in charge really"; "when the three of us used to sit together, we never felt any comment was silly. We would all be brainstorming and saying 'yeah' mightn't necessarily agree with what someone said but ..."; “I think we had the same goal, I think patient safety is important to the 3of us". The project is driven by a formal change program that dictates time, a methodology, momentum, and techniques for influencing change “...we don’t have time because we are within the confines of a diploma”; “following the
methodology we engaged the staff and that is really one of the reasons we did see improvements as well as changing the chart"; "having those diploma meetings every month really focused us, prevented us from falling there [valley of death]". The biggest challenge for the team was influencing front-line personnel with whom the team rewarded with cupcakes when positive change was noted - "... it is really learning that getting staff involved early, that whole engagement piece, and getting their feelings and what they think will work, even if it is the same thing that you would have come up with, that you are much better getting buy-in"; "In the end we engaged the nurses in a zero tolerance [exercise] that they could question the prescription, question the doctor, and both the nurse and doctor got a cupcake".

4.5.3.2. The innovation process
This project can be described as consisting of three stages: planning, engagement, and piloting. Each stage begins with a phase of exploration and ends with a phase of exploitation. (1) Planning began with a phase of exploration to generate ideas, acquire information about stakeholders, and gather data before exploiting this data and the driver diagram to refine their project. (2) Engagement dictated an initial phase for engagement with frontline personnel to solicit their ideas and resources before switching to a phase of exploitation to gain buy-in with frontline personnel for the project. (3) The pilot stage began with a phase of exploration for gathering information about the re-designed chart and ended with a phase of exploitation by refined the recommendations for implementation to gain acceptance for a re-print and roll-out beyond the project. The team would revert to this phase of the pilot several times.

1. In the first stage the team were focused on ‘planning’ that dictated a strategy for generating ideas; acquiring information about stakeholders; and gathering data - "in the beginning we were quite enthusiastic and we had lots of ideas ..., we used all the tools in the beginning and we did try to map it out..."; "[data collection] was
done in about 4wks [by] the 3 of us - We went to look at 10 charts per week, 10 prescriptions, we went to the medical wards, we defined what the key standards were...". This stage of planning continued with a strategy of exploiting the data they collected and the driver diagram to refine their project; "One of the things we did at the beginning with our base-line data was we got [IT person] to help us with a pareto chart and this helped us to focus. ... But by focusing on the areas with the biggest deficit also happened to be the most important things"; "it really narrowed our focus and that has helped as well because we are able to target those specific areas and if we target those, from a safety point of view they are the things that are most risky": "we did the driver diagram we mapped out in each of those categories what we were going to do really, I suppose in that way it was defined".

2. The second stage was shorter in terms of time but very significant for the success of the project as it concerned engaging front-line personnel in the project. This stage began with a strategy of networking with relevant personnel to communicate the project, to gain their support, to increase resources that would ultimately implement the revised document - Q-After you found the data, what did you do next? "First thing we did was simple education....”; "I think we did have a good idea of what the solutions were, but what we probably did differently using the methodology we did a lot more engagement then we would necessarily in other projects and speaking to the junior doctors and engaging them in what the solutions might look like and that I think was really effective in actually making improvements. We could have just rolled out a new chart in a day but actually following the methodology we engaged the staff and that is really one of the reasons we did see improvements as well as changing the chart". This stage continued with a strategy of exploiting the advantage of gathering the thoughts and feelings of front-line personnel to redesign the chart and capitalising on the potential of fulfilling their refined objectives - "We redesigned the chart "; "just recently, middle to end of January .... we got an
example from the NHS...they liked certain elements of it” “getting staff involved early, that whole engagement piece, and getting their feelings and what they think will work, even if it is the same thing that you would have come up with, that you are much better getting buy-in”.

3. The third stage concerned piloting the revised chart for prescriptions. This stage began with a strategy of exploring reactions to the revised chart in practice by auditing the charts on a continuous basis - "so at the minute [February] we have our re-designed chart on trial through the admissions". This stage continued with a strategy of exploiting the data to make corrections to the chart to improve quality, health and safety - "So, we found when we had implemented this [first chart re-design] we had four correct prescriptions that week. That was the first time we saw a fully correct prescription and you could see how others maybe didn’t get 100% but you could tell they were definitely trying to do it right, there was a big improvement". This stage of the innovation process was iterative, the team moved between exploring reactions to the chart in practice, making corrections based on findings and reverting to fresh audits - "what we found from doing the audits is that if their first prescription is right, the rest tend to follow correctly so decided to put an example prescription on the sheet because that may then help to lead us through"; "we changed the chart (again in May), there were some really low results which we didn’t expect so we changed the chart"; "we were monitoring to see whether we were achieving our standards or not so we would plot those on a rung chart so we could see where we were at, so when we could see sustained improvement that was an indication of the chart being implemented"; "but obviously we want to get things done and tested before we would go to full print and so we are looking for those at the moment, we are auditing once a week and we audit 10 charts once a week". This stage was complete when the team were satisfied that the chart was effective in gathering the correct information for prescriptions - "the focus for the hospital is the medication/drug chart will be updated hopefully in the next few
months"; "the feedback of the data (final stage), where we could show at the medical journal club, elements of the rung charts going up was really useful as well because normally people are going in there to 'give out' whereas that positive re-enforcement thing"; "just at the end of May, we decided the project was complete, time to write up".

The successful completion of key activities also enabled progress in the innovation process. The team described the engagement meetings and chart revisions more than any other activity they may have worked on for this project although weekly team meetings were briefly mentioned.

1. Engagement meetings: the team held multiple meetings with various frontline personnel including doctors and nurses where they would describe their project, gather feedback, revert with more information, and continue with this communication until they believed they had buy-in. This process also contained elements of exploration and exploitation but because it is happening at the level of a single event it is much more difficult to temporally order the process and in addition the study did not collect data at this level. However, the following data were coded for exploration and exploitation related activities related to engagement meetings:

a. Exploration –

i. Group meetings: "...we went to a medical journal club, it is all the doctors, we presented the base line data and said we would be doing this project and we will be continuing to measure and tell them if what we are measuring is effective or not...it was very negative overall";

ii. Research: "Then we went away, and we met with one of the lead NCHDs and she had been at the presentation ... one of the other doctors joined us and said ... what would be really powerful is patient stories". "We looked at patient stories, Person had seen a presentation that another doctor did, so we got a copy of that, we looked at some literature, some stuff from the NHS ..."
iii. Individual meetings: "we split the consultants, the nine medical consultants, so we took three each to go and talk to them individually because it is hard to get them all in one room and I suppose sometimes it is kinda good to divide and conquer": "We piggy-backed a NCHD session where we did a speed-networking thing...it was a really positive session where we had about 30 people telling us what they thought ...

b. Exploitation –

i. Group meetings: "So when the team shared the stories ... and we were writing them all down, a lot of their solutions were stuff we had considered ourselves, but I think it was important that they felt they were part of it. We talked about re-designing a chart and they were really for that so we showed them different types of charts, and they told us what they liked about it and what would be useful"; "But we had actually met everyone separately before so we didn’t have anyone thinking, moan, another, you know they all felt they were part of it, and they all had an opportunity to review it, and give feedback and it was a really positive, we got lots of really good feedback afterwards where we had people saying we really like your project, we think it is going to work really well, and it was the same consultants who were very negative the first time we met them so we found it was just about them feeling engaged"; "we got an example (chart) from the NHS which the NCHDs, when we showed it to them, quite liked, they liked certain elements of it", "...what would be really powerful is patient stories...So we went back (after two weeks) and just met with the junior doctors..": "And then we put in the example": "We told them we would give them cupcakes if they got it right (giggles). And we did, and we took a photo of them - and got our smiling stickers to put on the charts if they were correct"

2. Chart amendments: this activity was embedded within the pilot stage and was work in action with continuous revisions based on audits. "we changed the chart after we meet with you ... so we took
out this section, moved that...”, “we updated the rung chart and had a look at it, we changed the chart and implemented a slightly revised version and it got rid of the errors we were concerned about. We were able to see which parts of the chart were falling down so we could see which part of the chart they weren't following so by just changing that and it was fine”; “it wasn't until we plotted the rung charts with each standard individually could you see where one wasn’t working”.

3. Team meetings: “we meet every week. I suppose it re-focuses you every once a week to ask what are we doing”?

4.5.4. **Team four**

4.5.4.1. **The innovation process**

Team four’s project was achieved across three key stages as described by the team but interpreted by the researcher: refining the problem/solution; communicate the project; pilot. Each stage contains a strategy for exploration followed by a strategy of exploitation:

1) Refining the problem/solution: In the beginning the team did not quite know what problem needed to be fixed – “I signed up for the diploma without recognising there was a problem to be fixed”, so they their strategy was to explore options for the project by collecting data. Collecting data was much more than a single task, it was an entire process of navigating the administration system over time. Following an exploration of the system and gathering some data, the team switched to a strategy of exploitation to expose gaps or solutions to the problem “... so we have been collecting data, doing process maps, ....”. However, the team continued to switch between strategies of exploration and exploitation because they could not agree on a problem or a solution - “I suppose agreement on some of the problems, coming back to the primary drivers, I think as a group we talked a lot and didn’t really come up with nailing our colours to the mask on one thing and trying that and failing, and trying the next
thing and failing”; “... we had a kinda loop-the-loop”; “we were doing the project and then it changed”; “yeah so that was the Sept to Dec, that was what we did and then Jan started again, back to process mapping”. Finally, in January the team agreed on an area of the hospital where they had access and control and started the process again – “over Christmas I was thinking ... ok let’s just focus on my lab reports”; “we did the process mapping with [one department] then we realised it was too much, we couldn’t get buy-in, that engagement thing was just beyond us”; "yeah, we learnt a lot we have really narrowed it, we took on too much initially, so we just had to make it smaller and smaller and smaller”. From January the team began the process over with gathering data in one small area of the hospital and identifying where there were opportunities for improvements. Finally, the team agreed on making changes to an existing document to improve the chances of frontline personnel correctly completing the document in line with quality standards - “we have a little footer at the bottom this is standard accreditation for our laboratory so this is what we are going to insert down here so instead of what we normally get is this or this (random scribbling – paraphrased) so now they will have to put the date in, sign it, and medical council number, which is the regulation really”.

2) Communicating the project: The team needs additional resources to complete the project, these resources came in the way of people knowing about the project, understanding the significance of the project, and being aware of the changes they need to make to support the project. The began this stage by ‘randomly’ exploring opportunities to meet with influential personnel and frontline staff to increase awareness use them as a resource to enable progress – “it is not the big bang approach ... things come up ... you build to this meeting”; “I have been in other meetings where this can be discussed in another forum, our patient safety meeting I brought this up, [Person] had presented a clinic audit in relation to some of this from last year so again using that opportunity to start that conversation, so
just trying to find those opportunities, not to find them but they present, to recognise them and use them when they present itself”;
“[Person] would see a lot of the people that we would need, so she is working away in the background so it definitely helps to raise you know, there is an open door whenever we go to people in terms of we are trying to do so it works”. This stage progressing with the team switching to strategy of exploitation to gain consensus and ultimately approval for changing the existing document - “we did our driver diagram and that helped (identify stakeholders)”; “we had a meeting with all the consultants in ED first, I met up with a few people individually with the process maps”; “we’ve got sign-off to include this in the report”. This stage ended when the team could approval to proceed with proposed changes – “We just had a meeting with the Clinical Director ... we spent 20mins in his office talking it out”.

3) Pilot: This final stage of the project began in late February with the team circulating the amended document in practice - “people should know, .... what the expectation is. ...., so, at the moment, we are trialling this”. This stage progressed with the team audit the documents until they were satisfied the amended document was changing behaviours as per regulations – “but I think when I look at the reports we have a significant increase, a lot of the younger consultants are the ones who are taking this on and are very happy to do it, that intervention I had a sense already of the feedback”; “our goal was just getting them to sign the endorsement box, so it was very hard to drive a personal change because they went from not doing it and looking at it, to doing that to doing it right (points to page to show various locations of signatures)”.

The successful completion of key activities also enabled progress in the innovation process of which the team briefly described two: a survey and collecting data during the pilot for auditing. The survey was distributed and analysed; these data were collected and reviewed by way of physically following the paper trail to audit how and when relevant personnel were correctly completing the amended document.
- “so physically we are asking them to hang onto the reports before they send them for filing and we are just checking them and seeing if they were being endorsed or not”; “yes, we have asked clinics to hold reports, ... and we will continue to check them...”; “yeah, but January I was down there, and I did my last session last Friday (End June 17)”; “once a week one of us would go down”; “I have been going down the last month or so, just to get enough data to put into the report”. Like strategies, the key activity described by the team consist of an element of exploration followed by exploitation for completion.

4.5.5. **Team five**

The data gathered on team five is relatively brief compared to the other cases and therefore I provided the full picture in the main body of the thesis in section 5.5.6.

4.5.6. **Team six**

4.5.6.1. **Team and innovation context**

Team six consists of a core team of thirteen members, with dotted lines to an extended team of skilled personnel – “...we are the nucleus team and the other members on the invite who are not here (come and go)”; “And you need the wider team, which is why you have the organisation chart which shows the wider team, we set that up”; “We have all been involved in all of those phases but in inception phase it would have been quite tight, in design it would have opened up and percentages would have changed, and then you get into the outline design it would have opened up again because of the modular contracts, then we go into design and construct and it opened up again, do you know what I mean, so like it changes depending on what phase you are in” (with reference to the size of the team)”; working on constructing a new building commissioned by their client - "a modular build.... a fast-tracked project order to assist [airport] to provide additional resilience and service for non-contact stands for their European flights". The biggest challenge was the working conditions, i.e. strict deadlines, limited working space,
and managing multiple stakeholders’ requirements: “[The client] proposed an idea where they wanted a satellite building ...”; “it was the delivery time-line that dictated pretty much everything from the design even the location to a certain extent, and even the detail design it was only finished a couple of months ago it was being designed as it was built”; “the constraints on the site are phenomenal .... you are building it in a corridor”; “this was a top-secret project for nearly 6mths...”; “it is the fast-paced nature of the project ... no other project has ever been done this quickly or in this way”; “there are so many stakeholders in the airport”. Most helpful for progress were the following attributes: combined experience - “...I think a lot of that experience has been drawn on here because a lot of the main protagonists know each other already from previous experiences”; “one of the things that was identified is we need a team that will hit the ground running, we need a team that knows the [space], that know each other”; communication - “you have got the core and we communicate within ourselves and each person delegates further out for ... but it is the nucleus that must come together once a week co-ordinate, communicate, and make sure who is doing what, what are the priorities”; healthy working relationships - “the relationship amongst the team, you can’t underestimate how important that was, how the relationship building as well was critical...”; collaboration – “there was a collaborative approach too if you make a change what is the impact”; “so far we have managed as a team to still deliver that date and the only thing we have done is working as a team and by having all the various elements of the team to workshop the problem”; common goal - “...there was pride in this project, I think there was a hunger to achieve it as well, EVERYBODY lived this project .....“the common drive to not fail and not have it on your head that you failed”; commitment - “nobody said my time is too precious, EVERYBODY made the time”; respect – “...so multiple-case study average there was a great respect for every different discipline within the team and that can be unusual”; and trust - “where the trust was built in, in
terms of innovation, there were things that [PM] did that I have never had as part of a project team before and I think that allowed trust and openness and a willingness for people to engage and put forward their ideas without fear of it being knocked back ... I think that has been hugely critical to its success”.

4.5.6.2. The innovation process

Team six’s exploration and exploitation phases and activities produce four geometric diamond shapes representing stages as described by the team: inception; feasibility study; outline design; tender; detailed design and build.

1) Feasibility study: The team were handed a brief by their client in May 2016 to construct a building - “May 2016 is when we were handed the project as a team and told to deliver it”. The feasibility study began with a period of exploring various options with consideration for design, location, costs, and logistics - “May is probably when we went into feasibility side which is the optioneering what are the various things we can do - and this is more when this team gets involved, how do we achieve it? we could build something like this, that, single story, two story, we could connect it by bus/monorail/bridge, we looked at all the various options and tried to develop which is the more suitable one. The other parameters that go along with that are cost, quality, how do we develop the quality for passengers, customers, the final quality, the finished building. The other things are procurement, how do we get this, how do we buy it, how do we get somebody to build it, which then starts to get you into the construction methodology, so do we need to do a traditional build, a modular build which suits the more fast-tracked nature of the build”. After some time, the team switched strategies to reach a consensus on what would meet the brief in the time given - “we have gone through feasibility, ... we have a preferred option”; “a location on the airfield was identified that fixed the parameters, what they could do with that location to get this unit in place, so from that [the project] was born basically”. While the team say they did not
complete the feasibility stage “... so you haven’t finished out your feasibility you are kinda saying let’s take it to the next level” they did stop this stage in order to move forward to the next stage - “I would say the feasibility probably went to May/June, it wasn’t even a normal feasibility, I suppose a project like this would normally take 2.5yrs to deliver and we were given 12mths so that is kinda everything was done on the run...”.

2) Outline design: The second distinct stage was outline design which began with a strategy of exploring options available to the team for constructing a building that would meet planning regulations “... now we start to design it, it is an outline design”; “so it is the basic concept, we know ...., we start to draw it out and put costs against it”; “... at which point [Planner] drips in as well and starts to talk about how this affects planning, what is likely to be approved, rejected, these are all things we have to take conscious decisions on for stepping forward”. After some time, the team made decisions about the design that would enable them to go to the market to recruit a builder - "So as P said during the outline design we did the tender"; “we HAVE to tender it on basic information”.

3) Tender: The third distinct stage in the project was the tendering process. The team took the decision to tender on basis on an outline design only and explored the market for potentially suitable builders - “we HAVE to tender it on basic information”; (Tender out 8th Sept, decision 29th Sept); “we HAVE to find a builder who can do this, we HAVE to bring him to the table, and we HAVE to get his interpretation of how he can do it, and we HAVE to use him to work out the programme, builder-ability issues, to basically come together as one unit and say the only way you are going to do this is by following these parameters”; “we didn’t do a detailed design, we went out into the market place to find builders who can build this in such a quick timeframe and they are going to effectively help us deliver the detailed design”; After a relatively short period of time the team switched to a strategy is narrowing their
options and selecting a builder – “... we are going to select one (a builder) from a pre-determined tender process”; “one of the longest times it takes in a construction project is to employ your contractor, to agree the contract terms, costs, programme, so we had to do that with basic information and this is what we call a fast procurement route, we said come on board and help us do this as we go forward... from that we brought Contractor to the table...”; “we selected a preferred tender after a two-stage tender process, which was agreed with the client team”.

4) Detailed design and build: This final stage of the project took the longest time. The team started this stage by working with the new building contractor to develop the detailed design and scope building works while waiting for planning permission – “...from that we brought Contractor to the table, and we have pushed on with and developed the design while we have been building it”; “we noticed was there were two parallel processes going on the construction side, apart from having the design process which was like hitting a moving target, it was a very fluid brief, but there was one construction process going on in Lisburn but yet the Dublin based design and construction team were visiting there every two weeks and towards the end every week -we were working with [contractor] to provide a suitable scope and to confirm that our concept for delivery works”. Once planning permission was granted in February 2017 the team instantly moved to a strategy of constructing the building on site - “... it was only when planning was approved were we able to say 'right we can now put it on site' did the building come from NI and start to appear on the building site”; “ground works were December and the building structure only happened once we had planning ...final grant came through February 3rd“. The building continued until completion in September 2017 – “we are going to be operational on the 29th September....”.

The successful completion of key activities also enabled progress in the innovation process of which the team briefly described two:
regular workshops and the planning application. The workshops were a regular event, as much as every week when the team would ‘workshop’ a problem or issue and resolve to enable progress – “….so what we tend to do, as a team, when we identify a problem like this we will workshop it”; “I don’t think you can underestimate the amount of info that was funnelled down to group decisions and we all came to this with different ideas”; “but every single Wednesday I have been going to progress meetings ...., you have got actions from the meeting, you have targets, you have to have them responded to before the next meeting”; “so it is a meeting but we call it a workshop, so we get everyone around the table, we get everyone to throw their eye at it, we come up with sketches, ideas, people go away from the table, work on it, come back review it in a second workshop”;

Separately gaining permission to construct the building was fundamental to the project. The team made a lot of carefully informed decisions before seeking permission and then had to simply wait for a response - “… it was only when we had the outline design could we go to County Council, Dept., and all these people and say, 'planning permission', we want to build... blah, we would like permission to build this”; “we were building this in a factory in NI so the airport took a major leap of faith, a semi calculated risk, but it was based on we have a deadline to hit, we can’t wait for [Planning] to say yes you can build this so we used modular building techniques to build the entire building in a factory in NI”.

4.5.7. **Team seven**

4.5.7.1. **The team and innovation context**

Team seven consists of a core group of four members, two engineers and two data scientists - “we have two data scientists ... this is the minimum number of people we would need for a start-up and to make something of it” working on a strategically approved, award-winning project within the innovation hub of a MNC – “we won the multiple-case study average prize (Organisation Innovation Award) last
The team has time, space, and resources to explore the commercial viability of data analytics as a service and product for the internal and external market – “It is Data Analytics as a service”; “there is a digital strategy which is being rolled out in the next 5yrs across [the organisation] to make [the organisation] a more data driven organization”; “we are given the time and space to review and see is there a commercial opportunity...”; “So, we explore them ... if they become commercially viable, they tend to be handed over to a different part of the business”; “so when something like this comes along, we need resources, so the resources are put into it”. The team trades their reputation for trust for opportunities to gather case studies within the organisation and generate sales leads beyond the organisation using their network of connections - “... I have been working here for 14 years so I have a good body of contacts ... I know [how] to get the right person”; “I had identified some (potential clients) through the roadmap but through the roadmap I increased my contacts, ...”; “reputation is built on trust .... to date I am keeping them happy”; “we have about 15 or 20 proofs of concept or used cases”; "The channels are [the organisation's] clients and their external customers".

4.5.7.2. The innovation process

Team seven’s project has three distinct stages as described by the team but interpreted by the researcher – invention, development, and implementation. Each stage contains a strategy for exploration followed by a strategy of exploitation:

1) Invention: In this first stage two of the team members based in the wider innovation hub took on the challenge of finding a product or solution to meet an Organisational objective - "... I am on the team, nearly two years now but when I joined there were four key areas the business wanted to target, this is around 'Big Data', so I took that one on, mmm, and this kinda lobed out of that “. At that time, the team engaged in an exploration strategy to gather information on what ‘big data’ means - "how we got there initially, was through a number of
structured workshops, disruptive mind sort of workshops, so we worked with an external facilitator called XX, they initially held about three or four meetings with us. So, we had a good cross functional team from across the business, so all the different business areas were included, so we have sixteen people in total from IT, EI, Networks, Marketing, so we had a good diverse group. And the whole idea of the disruptive mindset was we had to first kinda look at not focus on [the Organisation] but look at what the world thinks about Big Data, but also the analytical bit was important to get the value out of Big Data.". This stage progressed with the team switching to a strategy of exploitation to limit options and variability by using a roadmap to gain consensus - “we did a Big Data strategic roadmap for [the organisation], that was delivered June 2016 and that confirmed Big Data as an area [we]..”; "the road map kinda took from Oct2015 to June 2016"; “We came to the conclusion that we need to be more active in this analytical capability space, so hence, we set up the team on the basis of that road map then, so ... it has been a reaction to the road map that we have been active in this space to date”. This stage ended with approval for increasing the team to support developing the project.

2) Development: The second stage of the process for this team concerned developing their idea to proof of concept. This stage began with a strategy of acquiring resources by way of seeking cases to build for proof of concept - “initially targeting [the organisation], these are customers in various parts of the world who are involved in power and utilities sector and possibly energy sector too”; “we have been trying to get ourselves out there ... that part of my role for the past year has been trying to spread the gospel .. and we are just looking for ideas or used cases try to help you get the value and benefit from the data you are sitting on”. This stage progressed with the team capitalising on their network and collecting used cases - “through the used cases we have done with the business, 15-20 potential used cases that we can display to clients and say would you
be interested in this”? “to date we are just building up a different variety of used cases, piloting, testing depending on our customer then we can target and say well we have done these three projects previously, are they meaningful to you?”; “to date we have been developing used cases for internal business so we have a broad spectrum of used cases which are very different some are very simple e.g. simple dashboards for sitting on top of existing data set”; This stage ended when the team felt they had a product offering for the wider market - “... so now people are coming to us and so I don't have to go chasing people any more”; “we got to the point where there are four products that we are offering...”.

3) Implementation: In this final stage of the project the team are concerned with getting their product to the wider market, that is beyond the internal organisation. This stage began with an exploration strategy of increasing resources that would facilitate their getting to market by utilising the Organisation’s business development team’s contacts – “.... we may as well start now and take advantage because we can see the competition is out there and it is increasing so we are trying. We don't have first mover advantage, but we have an advantage in terms of looking at other customers in the power/utility sector that are behind”; “it is a lot of looking outwards, there are a few ways of looking at it, one is looking at other companies in a similar sector as ourselves ... and then we can look at other industries, and see what innovations are happening in those areas”; “the next step is external customers, ...we had focused on [the Organisation] as a channel to market... to date we have a few contacts, they have shown interest but ... slow to materialise”; “we need some international clients ... to give us a good testimony”; “so I think the four categories that we have are flexible enough to capture a lot, at the same time it is focused the customer”; “and we are working on targets for next year based on a charge out time”.

The successful completion of key activities also enabled progress in the innovation process of which the team mentioned several:
workshops - “through [four] structured workshops, ... external facilitators ... with a good cross functional team from across the business, ... external facilitators [had us] ... look at what the world thinks about Big Data ...”; Internal presentations - “So I have done a number of internal presentations”; Awards: “and we did the [the organisation] Innovation Awards - we won the multiple-case study average prize last October/November 2016; “More recently we won a start-up trip to the European Utility Week in Amsterdam so we had 3 days there to meet potential clients”; Client meetings - “… with the Pilot groups to date, we sat down with them [the customer] in a half-day session, ... we take it away, ... we will develop something and get a bit of feedback from them, so it is continuous feedback loop. ... tweak it on recommendations, ... ... they keep the prototype, and use it”; Roadshows - “I did a few roadshows too where we would give a presentation and example of the work the team is doing as used cases .... So that is how it evolved”; “at the conference as well we had discussions with (potential buyers)”; “The feedback from utility week was that we are offering something that is a little bit different”; and social media - “we are working with social media, LinkedIn and that, to try to be a bit more active in terms of drawing attention to what we are doing”.

4.5.8. Team eight

4.5.8.1. Team and innovation context

Team eight is working on a project, commissioned by their client for improving hospital waiting lists at a national level - “… we are an independent statutory entity ... [to] meet the requirements as set out by the Dept. of Health. Those requirements were set out prior to me arriving, negotiated, and discussed. The project has three components: a national protocol; a toolkit that responds to the national protocol; and a training programme for implementing the protocol and corresponding toolkit – “… the need identified for the delivery of a national protocol for in-patient day-care planned
procedure waiting list management, as well as a supporting tool-kit, as well as a training and development programme. So the delivery of these three requirements was signed to the PMO and this then initiated the project – the project title is ‘2017 ‘National In-Patient Day Case and Planned Procedure Waiting List Management Project’; “... Some of the changes were new, new processes, but some of the changes were improvements of existing processes or maybe more kinda of in-depth information or pathway clarification around things that were already being done in the system around scheduled care”; “I think it was a facilitator project so what we were looking to do was facilitate the hospital groups and the hospitals to consistently manage waiting lists in the same way, to promote homogenous equity for patients out there”. This team consists of a core group of four members with extended lines to a Steering Committee made up of influential personnel including senior stakeholders and relevant other expertise as and when required – “... we are an independent statutory entity”; "I was brought in as the Project Development Manager to establish the Project Development Office”; “The office was established in March 2016”; “I don’t have a project management team, I work on my own”; “There were two things (that helped progress), one was the steering group which had the national representative..... [and] a workshop that we would invite 48 people from around the country to come together and share their knowledge, experience”; "we are a very small team, and something like this need dedicated resources which we don’t have at the moment ... there is an identified consultancy with a proven record in this area ...”; “we also pulled in favours in that we needed more senior representatives”; "So having the right people involved at the start so we were very careful in the early days"; “... the steering group (a high-level decision body) .... we also decided last August that we would run a workshop and that we would invite forty eight people from around the country to come together and share their knowledge, experience within waiting list management”; “we also pulled in favours in that we needed more
senior representatives”; [Person] has a lot of contacts, they opened a lot of doors”; “We actually got a Blackbelt in healthcare to facilitate the day”; “Yes, they took away all the worksheets from the day and analysed the data and give it back to us”; “we are a very small team, and something like this need dedicated resources which we don’t have at the moment … there is an identified consultancy with a proven record in this area ...”; The team believes their experience, reputation, network, ability to build trust, ability to build relationships, effective communication, and collaboration are instrumental to the project -

- **Experience:** “There is one very important thing that myself and [Person] have that some of our colleagues don’t have and that is we have been there, we have done it and we have the T-shirt, we both worked in operations in hospitals ...”;

- **Reputation:** “...I also think reputation is a big part of this. I do think that people want to be associated with a project that is going to be successful ... then people are going to buy into it, but they are buying into the reputation”; “My reputation would have been well known ...”;

- **Network:** “So the communication, networking, relationship development would be very important”; “[named persons] have so many links and connections, they would know everybody around the country, so they opened a lot of doors, they made a lot of phone calls, sent a lot of emails, ... [Person] also made a lot of introductions, these girls have a lot of information on clinical prioritisation, you will want to hear it, so there was a lot of that”;

- **Building trust:** “I find sometimes with the HSE hospitals there is an element of trust before they would start to speak – does that make sense?”; “... there is nothing like face-to-face, particularly in relation to ... gaining that trust. Being able to have that difficult conversation, for someone being able to tell you about a practice or
process that is going on in their hospital that they are aware of, or don’t know what to do about it";  

- **Building relationships:** “the relationship development is very, very, important”; “they would know us, or they would know me they would know they are in a safe place if that makes sense”;  

- **Communication:** “I think as well, communication is key here ... Being able to have that difficult conversation, for someone being able to tell you about a practice or process that is going on in their hospital that they are aware of, or don’t know what to do about it...”;

I think from a communication perspective we managed to gain momentum because we were targeting so many different levels .... The workshop was also very beneficial for communication";  

- **Collaboration:** “It is very much a collaborative project approach bringing all stakeholders together, .... So really, we were more facilitators almost from a project perspective”; “oh collaboration of the clinical care programme was the fifth thing that I saw as fundamental to the success of the project”.  

In addition, the team believe a key contributing factor to reaching targets was their managing the project in accordance with a pre-determined ‘terms of reference’ and ‘project charter’ - “a project charter agreed before that even started which was very important, so people weren’t trying to change the scope of the project as it was moving ...”; “I think the multiple-case study average project structure has been one of the keys to successful communication”.  

**4.5.8.2. Team eights innovation process:**  

1) **Phase 1, Protocol:** In March 2016 – “The office was established in March 2016”. The team began the project with a strategy of exploration to prepare and acquire additional resources that would enable them to deliver the project. Specifically, the team gathered information on key stakeholders who are also influential decision makers and sought to increase their awareness of the project
As you prepare is how you pin in... If you spend a longer amount of time on preparation you are not going to veer off track as easy if you are not spending the time on preparation”; “the Steering Group would be a high-level decision body”; This stage progressed with a strategy for gaining consensus among stakeholders by holding meetings and a workshop to capitalise on their knowledge and influence - "the first steering meeting was in August 2016 - you actually got a project charter agreed ... so people weren’t trying to change the scope of the project as it was moving. There would be named responsibilities, project advisor, project sponsor, advisor, so you really had to free up your time for this project and make decisions or it would delay the project”; "...a workshop and that we would invite 48 people from around the country to come together and share their knowledge, experience within waiting list management". The data gathered during the workshop was analysed to inform the Protocol – “data was taken away, it was analysed, and it was reported back within three weeks”. The Protocol was formally launched in January 2017, but information sessions continued until May 2017 which ended this Phase - “the protocol was endorsed and signed off at the end of December 2016, it was launched in January 2017”. “That then means the protocol is done by the middle of May 2017 all the information sessions will be complete”.

2) Phase 2, Toolkit. This Phase began before Phase 1 was formally completed because of the length of time it took to communicate the Protocol across the country. However, when this stage began the Protocol was officially launched - “so now we are starting on Phase 2 – the tool-kit started at the end of December....”; “the protocol was endorsed and signed off at the end of Dec., it was launched in Jan." The toolkit phase is comprised of several activities focused on building two strands, an administration and technical strand - “So, the tool-kit at the moment is developing in two strands: an administrative strand and a technical strand”. The focus for this stage is to develop the necessary tools to fulfil the Protocol as
identified during Phase 1 when the team were developing the Protocol - "Going through the protocol process it became apparent what are the tools we need to implement this protocol". This stage began with the team acquiring information on existing administration and sourcing additional capability for the technical strand – “Before Christmas I asked each of the steering group representatives to nominate somebody from their group that was involved in communicating with patients. So, I have a smaller group of six or seven people that are involved in scheduling patients changing or cancelling appointments and validating them. We haven’t had a meeting, yet it has all been done on the email, so I have gathered samples from each of the sites involved”; “…we are commissioning consultancy to help us with that, they are, at the moment, scoping that, and it is due back to me by the end of next week”. This stage progressed with the team selecting three patient correspondences and testing them their effectiveness - "We are starting with just three letters (administration strand) and at the moment we are taking bits from a couple of the different letters"; “we are due to start researching which correspondence is more effective and that is actually due to start now between August and Sept”. The technical strand is currently on hold because of a change in CEO who has a different opinion on how that strand should be developed – “Now we did develop that part of the project and then we changed CEO and our new CEO has a difference of opinion in terms of how we should develop it”. This stage will continue until the team have implemented all elements of the tool-kit.

3) Phase 3, Training: This third Phase concerns the design and implementation of a training programme to support the toolkit which will fulfil the Protocol - “The 3rd piece is to provide training and developing around the protocol and we are in the design phase of the T&D programme”; “Before the end of the year October-December will be training”. There is no data available for the range of activities to complete this stage.
The successful completion of key activities also enabled progress in the innovation process of which the team mentioned several: meetings with Steering Committee – “a high-level decision body”; a workshop – “so we used lean tools and methodology, we had a lean facilitator and all of that data was taken away, it was analysed and it was reported back within three weeks”; information sessions - So, the roll-out involves a number of information session which I am facilitating around the country”; and toolkit related activities – “ I have gathered samples from each of the sites involved... I am going through them at the moment”; “They are ... scoping that and it is due back to me by the end of next week”. While the data related to activities is very brief there are elements of exploration and exploitation type behaviours associated with them.

4.5.9. Team nine

4.5.9.1. Team and innovation context

Team nine consists of a core group of four members with an extended team of contractors and stakeholders working together for the exclusive purpose of this project. This group has not worked together before but believe they have good working relationships - “we are a team who by and large haven't worked together before”; [Project managers] are relatively new [to the company], this is the first time we have worked with the consultants ... We are a small enough team and because of the type of environment .... we have ALOT of stakeholders”; “we have all stakeholders involved, initially the workshops were concise but now they are expanded ... the stakeholders circulation list has increased or widened”. They are working on a construction project commissioned by their client which affects multiple stakeholders both on the client site and beyond, into the surrounding community and environment, as well as national tourism - “We have such a wide community interested in what we do, people want to have a say in what we so we are under a lot of scrutiny”; “agendas, wants and needs, they are all relevant, every suggestion put forward from a stakeholder ... are all extremely valid
.. you have to risk assess and prioritise them and there is huge client buy-in”; “you have external stakeholders as well, statutory authorities, county council, the EPA, Irish Water, and they bring an external influence on the project as well”.

The team seek to explore issues, narrow and resolve for progress – “we are tasked with keeping it focused, keeping it on-programme, online, and on-stream, so we are quite innovative in how we respond to things, how we build phase, how we have gotten it through senior management approval…”; “you listen to them and map them out, just present the different issues and prioritise through a matrix or table form and it is the pros and cons against the issues and hopefully you will get it narrowed down to an extent that ultimately everybody will buy in to a final layout”; “so it was getting them all together into the one place and then putting them into smaller groups of issues that you can then resolve and then those meetings would be very targeted for a specific issue that requires inputs from three or four stakeholders”: “..then we present both sides and regardless of the disagreement or conflict it is not like meetings end up in a big chaos but keep it at a level where we can agree or disagree and allow someone else to decide”. They believe their ability to define and maintain focus on the ultimate goal helps them navigate the process - “you have to have your eye on the ultimate deliverable .... ultimately you have to be able to see that end goal, that end target and that has to be your focus right the way through regardless of what obstacles come your way or how innovative or creative you get in getting over those obstacles, that is what I see as the day to day job of an engineer just getting over those obstacles whatever guise they come in”; they emphasish the value on managing all stakeholders expectations and being able to listen and communicate effectively with all involved - “you have to make them feel important, if you dismiss someone from the off they are going to be difficult, if you hear their problem and you put it on the table, it will elevate and escalate and maybe try to understand their ultimate goal and if you reciprocate that concern
you are going to get quicker buy-in”; the team have a range of expert skills - “so [three team members are engineers and [person] is a planner, so we have different skills”; and they recognise the value in building a good reputation through their collaborative working nature - “I think it is very important when we have these big workshop that in the way you talk and communicate with people that you listen to everybody, you don't cut anybody off, you let everybody get their word and say what they need to say and then I think everybody understands that this is a process and I think that if everybody got everything they wanted every time I think it would be boring really”;

“We are getting good feedback from across the business about how the project is being managed as a whole”.

4.5.9.2. The innovation process

Team nine’s project has five distinct stages as defined by the team: feasibility; tender for consultant; outline design 30%; outline design 100%; tender for construction. - the stages of the process were: the feasibility design would have been done last summer, and then the tendering process for a consultant to do the design phase would have been carried out at the end of last year and [consultant] were appointed in April, .... Then they begin the outline design phase to develop the design fully because feasibility is a high-level design and that is where they are at the moment and once it is completed at the end of summer then they will go into more detail with the design as we also start the procurement process for the contractor to build the works next year.

Each stage contains a phase for exploration followed by a phase of exploitation:

1) Feasibility – for this first stage the team does not describe the feasibility study but merely stated it purpose and time-scale. However, it is implied in the transcript that this stage comprised a period of exploration to gather information followed by a period of exploitation to narrow options and achieve consensus - “Feasibility
study was carried out before Christmas (2016)”; “you would've justified that brief in that it can be delivered ultimately ...”; they would have taken the design to a certain level, approved that the concept is deliverable and budget estimates would have being prepared on that to make it stack up and make it viable and get it past the capital clearing house to fund the project which leads into the tendering and appointment of the consultant to get it to validation/feasibility stage and outline design”

2) Tender for consultant: this stage was not described during the interviews, but it is assumed they sought options for a consultant using the information from the feasibility study and selected a consultant from those who expressed an interest.

3) Outline design 30%: This stage began with a period of exploring options for the design and gathering information that informs the design before switching to a phase of converging options and gaining consensus - “you can say this is like a funnel, initially it is very broad, you have a lot of options and you try to narrow it more and more and before we move we believe the outline design is not all the way through the funnel but based on all the discussion you say, this is not, this is not, and you still need to refine some of that further, but now you know more precisely what way the water is running - you are getting down to that one route forward”. During this stage it was commented that the first task for the contractor was to validate the feasibility study - “so [contractor’s] first task was to validate that feasibility design and comment on that”. Within this stage there was the activity of gaining planning permission. This was an iterative process in itself - there is a planning process that sits along-side that as well, ... so there is an iterative process at the moment ... that will culminate in a planning submission of sorts ... and then once I complete, I hand back to the team to say go forward to final design and build.

4) Outline design 100%: This stage began with a phase of gathering opinions and acquiring additional information about the outline design (30%) from various stakeholders before analysing this
information and capitalising on it to reduce variability and seek consensus – “around 12th Sept we had that outline presentation - we did a presentation on the outline design to all stakeholders and following that we released all outline design drawings, documents, technical notes and memos to the stakeholders for comment, we collated all those comments and presented an outline design at an outline design workshop and they bought some of their more pertinent issues to that workshop and then in the weeks preceding that we closed out those comments and we are at the stage where it is frozen”.

5) Tender for construction: This stage began with a phase of exploring the market to attract options and finish with a phase of decreasing variability and gaining consensus - we will go out to the market - the European tender regulations and pre-qualifications and send out - it is a feeler to the market to see who would be interested in this project and we give a brief summary of that - they submit and we can narrow it down to six suitable tenderers and then we release the reference design with employer requirements to those select few at that point "and you can then cut out ones that are not suitable going forward and in that way your tender process with Design & Build contractors is much narrower”; “they all sign a pre-construction agreement with those selected tenderers where we actually pay them a sum of money for the time to develop a design and tender and take our reference design and flesh it out and be able to demonstrate that they can deliver".