THE LEADERSHIP OF INNOVATION IN BRITISH SMALL TO MEDIUM SIZED SOFTWARE ENTERPRISES

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ABSTRACT

This thesis describes qualitative research into the experience of executive leaders and software engineers engaged in innovation in British small- and medium-sized software enterprises (SMSE). It asks, “How are executive leaders of British SMSE perceived to influence the innovative work behaviour of software engineers?”. Executive leaders, software engineers, and private equity (PE) investors were interviewed, and the data transcribed and coded using constructivist grounded theory methodology (CGTM) (Charmaz 2014). Coding revealed new insights into innovation leadership in SMSE.

Theory suggests innovation is important to firm survival and success (Pisano 2019). Leader support for creativity and innovation in software firms is considered strategic (Florida and Goodnight 2005). However, executive leaders in this study were concerned with cash generation, primarily focusing on customers and funders. Once firms established product market fit, innovation became incremental, focused on features, functions and processes. Leaders were transactional (Bass 1985) and instrumental (Antonakis and House 2014) in their interaction with engineers and did not try to influence creative climate (Amabile 1996; Ekvall 1996), pursuing exploitative incremental innovation and rarely considering exploratory innovation (Tushman and O’Reilly 1996).

Software engineers had little interest in commercial matters, but favoured innovation, particularly if it allowed them to use new tools, techniques, and languages. They embraced technical change but were less comfortable with cultural change. They did not establish close relationships with their leaders and saw them as being responsible for providing resources to enable objectives to be achieved.

PE investors aspired to invest in firms that had established product market fit and were focused on growth and margin improvement. They rarely supported innovation requiring additional funding or not focused on improving short-term competitive advantage or margin. They preferred working with executives focused on delivering the original investment thesis and so tolerated incremental innovation but were less supportive of explorative innovation.

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GLOSSARY OF ACRONYMS

1IR	First industrial revolution
2IR	Second industrial revolution
3IR	Third industrial revolution
4IR	Fourth industrial revolution
AI	Artificial intelligence
B2B	Business to business
CAGR	Compound annual growth ratye
CAQDAS	Computer Assisted Qualitative Data Analysis Software
CEO	Chief Executive Officer
CGTM	Constructivist Grounded Theory Methodology
CLB	Closing leader behaviours
CIO	Chief Information Officer
COO	Chief Operating Officer
EBITDA	Earnings before interest, taxes, depreciation and amortisation
GTM	Grounded Theory Methodology
HPWP	High performance working practices
HR	Human resources
HRD	Human resource development
HRM	Human resource management
ISO	International Standards Organisation
IWB	Innovative work behaviour
MIRP	Minnesota Innovation Research Project
MIT	Massachusetts Institute of Technology
NSI	National Systems of Innovation

OECD	Organisation for Economic Co-operation and Development
R&D	Research and development
SAPPHO	Scientific Activity Predictor from Patterns with Heuristic Origin
SIC	Standard industrial classification
SME	Small- and medium-sized enterprise
SMSE	Small- and medium-sized software enterprise
SPRU	Science Policy Research Unit
OLB	Opening leader behaviours
O&W	Organisation and work
RSA	Royal Society of Arts, Manufactures and Commerce
SaaS	Software as a service
UK	United Kingdom
US	United States (of America)
WW1	World War 1
WW2	World War 2

1 INTRODUCTION

1.1 Background to the research

For the last 30 years, I have run technology businesses. Some of these ventures resulted from my own entrepreneurship, others were turnarounds helping external investors and management teams to ensure survival and value creation. Whether these firms were large, small, domestic, or international, I always tried to create an environment supportive of innovation. My personal belief was making time and resources available for innovation would result in competitive advantage and deliver value for all stakeholders. I justified this belief by pointing to the positive investment returns achieved on exit. However, I never rigorously questioned whether this correlation truly represented cause and effect.

My own experience led to a curiosity about other businesses and how they are run. Do other chief executives see innovation in the same way that I do? How do they interact with their software engineers and investors to promote a creative climate that favours innovation? Is the case for investment in innovation universally accepted? These and many other questions led me on a quest for knowledge that started with a master’s degree in the leadership of innovation and change, continued into wider but unstructured reading, and ultimately brought me back to the Business School at York St John University to embark upon research into leadership of innovation in the types of business that I typically work with. The result is this research.

1.2 Research question

This introductory chapter outlines a doctoral thesis to understand the inter-subjective socially constructed perceptions of executive leader influence on software engineer followers engaged in innovative work behaviour in British small- and medium-sized software enterprises (SMSE). This research asks,

> How are executive leaders of British SMSE perceived to influence the innovative work behaviour of software engineers?

The research explores this question of perceived influence through semi-structured interviews with executive leaders, software engineer followers and external private equity investors.

The question was refined over several months of contemplation and debate with my supervisors, other students, and academics working in the areas of leadership and software innovation. Like many PhD students before me, my initial approach was too broad and lacked focus on a single element of innovation and leadership within software firms.

What executive leaders of SMSE think, say, and do may have both direct and indirect implications for software engineers within those firms. This research seeks to develop a critical understanding of the influence and impact of executive leaders on innovation within their firms and focuses on the self-perception of the leaders and the perceptions of software engineers. Whilst many people in any organisation may be involved in innovation, within an SMSE, the creative act of writing software to deliver defined functionality rests with software engineers and so they are the authors of software innovation within their firms. The extent to which leaders influence their innovative work behaviour may be significant for theory and practice and so subsidiary questions to the main research question are also posed:

> What do executive leaders believe that they do and say to influence the innovative work behaviour of software engineers within their organisations?
>
> What do software engineers believe that executive leaders do and say to influence their innovative work behaviour?

The research started by seeking to understand innovation leadership from the perspectives of both the executive leaders and the software engineers that work with them.   The research uses Constructivist Grounded Theory Methodology (CGTM) to perform a qualitative analysis of interview data exploring the intersubjective experience of executive leaders and software engineers. Later in the research process, CGTM coding highlighted that leaders who ran private equity (PE) backed firms displayed some different behaviours to owner-managers. PE investors typically stay close to the firms and the executive leaders that they invest in but occupy a position of being slightly detached observers. They have influence on the activities of executive leaders. Through the board and other controls associated with their investment, they have the power to directly influence the innovation agenda of firms that they invest in. Therefore, the research was extended to include interviews with PE investors who had experience of investing in British SMSE. In probing the similarities and differences between owner managed and PE backed businesses, the research also asked, In those SMSE with external private equity investors, are there specific behaviours and experience related to the leadership of innovation that the investors explicitly select for when recruiting executive leaders to run their portfolio SMSEs?

Do the behaviours and experience that private equity firms identify as important in executive leaders differ from the behaviours, traits and experience found in owner-managers?

Does firm size and ownership influence the innovation leadership behaviour of SMSE executives?

The interviews probed how software engineers think and feel about their interaction with executive leaders, and the way in which they believe executive leaders impact their environment and their innovative work behaviour. The research seeks to understand how the leaders themselves feel about this interaction, to assess how conscious they are of what they say and do and how aware are they of the impact that they have on the innovative work behaviour of software engineers. This goes beyond direct influence and personal interaction. It also encompasses other aspects of leader influence including resource allocation, culture, and climate.

In summary, the research seeks to develop a critical understanding of:

- The extent to which executive leaders of SMSE influence the innovative work behaviour of software engineers.
- What executive leaders of SMSE think, say and do that influences the innovative work behaviour of software engineers.
- What software engineers think and feel about the efforts of executive leaders of SMSE to influence their innovative work behaviour.
- How executive leaders of SMSE think and feel about their interaction with software engineers and the effect of their actions on the innovative work behaviour of engineers.
- The attitudes of private equity investors towards the leadership of innovation in portfolio SMSE.
- What the impact of the interactions between executive leaders of SMSE and software engineers might be for innovation within their firms.

The perspectives that are reflected in this research are those of the executive leaders themselves, the software engineer followers, and PE investors who provide funding to SMSE and exercise power and influence through the board and other interactions with executive leaders.

1.3 Small and medium sized enterprises

SMSE are a subset of small- and medium-sized enterprises (SME). For purposes of definition, The Companies Act 2006 (2015 revision) defines SME as meeting two out of three criteria: annual turnover of less than £35m, fewer than 250 employees and gross assets of less than £18m (UK Government, 2006, s382 and s465). All the SMSE in this research qualify as SME under the definition provided by The Companies Act 2006 (2015 revision). In addition, all the firms involved in the research provide business to business (B2B) software rather than consumer software. The firms had all been established for at least five years at the time of interview, and so were beyond the start-up phase. The firms have all achieved a degree of commercial success measured in terms of revenue growth and increasing market share in their niche markets and all were still trading at the time of submitting the thesis.

1.4 The intersubjective experience of executive leaders and engineer followers

The starting point for the research is that in fulfilling the responsibilities of their roles, executive leaders analyse the internal and external environment and respond to that by making statements, engaging in conversations, and performing actions in response to their analysis. They lead and manage their organisations based on their view of their organisation, the market, and the requirements of other stakeholders. In turn, the decisions that they make and the actions that they take may have an impact on all aspects of the organisation, including the innovative work behaviour of software engineers and the physical environment, culture, and climate within which they work.

Software engineers engaged in innovative work may be subject to a variety of influences. Rather than trying to establish cause and effect of specific mediating and moderating variables, this research seeks a critical understanding of the role that leaders play in influencing the innovative work behaviour of software engineers. These influences may result from what engineers see and hear from their executive leaders, interpreting and attaching meaning to the signals that they receive and taking actions which might have a positive, negative or directional impact on innovation outcomes (figure 1.1, below). They may also result from indirect leader influences and aspects of culture and creative climate which might be affected by leader behaviour.

Figure 1.1 Perceptions of executive leaders and software engineer followers engaged in innovative work behaviour

1.5 Why study SMSE?

Aside from my own curiosity born of professional involvement in the industry, I believe that the economic and social significance of SMSE make them worthy of greater scholarly attention. The Tech Nation Report (UK Government 2020a) shows that almost three million people are employed in the UK digital economy. In 2019, the UK software market was a $23.7 billion industry with an expected compound annual growth rate (CAGR) to 2024 of 12.3%, ranking second in Europe to Germany which had a software market value of $27.9 billion (MarketLine 2020). In economic terms, the UK technology sector is the largest in Europe and is a market leader in many areas of software development (UK Government 2020a).

Some researchers have stated that innovation is important to the competitiveness and survival of SMSE (Pikkarainen et al. 2011). Innovation may help SMSE to differentiate and defend margins (Rose 2010). It may also improve competitiveness, resulting in increased market share and driving growth, although it has been noted that SMSE may be more focused on defending an existing market position (Heirman and Clarysse 2007; Cooper 2011 and 2012). SMSE do not usually have the resources to afford separate research and development (R&D) facilities (Love and Roper 2015), and so understanding the leadership of innovation in SMSE has strategic importance.

Given the economic, practical and social significance of SMSE, it seems worthwhile for both academic theory and business practice to explore the extent to which leaders of SMSE may be able to contribute to the development of a culture and climate within their organisations that encourages creativity and innovation among software engineers and to understand how leader behaviour might influence the innovative work behaviour of software engineers.

1.6 The research

The fieldwork involved interviews with 14 executive leaders, 13 software engineers, and seven PE investors. The 12 SMSE in the research had been established for between five and 25 years (i.e. not early stage start-ups) and all provided B2B software either under a licence model or software as a service (SaaS). The seven PE firms are well-established UK based mid-market investors that have made multiple technology company investments. Some of the SMSE had been funded entirely by the founders, others had received one or more rounds of venture capital or private equity funding. Each of the firms has achieved a degree of commercial success within their market niche measured in terms of revenue growth and increasing market share.

The resulting narrative data from the interviews was transcribed and coded using constructivist grounded theory methodology (CGTM). The research did not commence with the intent to interview a defined number of participants. Instead, as described in more detail in Chapter 5 on methodology, interviews and analysis continued until a point of saturation had been reached, when no new themes were emerging from the data.

Gaining access to executive leaders across multiple firms to study leadership processes is considered difficult (Caridi-Zahavi, Carmeli and Arazy 2016). Although scholars link firm performance to executive leadership through upper echelon theory (Hambrick 2007), establishing specific cause and effect on the ways in which leadership behaviours influence innovation seems to be an area that requires greater research attention (Felekoglu and Moultrie 2014).

1.7 Originality of the research

The originality of this thesis is three-fold. First, leadership and innovation have been studied in a variety of different organisational contexts, but specific focus on the software development industry is recent (Rose, Jones and Furneaux 2016). This research is original and unique in addressing the question of executive leader impact on the innovative work behaviour of software engineers in British SMSE. Secondly, British SMSE are economically important but have not been studied in detail. Most innovation leadership research into technology firms is focused on large organisations (Koberg, Detienne and Heppard 2003; Rose, Jones and Furneaux 2016). SMSE have attracted little primary research (Carlo, Lyttinen and Rose 2011) or inter-disciplinary cross referencing (Rose, Jones and Furneaux 2016). Unique sector attributes mean SMSE are worthy of specific attention (Rose, Jones and Furneaux 2016) and exploring innovation leadership in these firms is a nascent area. Finally, the research that does exist into software firms generally takes a positivistic stance (Jantunen and Gause 2014) and research into smaller firms is often approached using the dominant quantitative and positivistic methodologies typically applied to larger organisations (Hill and Wright 2001). Taking a less common qualitative and inductive approach might reveal depth and nuance within the data.

1.8 The findings

Although clear themes emerged from each of the groups of stakeholders interviewed, it must be acknowledged that this relatively small sample may not reflect the experiences of other individuals working in other organisations. The theoretical discoveries of this CGTM research are substantive but can only claim validity in the context of this specific group of SMSE. Significantly more research using a variety of other methods and perspectives would be required to build from the ideas presented in this thesis to start the process of developing a general theory of innovation leadership in SMSE. The findings of this research can be summarised from the perspectives of each of the interview cohorts.

The executive leaders of British SMSE interviewed expressed a primary concern about cashflow and survival. Their focus was on exploiting product market fit for existing software products and organisational competencies, rarely having the time, resources, or inclination to pursue exploratory innovation. They displayed a limited but varied understanding of established theories of innovation leadership. Although they lacked a common vocabulary for leadership theory, they each discussed using leadership styles and management techniques in their day-to-day interactions with software engineers and other stakeholders. Despite a contemporary theoretical focus on authentic leadership (Cashman 1998; Luthans and Avolio 2003; Avolio and Gardner 2005) and transformational leadership (Bass 1985; Bass and Avolio 1990; Judge and Piccolo 2004) in the literature, the leaders interviewed for this research did not generally present themselves as authentic or transformational. Rather, they could best be described as approaching the leadership challenge with pragmatism and endeavouring to be resourceful in their efforts to support innovation within their own software teams. Their innovation leadership interventions seemed to be mainly reactive using their management skills and authority to ensure adequate resources were available to software engineers and demonstrating aspects of instrumental leadership (Antonakis and House 2002, 2004 and 2014). Occasionally, both leaders and followers discussed examples of behaviour that could be interpreted as transactional leadership (Dansereau, Graen and Haga 1975; Bass 1985) through the provision of contingent rewards.

The leaders were generally outward looking and spent most of their working time with customers and external stakeholders as they focused on revenue and funding. Consequently, their day-to-day interaction with the software engineers was sporadic. Personal contact was often based on group interactions such as team meetings or project reviews. Email was often the primary communications medium used to provide direct instruction or feedback on software functionality and quality to software engineers. Some leaders suggested their use of email as a primary communication medium resulted from being in different locations to engineers, but the use of email was also prevalent where leaders and engineers were in the same small office. In most firms, there was little evidence of significant in person contact between the leaders and the engineers and the relationships were mainly relatively formal despite the small size of the businesses.

The interview narrative of the executive leaders of PE backed businesses within the research sample displayed more evidence of knowledge of established leadership theory than owner-managers. These PE backed executives discussed being conscious of their personal impact on software engineers. Owner-managers expressed an acceptance of talent churn, viewing software engineers as replaceable and their services as a factor of production. PE backed executives showed more evidence of active consideration of retaining and developing talent and displayed some understanding of the business impact of talent churn.

The software engineers interviewed were mainly focused on self-actualisation (Maslow 1943) within an environment that allowed them to pursue their intellectual passions for problem solving and writing elegant software. They were not primarily commercially motivated and many of them seemed relatively uninterested in the commercial aspects of the businesses that they worked within. Beyond the hygiene factor (Herzberg 1966 and 1968) of receiving an adequate competitive regular salary for their labour, their main motivations related to the software and tools that they were able to use, the quality of software that they had time to produce, and the culture of their working environment. Most of their creative and innovative efforts related to meeting immediate client needs and making improvements to exploit existing applications rather than exploring new product or new process innovation opportunities. Most of the engineers projected an almost indifferent view to the behaviours of their business leaders. Despite many of the owner-managers starting their careers as software engineers, there was usually little evidence of close collaboration or empathy between the two communities. Nor was there evidence of loyalty and most of the software engineers said that they would be willing to move to another firm within a reasonable distance of their existing home if more interesting (rather than better paid) work were available.

PE investors were interviewed towards the end of the field research. CGTM coding highlighted differences in leadership approach by owner-managers and PE backed executive leaders, and so PE investors were identified as a potentially interesting source of incremental data. They expressed a preference for backing businesses that have already established product market fit and can grow through execution or further complementary acquisitions. Interviewees suggested that the preferred model for PE is to find software businesses with proven leadership, but they often found that owner-managers struggled with various aspects of the transition from personal ownership of the business to PE ownership. Consequently, all the interviewees had experience of replacing executives post acquisition. In these cases, they were less concerned about the technical skills or market knowledge of the incoming executive leader, and more concerned with prior leadership experience within a PE backed business. They felt that this focus on hiring proven and competent managers explained some of the differences that were noted in the behaviours and competences of the PE backed executives compared to the owner-managers. Although some of the PE executives interviewed had higher degrees in business and management, they did not display a significantly deeper knowledge of leadership theory than the executive leaders interviewed. Given their explicit focus on hiring the right leader for their firms, it was interesting to note the limited formal knowledge of leadership theory.

None of the investors interviewed claimed to be looking for transformational leadership traits in the executives that they hired to run their businesses. Instead, what they were really looking for was proven competence to execute and a realistic and honest approach to dealing with investors and the board of directors. Execution credentials and management competence seemed more important to the PE investors than leadership traits, skills and behaviours.

1.9 Theory of innovation leadership in SMSE

The purpose of using CGTM is to construct theory (Charmaz 2014). The analysis of the narrative content from the interviews has indicated a theoretical construct of leadership in SMSE which differs from the literature and is described in detail in chapter 7 and summarised in diagram (figure 1.2) below.

The literature suggests that innovation is strategically important to the long-term success of firms (Pikkarainen et al, 2011; Pisano 2019). Organisations are counselled to consider an ambidextrous approach to innovation, innovating to exploit their existing capability whilst simultaneously exploring innovation streams that will deliver future value (Tushman and O'Reilly 1996; Govindarajan 2016; Govindarajan and Tangri 2020). Innovation leaders are thought to employ a variety of leadership styles and behaviours (Oke, Munshi and Walumbwa 2009), employing open (Zacher and Rosing 2016) and divergent (Van de Ven 2017) leader behaviours to encourage exploratory innovation. Organisational leaders in large organisations have been demonstrated to undertake multiple innovation leadership roles to help shape and influence innovation progress (Van de Ven et al. 1999). Leader influence on culture and climate is thought to enhance creativity and support innovation (Amabile 1996; Ekvall 1996). Organisations are encouraged to create processes to capture and prioritise innovation ideas (Oke and Goffin 2001; Goffin and Mitchell 2017).

The model of innovation leadership in British SMSE constructed from the CGTM analysis suggests that British SMSE leaders are primarily focused on cash and cashflow, have a strong external focus on customers, investors and financiers, and so consequently do not spend time personally engaging with software engineer followers. The short-term focus on cash and cashflow mitigates against exploratory innovation. SMSE leaders do not typically attempt to influence culture or creative climate to support innovation and seem unaware of innovation leadership theory. Leaders are primarily instrumental and transactional, and display closing and convergent behaviours which discourage exploratory innovation. Leaders do not undertake a variety of innovation roles, primarily acting as institutional leaders and occasional critics. SMSE do not develop formal ideation and innovation processes to capture ideas and prioritise innovation. SMSE innovation is reactive, based on specific customer or market feedback and so is exploitative and incremental within a path dependent trajectory.

THEORETICAL PERSPECTIVE	OBSERVATIONS FROM RESEARCH	IMPLICATIONS
Innovation is strategically important (Pikkareinen et al. 2011; Pisano 2019).	Considerations of cash and cashflow dominate the perspective of SMSE leaders.	SMSE leaders develop a reactive approach to innovation based on customer feedback.
Firms should pursue exploitative and exploratory innovation simultaneously (Tushman and O'Reilly 1996) Firm should innovate for the future (Govindarajan 2016; Govindarajan and Tangri 2020)	SMSE leaders focus innovation efforts on exploitative innovation to improve software feature functionality in response to customer requests. Leaders do not provide adequate budget or resource to support exploratory innovation.	SMSE innovation is incremental.
Leaders employ a variety of leadership styles and behaviours (Oke, Munshi and Walumbwa 2009), employing open (Zacher and Rosing 2016) and divergent (Van de Ven 2017) leader behaviours to encourage innovation and undertake multiple innovation leadership roles (Van de Ven et al. 1999)	Leaders are primarily instrumental (Antonakis and House 2014) and transactional (Bass 1985). Leaders use closing (Zacher and Rosing 2016) and convergent (Van de Ven 2017) leader behaviours and act primarily as institutional leaders (Van de Ven et al. 1999).	SMSE focus on incremental and exploitative innovation within a path dependent trajectory.
Leaders can influence culture and creative climate to enhance the creativity and improve the innovative work behaviour of followers (Amabile 1996; Ekvall 1996)	Leaders pay limited attention to culture and creative climate and are not reflexive.	SMSE leaders engage in infrequent and low quality LMX (Denti and Hemlin 2016) with software engineers mediated by email or in group meetings.
Firms should establish innovation processes to capture and prioritize innovation (Goffin and Mitchell 2017).	There is no formal process to capture and prioritize innovation ideas.	Limited incremental innovation is undertaken within a path-dependent trajectory

Figure 1.2 Components of innovation leadership in British SMSE

The incremental and exploitative approach to path dependent innovation has sustained the SMSE within the research sample and allowed them to grow and defend market share and revenue over the medium run and in some cases, longer. However, SMSE in this sample are niche suppliers and typically supply a single product or platform to a well-defined market segment or sector. The approach to innovation ignores the threat of significant changes in the external environment. Data available from central Government (UK Government 2019) demonstrates the short life-expectancy of SME in the technology sector, with many failing in the first two years and few surviving beyond five years. There are many reasons for small firms to fail, but perhaps one is that without scanning the horizon and pursuing some exploratory innovation, they are ill-prepared to adjust to changing market conditions and can be too easily swept aside by the "*gale of creative destruction*" (Schumpeter 1942, p.82).

This model of exploitative incremental and path dependent innovation works for some firms some of the time and brings great focus to the early stage of development once the firm has found product-market fit. However, as the firms mature and cashflow pressures ease, then there may be a case for considering alternative approaches to innovation that include an exploratory agenda that is best served by open and divergent leader behaviours.

Some theoretical constructs of innovation leadership have been logically deduced in a syncretic model of innovation leadership, which is proposed in chapter 4. The research was not designed to test for the existence of such constructs and the model was developed at the time of the literature review and after the field research. The constructs of innovation leadership evident in the narrative data were labelled Project and Tactical Innovation Leadership and are coloured green in the diagram below (figure 1.3). The syncretic model suggests that more constructs could theoretically exist, and these could be appropriate for different stages of SMSE development.

Caridi-Zahavi, Carmeli, and Arazy (2016) have previously discussed a construct of visionary innovation leadership evident in Israeli SME. Like the proposed syncretic model, their construct of visionary innovation leadership manifests through vision and enactment of vision through leadership behaviours. However, Caridi-Zahavi and colleagues focus on the impact of connectivity and knowledge integration on product quality, product innovation and development speed. The focus of the syncretic model described in this thesis is more clearly defined in terms of leadership styles and behaviours and the inter-subjective experience of executive leaders and software engineer followers.

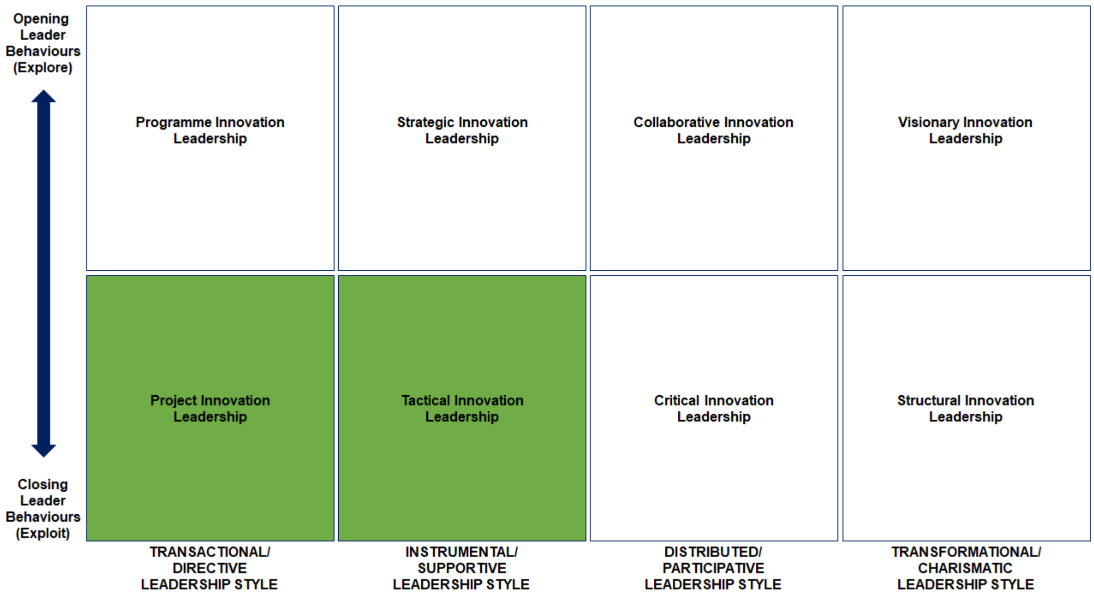


Figure 1.3 Syncretic model of innovation leadership

1.10 Contribution to knowledge

This research has identified phenomena that challenge elements of existing innovation leadership theory and so contributes to academic knowledge on innovation leadership by exploring the specific contingent situation of British SMSE. The literature assumes that innovation is important to the survival and success of firms and encourages leaders to support an ambidextrous balance of exploitative and exploratory innovation. In this research, cashflow and cash generation dominated the attention of executive leaders and they had limited engagement with software engineers which was mainly conducted via email. Despite this, once the firms in this research had established product market fit, they were able to survive and grow in the medium run through modest incremental path dependent innovation, typically responding to customer feedback and market demand. Whilst this may seem to challenge existing theory, there is a question of timing to address. These firms were born from novelty, adaption and disruption. As start-up firms, the leaders were focused on establishing product market fit for their new businesses. In the start-up phase, founding entrepreneurs and owner-managers discussed managing cash with great parsimony until they found product market fit and were able to attract external investment and bank debt. This focus on cashflow and cash generation seems to be a healthy survival instinct but also seems to dominate leader thinking long after their firms have become profitable and cash generative. As SMSE mature, there is the risk that market requirements may change, or competitors may start to erode their market position. Without a longer-term strategic horizon and no thought or investment into innovation to develop future trajectories, then a firm may ultimately perish.

The research draws attention to the relatively low levels of theoretical awareness of leadership theory in smaller British software firms. Despite the industry that has grown up around leadership education, consulting and publishing, leaders and investors in this market were relatively unaware of innovation leadership theory and did not frame their decisions or perspectives in a theoretical context. For PE investors working on a relatively short investment horizon then a simplistic view might be that maximising earnings in the short term best serves value creation objectives at exit. However, it might equally be argued that selling an SMSE that has resilience because it takes a longer-term view and has proven innovation capability is value enhancing beyond existing earnings multiples. From a leader perspective, reducing strategic fragility by creating adaptive potential through exploratory innovation may give the business longevity. Reaching this fragmented community is challenging for academics and educators.

At a practical level, this research may be helpful to SMSE leaders and their software engineer followers by bringing attention to alternative innovation leadership approaches. Secondly, PE companies may find the observations helpful when analysing and directing the SMSE that they invest in. Finally, the thesis may be valuable to policy makers as the British Government continues to promote the national economic importance of software within the creative industries. These practical and policy implications are discussed further in chapter 7.

1.11 Structure of the thesis

The structure of the thesis is traditional. However, the order of the chapters belies the true sequence of activity. Glaser and Strauss (1967) counsel us to bring as little as possible into grounded theory research. Rather than conduct a thorough literature review prior to commencing field research, I researched the literature as I performed the coding and analysis of the data. This approach is regarded as methodologically sound in grounded theory research (Urquhart and Fernandez 2006). Therefore, although the literature review appears in the thesis prior to the chapters on methodology and findings, the literature presented here was evaluated and synthesized after completion of the field research and in parallel with writing up of the results.

Consistent with grounded theory methodology, memos were created throughout the analysis of the interviews. Some of these influenced the theoretical sampling, some helped to build categories and themes and others informed the literature review chapters. A selection of memos is included as appendix 10, many of which are explicitly referenced in the theory building of chapter 6.

The structure of the thesis is described below by chapter.

Chapter 1 introduces and explains the background to the research. It defines the research question and objectives and explains why the research is unique and how it contributes to academic knowledge and practice. It provides a summary of the conclusions drawn from the research. It then outlines the structure of the thesis.

Chapter 2 constitutes a review of innovation studies literature. The literature provides historical context from the pre-industrial era through to the current day but focuses mainly on developments in theory since the early 20th century. The reason for starting the review so early in the history of innovation studies is because the SMSE of our fourth industrial revolution seem to have parallels with the atomistic businesses of the 19th and early 20th century described by Schumpeter's (1912/1934) early work. The chapter establishes a common vocabulary for discussing innovation and provides a theoretical framework that gives context to the research.

Chapter 3 considers creativity as an antecedent to innovation. It introduces theory and research on culture and creative climate and discusses selected seminal literature on how leaders influence the culture and creative climate of organisations. It also introduces some of the more recent research on climate, mood and creativity specific to software development and creative enterprises.

Chapter 4 reviews innovation leadership literature. It provides a brief introduction to general leadership theory before discussing how some of the major leadership theories have been applied to innovation leadership. The chapter notes the limited range of extant literature specific to SMSE, and so draws on wider innovation leadership literature. Although much of the literature relates to analysing specific mediating and moderating variables, there is an increasing recognition of the integrative nature of leadership theory. In this spirit, a logically deduced syncretic model of innovation leadership is proposed that might find practical application in SMSE.

Chapter 5 explains how and why the specific research methodology of Constructivist Grounded Theory Methodology (CGTM) was selected. It also discusses epistemological and ontological issues in relation to CGTM and acknowledges the academic debate about limitations of the chosen methodology. The chapter describes the research process in detail.

Chapter 6 describes the findings of the research in the context of each of the research cohorts (executive leaders, software engineer followers, PE investors) before analysing and synthesizing their perspectives and identifying 23 themes.

Chapter 7 discusses the findings in detail, relating them back to the literature. It also considers implications of the findings for theory, practice, and policy. For executive leaders, it provides a reflection on how theoretical perspectives of leadership compare to the actual experience of those interviewed. For software engineers, it provides commercial and social context for the environment within which they work. For investors, it discusses issues of strategic alignment around innovation. For Government and policy makers, attention is drawn to aspects of support, investment stimuli and education that are indicated by the insights gleaned from this research cohort.

Chapter 8 summarises the findings and assesses the contribution to knowledge made by the thesis. It considers the methodology and notes limitations of the research before proposing further avenues for potential research into the leadership of innovation in SMSE.

2 INNOVATION STUDIES

"A desire to innovate all things moveth troublesome men."

(Calvin 1561)

2.1 Chapter introduction

This chapter discusses definitions of innovation that have been offered by academics, business writers and research organisations. It then explores the history of innovation studies, beginning in the pre-industrial era but primarily focusing on the 20th century through to the current day, drawing attention to several significant studies.

The main aim of this chapter is to provide a common vocabulary for discussing innovation. Providing a theoretical framework to innovation gives context to the research and lays a theoretical foundation from which the results of the research can be compared and assessed.

Given the scale of innovation studies literature, this review is not exhaustive in approach, but it is purposeful and structured in identifying seminal literature and guiding the reader to an end point that reflects the current state of academic thought.

The chapter conclusion notes that innovation studies has evolved to be a distinct and complex multi-disciplinary subject that integrates economic and social theory, recognising that innovation takes many forms and has multiple sources of origination.

2.2 Defining innovation

The term innovation has a Latin etymology from *innovatus* which means to change or renew. One of the earliest printed references to the term in English dates to Thomas Norton's translation of Calvin's Institutes (Calvin 1561) and prior to the 19th century the term was not used to imply favourable change (Godin 2010).

Prior to the 20th century, innovation was not explicitly considered by economists and the benefits of innovation were considered an exogenous factor to economic growth (Godin 2012). In the last decade of the 19th century, Tarde (1903/1962) developed a theory of change based on a sociological and psychological perspective of invention and imitation (van Ginneken 1992) that Rogers (2003) considers to be an important starting point for innovation theory.

Joseph Schumpeter (1912/1934) identified the distinction between invention and innovation. Innovation was explained to mean more than novel productive processes and outputs. Schumpeter included novelty in products, methods, markets, sourcing, and organisation within his view of innovation. Today, innovation is generally accepted to be the introduction of new or significantly improved goods, services, or processes (West and Farr 1990; Luecke and Katz 2003). Bessant and Tidd (2016, p.39) define innovation as,

> *"the process of translating ideas into useful new products, processes or services."*

Innovation has also been defined as,

> *"a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)."* (OECD/Eurostat 2018, p.20).

The OECD goes on to offer more detailed descriptions of product innovation and business process innovation. Of interest in the OECD definition is the use of the relative term "*significantly*". It raises a question that is not addressed by the definition as to what might constitute such significance. It has been suggested that the perception of novelty by the individual may be enough to define something as innovative (Zaltman, Duncan and Holbek 1973; Rogers 2003).

Henderson and Clark (1990) and Damanpour (1991) recognised the contrast between radical and incremental innovation but did not attempt to provide an objective scalar measure of incremental innovation to clear a notional hurdle of significance as presented in the OECD definition. Damanpour (1991) noted other contrasting pairs of innovation types labelled process/product and administrative/technical.

Crossan and Apaydin (2010) produced a multi-dimensional and systematic review of innovation literature, and offer this definition, attempting to capture the broad scope of their review (Crossan and Apaydin 2010, p.1155):

> *"Innovation is: production or adoption, assimilation, and exploitation of a value-added novelty in economic and social spheres; renewal and*

enlargement of products, services, and markets; development of new methods of production; and establishment of new management systems. It is both a process and an outcome."

Pavitt (1984) took a taxonomic approach to classifying innovation modes based on knowledge flows within sectors and proposed four types of innovative firm:

- Firms that acquire technical expertise from suppliers.
- Specialised suppliers that provide innovative equipment and capital goods to other firms.
- Scale intensive firms that innovate to cope with and exploit their size.
- Science based firms that innovate from within their own R&D laboratories.

This taxonomic framework has proved influential in industrial economics and science policy (Archibugi 2001). Pavitt (1990) subsequently added a fifth type of firm to recognise the importance of information intensive firms such as banks, insurance companies and software businesses that use data and information to innovate. He also suggested that supplier firms were increasingly information intensive. In this research, the software businesses being researched relate most closely to Pavitt's last category of information intensive firm.

From the various perspectives, we see that innovation may be considered an output, a process, or a capability (Conway and Steward 2009). Nagji and Tuff (2012) illustrate different types of innovation in a matrix that is redolent of Ansoff's (1957) approach to strategies for diversification (see figure 2.1 below).

Within digital businesses, the historical demarcation between types of innovation are becoming less distinct (Clark and Staunton 1989), and so it may be helpful to turn to a specific definition of innovation that is relevant to the software development sector (Lippoldt and Stryszowski 2009, p.10):

"Software innovation can be seen as a process leading to:

- *development of a novel aspect, feature or application of an existing software product or process; or*
- *introduction of a new software, service or process or an improvement in the previous generation of the software product or process; and*
- *entry to an existing market or the creation of a new market."*

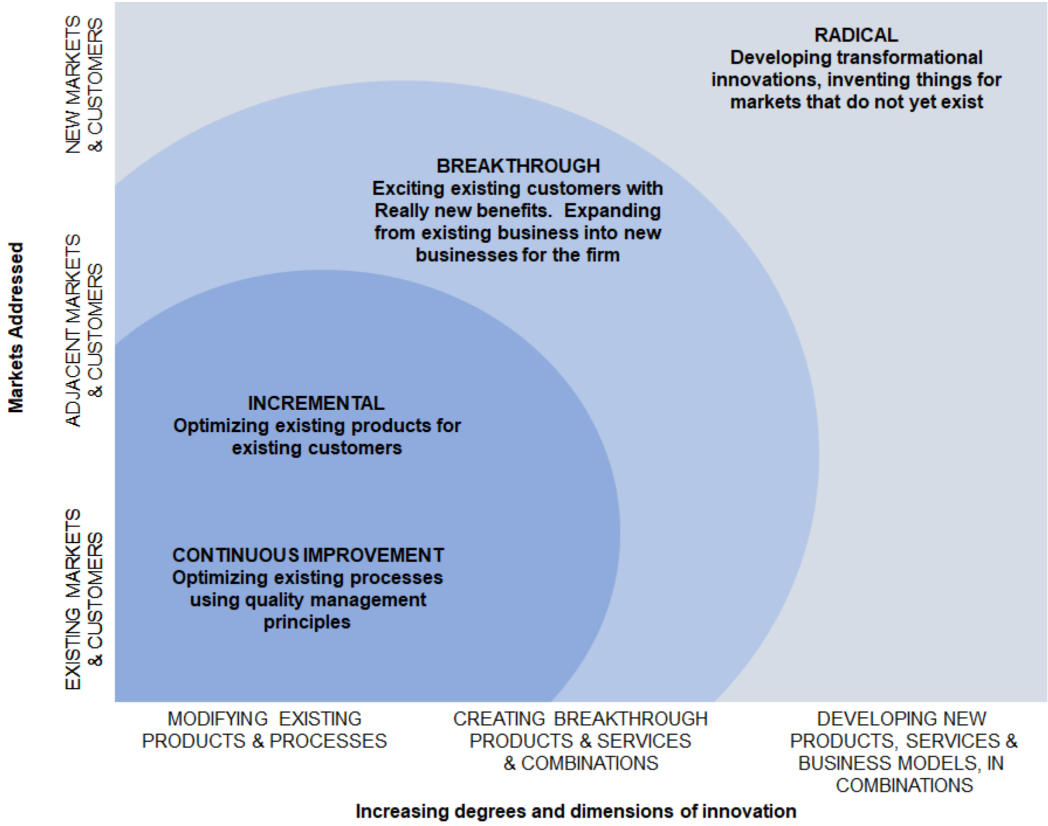


Figure 2.1 Innovation ambitions (Nagji and Tuff 2012, p.70)

2.3 A brief history of innovation studies

We live in an age of unparalleled wealth (McClosky 2010). Mokyr (1992) explains the sources of growth since the start of the industrial revolution as being *Smithian* (after Adam Smith) through trade and specialization, *Solovian* (after Robert Solow) through increased investment in capital goods or production equipment, *Marxian* (after Karl Marx) from the increased exploitation of labour, and *Schumpeterian* (after Joseph Schumpeter) through innovation. It is this last category that has driven the high rates of economic growth witnessed over the last 200 years (Mokyr 1992) and although innovation has always been a feature of human development, it is the pace and scale of innovation of the industrial era that is remarkable; something that McClosky (2010) attributes to a change in bourgeois ideology.

Rothwell (1994) proposed a theory of innovation that develops through five generations covering the period from the 1950s to the 1990s. He described how theory has developed from a simplistic linear view of the innovation process, through to a more integrated view in which new technology and market need interact through a complex network of actors. I am borrowing from this approach, but extending the timeline to go from before Britain's first industrial revolution (1IR) which took place in the late 18th and 19th centuries through to the current so called 4th industrial revolution (4IR) where artificial intelligence (AI) and quantum computing are expected to redefine many aspects of work and wider society.

The reason for starting this journey so early in the economic history of Britain relates to the nature of the firms being studied in this research. SMSE are atomistic in nature, seeking to industrialise their craft skill, often under the significant influence of an owner-manager or entrepreneur who is attempting to establish a sustainable niche for their software. In some ways, the parallels between these firms and early industrial manufacturers are striking even though the nature of technology being exploited and improved upon is of another time.

Some writers have proposed that we have already passed through the 4IR and that we are now living in a fifth industrial revolution (Kaili 2019; Muir 2019), propelling us towards a future where intelligent machines exploiting AI and quantum computing are capable of discovery and invention at rates never previously achieved by humans (Kurtzweil 2005). However, my view is that AI and quantum computing sit on a natural trajectory of a digital evolution that started in the 20th century.

The four industrial revolutions are punctuated by distinctive shifts in innovation studies literature exemplified by seminal works that gained academic attention within their era. I have labelled these eras Innovation 1.0 through to innovation 10.0 and provide a review of the defining features of each of these stages, drawing attention to seminal concepts, in figure 2.2 (below). More eras will certainly follow as innovation studies continues to develop.

Pre-industrial era

Prior to 1IR which commenced in Europe from around 1760, the basis of enterprise was agricultural, artisanal, and mercantile. Economics had been studied since the time of Aristotle in the third century (Aristotle 1984)[1]. The views attributed to Aristotle from this work relate to a taxonomy of types of economy and the necessity

[1] Some debate exists around the true authorship of Aristotle's work in this area, with many scholars attributing the work to a pupil of either Aristotle or his successor Theophrastus (Pomeroy, 1994)

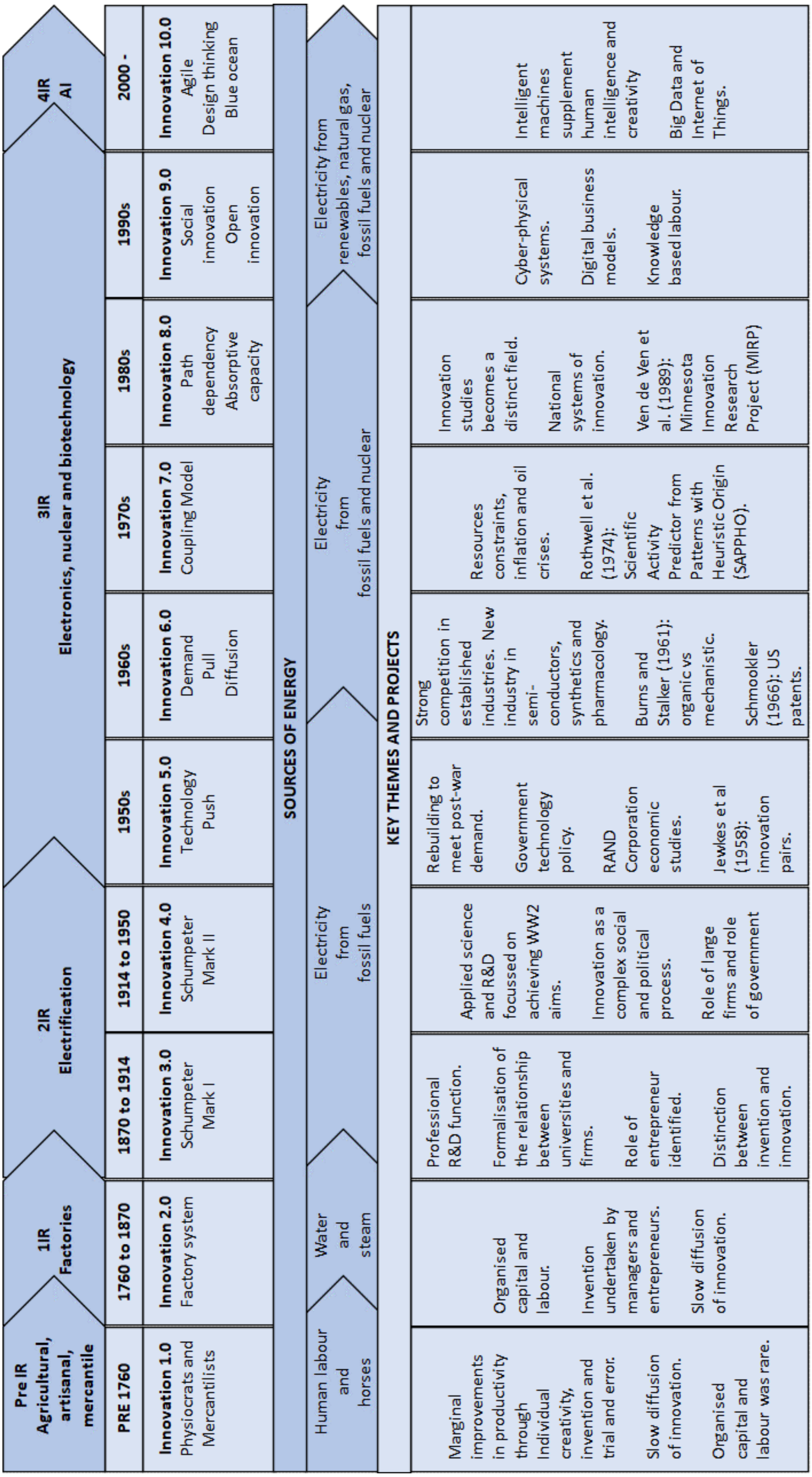


Figure 2.2 Innovation studies timeline

of understanding them to participate successfully in society. Aristotle's ideas were grounded in the reality of the time and relate to personal economy and to the wider political economy considering the difference between societies that are ruled by kings or governed by satraps. These ideas on economics have little in common with the prevalent microeconomic and macroeconomic theory of the last century. Aristotle's main concern with innovation related to the development of political systems rather than technology or business.

Ibn Khaldun discussed economic theory more than 400 years before the European industrial revolution began, introducing the concepts of the specialised division of labour and trade between communities from their accumulated surplus (Alatas 2013). Ibn Khaldun took an early sociological approach to understanding the impact of science on society and emphasized the importance of knowledge and learning (Alatas 2013). Whilst Ibn Khaldun did not address innovation in modern terms, the recognition of key themes around science, education and learning are significant.

It has been argued that national innovation systems were present in the mercantile economy of Neapolitan society (Reinert and Reinert 2003). However, if we look at the economic literature of the time as exemplified by the 1621 writings of Mun (McCulloch 1856) or Malynes (1622), these texts remained largely silent on innovation and focused mainly on the economics of trade. Jean-Baptiste Colbert, the champion of mercantilism in the reign of Louis XIV, is credited with creating the pre-revolutionary French economic system and developing trading companies to compete against the British and Dutch East India Companies (Cole 1939). Colbert tried in vain to create free trade within France and standardise weights and measures. He was more successful in establishing a reputation for French luxury goods within Europe. However, he is considered to have had a rudimentary view of economics but concerned himself mainly with trade policy grounded principally in tariff structures and showed little interest in innovation and displayed little innovative flair himself (Goubert 1970).

Prior to the French enlightenment, economists such as Quesnay (Vaggi 1987) and Turgot (1895/2014) presented a physiocratic view that wealth was derived from agriculture and the development of land. In this pre-industrial era, individual creativity, invention and trial and error led to marginal improvements in productivity (Black 2014). Limitations in literacy and lack of communication and transport infrastructure have been suggested as reasons that the diffusion of innovation was slow (Overton 1985). Agriculture and manufacturing were powered by horses and human labour (Wrigley 2010). Local trade was limited by transport infrastructure and global trade was primarily conducted by sailing vessels exploiting trade winds (Mokyr 2002). At this time, organised capital and labour were rare and confined to smaller artisanal enterprises and family businesses (Gelderblom and Trivellato 2019).

Prior to the 18th century, trade with many regions of the world was in agricultural produce. However, the British East India Company and Dutch East India Company also led significant trade in manufactured goods from Asia. These corporate structures represented a business model and commercial innovation that owed their existence to the voyages of discovery that had opened trade routes (Picard 2016). The maritime, hydrographic, and navigational capabilities that supported such global trade by sea showed a rich tradition of invention and innovation and were regarded as economically and militarily strategic to the nation (Rodger 1997).

The first industrial revolution

The industrialisation of muslin production for export from India to Europe and the mass production of porcelain in Jingdezhen China both pre-dated the European industrial revolution. Berg (2005) discusses the importance of this trade with Asia as a stimulus for European industrialisation, suggesting that the taste for luxury manufactured goods by the emerging middle class created a demand stimulus to European scale manufacturing. The identification of this possible antecedent to European industrialisation draws attention to the likelihood that the British and European industrial revolution was linked to the wider global economy, rather than being a regional economic miracle (Berg 2014).

Whilst human history is underpinned by a story of constant innovation, the European industrial revolution of the late 18th century marked the starting point of a structured approach to research and development (R&D) with the explicit aim of improving productivity and competitiveness; a period of entrepreneurially led innovation that enabled scale and the accumulation of capital that could be invested to fund yet more innovation (Landes 1969). The transition from an agricultural to an industrial society allowed enlightenment thinking and the new rational sciences to be exploited to fuel economic growth, population growth and a necessary improvement in agricultural production and distribution to support the urbanised masses.

In Britain, 1IR spanned from around 1760 to 1870 and was characterised by a shift from a primarily agricultural economy to the rapid urbanisation around newly formed industrial enterprises (Bairoch and Goertz 1986). Harnessing water and steam power allowed industries to scale, although it has been argued that the impact of steam during 1IR was less significant than is sometimes assumed and waterpower remained dominant for much of the era (von Tunzelmann 1978; Atack, Bateman and Weiss 1980).

Kapás (2008) argues that during 1IR, invention and innovation were the result of individual genius and creativity. The era can be characterized from the perspective of major transformational innovations in the iron industry, the cotton industry and through the innovative use of waterpower and water transport (Freeman and Louçã 2002). Many of these developments were the result of the work of individual owners and managers who had the ingenuity and skills to design and build their innovations or had access to craft skills within their local area such as blacksmiths and wheelwrights who could help them to realise their designs (MacLeod 1992). MacLeod has suggested, "*that user-inventors would tend to restrict diffusion and maker-inventors would tend to promote it*" (MacLeod 1992, p.288). MacLeod provides examples of original inventions in power looms, wool combing, glass-grinding, and printing which were at first unsuccessful, but subsequently improved upon by other manufacturers (MacLeod 1992, p.291).

Whilst Enlightenment science may have been an important antecedent of the 1IR (Mokyr 2016), Khan (2016) has presented data that shows the scientific elite of the Royal Society of Arts (RSA) had little impact on technological innovation between 1750 and 1850. Similarly, O'Grada (2016) has suggested that the RSA and the many other scientific societies that existed in this period may have lent respectability to scientific ideas, but in practice did little to spread these ideas in a way that supported industrialization or technological innovation. However, there was some interaction between firms and universities (Jewkes, Sawyers and Stillerman 1969). Academic writing on innovation in this period was largely concerned with economic impact (Smith 1776/1982; Ricardo 1821) or social impact (Marx and Engels 1848/1967). Invention and innovation were of material importance to early industry and led to significant productivity gains and the creation of entirely new technological trajectories (Marx 1858/1981).

Schumpeter and the origins of innovation studies

The origins of innovation studies can be traced to the time of the second industrial revolution (2IR). Tarde (1903/1962) provided an early theory of innovation in the context of social change, considering it a three-fold process of invention, opposition, and imitation (Godin 2008).

In the period between 1870 and the beginning of World War One (WW1) larger firms began to introduce a professional R&D function to commercialize research and invention (Murmann 2003). Developing links between British university research and industry were evident in the foundation of Owen's College and subsequently the Victoria University of Manchester with colleges in Leeds and Liverpool (Thompson 1886; Charlton 1951), emulating a successful German model influenced by the Manchester Vice-Chancellor Professor Henry Roscoe who had studied under Bunsen in Heidelberg and seen the potential of linking academic research and industry (Nature 1933).

Schumpeter (1912) explored the nature of entrepreneurship and began the systematic study of innovation that ultimately led to innovation studies as a distinct field of academic endeavour. Up until this time, innovation had been assumed to be an exogenous economic factor of peripheral importance to economic development (Godin 2012). In Schumpeter's 1912 work that considers the importance of innovation (translated as *The Theory of Economic Development* in 1934), he suggested a model of economic activity that was typical of the conditions of late 19th century Europe. Schumpeter assumed markets to be composed of atomistic competitive firms which could be disrupted by entrepreneurs entering the market with better products or processes, resulting in the new entrants achieving a temporary monopoly.

The principles described in Schumpeter's *Theory of Economic Development* (1934) have become known as Schumpeter Mark I (Nelson and Winter 1982; Kamien and Schwartz 1982). Schumpeter provided a systematic view of innovation as an economic, psychological, and sociological process. Ogburn (1920) championed a psychological perspective of the manufacturing process and explored innovation in the context of its origins, how it diffused and what the societal effect was (Ogburn 1922) creating an early conceptual framework for innovation studies. Bernard (1923) took a sociological view of invention and innovation drawing the contrast between discoveries which come from experimentation and planned or projected invention.

The development of capitalism in the industrial revolution gave rise to a constant evolutionary process that Schumpeter (1942, p.82) described as a "*gale of creative destruction*". However, despite the importance of innovation to the survival of firms, the growth of economies and the development of society, the study of innovation attracted little attention by scholars for many years. Even after Schumpeter, science, science policy, research policy, invention, research and development, and innovation all tended to be bundled together into a single category of activities of marginal interest to scholars within the wider developing field of economics; a situation that persisted until the 1960s (Martin 2012).

Schumpeter went on to develop an alternative view of innovation and entrepreneurship in *Capitalism, Socialism and Democracy* (1942) which reflected observations about the large industrial firms typical of the United States in the first half of the 20th century. This view, known as Schumpeter Mark II (Nelson and Winter 1982; Kamien and Schwarz 1982), considers the importance of the professionalisation of R&D within the laboratories of large firms, who could use their accumulated knowledge, skill and resources to establish barriers to entry for smaller firms. By this stage, Schumpeter recognised innovation as a complex social and political process that involved large firms and Government.

From the time of Schumpeter, two distinct research traditions were established in innovation studies. One being primarily led by US neo-classical economists who considered innovation as technological inventions utilised in the production process. The second being a more descriptive analysis of innovation as a social process that works at a product as well as a process level and takes account of complexity, scale, and specialisation (Godin 2012).

Schumpeter's work causes us to consider four questions about innovation (Coombs, Saviotti and Walsh 1987) that have contextual relevance to this thesis. First, Schumpeter Mark 1 is focused on the role of entrepreneurs and small firms similar in size and ownership to the niche SMSE being studied in this research. However, in the software industry we also see evidence of the Schumpeter Mark II model from larger firms which have the R&D capability and market power to push new technology into the market. The balance between the innovative impact of SMSE and much larger businesses is of interest. Secondly and related, is whether size itself is an important factor in the stimulation of innovation within software firms. Thirdly, the possibility that there may be an optimal size range for firms that favour software innovation. Finally, understanding the counterbalancing role of market demand in influencing software innovation. How leaders of SMSE respond to these aspects of firm size, market position and demand are important framing considerations for this research.

Innovation and conflict

The two world wars that dominated the history of the first half of the 20th century have been suggested to have had a profound impact on innovation. Specific examples of technologies that developed because of focused R&D are offered as evidence of the positive impact of war on innovation (Ruttan 2006; Rosenberg 1976). However, the evidence for a positive correlation is at best mixed, with some studies showing a negative correlation (Nef 1963; Rossman 1931) and other studies showing no discernible relationship (Thomson 2010). It may be that the results to some extent depend on the war or the technology. However, the politicisation of R&D, invention and innovation following the successful exploitation of applied science in World War Two (WW2) led to significant work on the importance of science and technology policy to economic growth. Today, computer software has been weaponised. Software is a component of many weapons systems. More directly, cyber-warfare has itself become an axis of direct conflict, stimulating offensive and defensive innovation (Neutze and Nicholas 2013).

Although academic opinions vary on the impact of war on national innovation, at the end of WW2 the US Government embraced science and technology as a force for innovation and economic growth. In 1945, Vannevar Bush published a report for the President of the United States titled, *"Science – The Endless Frontier"* (Bush 1945) which acknowledged the achievements of applied science in wartime and considered how the wartime focus on R&D could be maintained to the benefit of society in peacetime. Bush's report was important in setting a post-war agenda that aligned scientific discovery with invention and innovation in industry as a legitimate area of policy for Government.

Linear view of innovation

W Rupert Maclaurin was a colleague of Bush at The Massachusetts Institute of Technology (MIT). He started to systematically analyse innovation in specific industries to track the progress from scientific discovery through invention and to innovation. In this sequential process, Maclaurin saw the innovator as the final participant in a process that began with pure science, progressed through invention, and was commercialised by an entrepreneur (Maclaurin 1953). This linear view has been open to criticism (Schmookler 1966; Edgerton 2004) not least because it oversimplifies a complex two-way process (Freeman 1982). However, it has persisted in theory and been important in policy making because it emphasizes the economic importance of basic science.

The third industrial revolution

The post-war era saw the rebuilding of traditional industries to cope with increased demand that often outstripped the supply capabilities of war-ravaged economies. The 1950s and 1960s represented the start of a third industrial revolution (3IR) based on electronics, nuclear engineering, pharmacology, material science and biotechnology (Xu, David, and Kim 2018). These industries were dependent on science and technology and required significant scale and investment to create professional R&D capabilities within firms. During the 3IR, several influential studies began to lay a foundation for structured academic enquiry into both the economic and social aspects of innovation.

The RAND Corporation has played a significant role in supporting and promoting research into innovation. Economist Robert Solow worked at RAND from 1951 to 1961 and published papers that showed how advances in technology boost economic growth and accounted for around 80% of growth in output per worker in the US (Solow 1956 and 1957). Also working at RAND, Arrow (1962a) published work that led to the endogenous growth theory of innovation helping to explain why firms innovate and recognising the importance of individual economic actors within the model. Arrow's "learning by doing" (1962b) described the economic importance of practice and minor innovation in increasing productivity as workers learn to use technology more effectively in the productive process.

An economic approach to analysing innovation dominated the period immediately following Schumpeter's work. This perspective on innovation can only really assess inputs and outputs and it is often hard to interpret the degree of correlation between investment and successful measures of innovation in terms of revenue growth, profit or even patents (Hagedoorn and Cloodt 2003; Artz et al. 2010). In addition to economic factors, there are also likely to be a sociological aspect associated with innovation success (Dahlen 2014). Economics can help to answer the "what?" questions in terms of the impact of innovation, but it does not really tackle the "how?" and "why?" questions which require a more behaviouralist psychological and sociological approach. From the 1950s onwards, there have been several important studies that take a more integrated multi-disciplinary view of innovation.

In the UK, Carter and Williams (1957) looked at 250 British firms questioning the dominant theory at the time that promulgated the view that taxation, full employment and an excess of small firms inhibited innovation. Instead, they identified the need for more qualified scientists and improvements in management training. Consistent with Schumpeter (1939), Carter and Williams noted that firms might be innovative through adoption or imitation rather than being truly original.

John Jewkes worked with David Sawers and Richard Stillerman (Jewkes, Sawers and Stillerman 1969) who were his research assistants and conducted a pioneering study which analysed case studies of 19th century and 20th century technological innovations. They noted that many of the most important inventions of the period were the result of the work of individual entrepreneurs rather than R&D departments of large organisations. However, they acknowledged the role of large-scale R&D in commercialisation of invention in the chemical and oil industries. They also questioned the reasons economists had not previously focused on the impact of technology and concluded that there were three explanations. First, an ignorance of the natural sciences; secondly a primary focus on trade cycles and employment; finally, a lack of usable statistical data.

Burns and Stalker (1961/1994) looked at management practices in Scottish electronics firms. Their work was unique at the time because it considered failure as well as success. Prior to this, much research into innovation only tracked successful innovations. Through their interviews with workers in the firms they surveyed they observed two alternative ways in which they felt the firms were managed. They defined one approach as “mechanistic” and felt this to be most appropriate in large hierarchical firms that existed in relatively stable market conditions. The second type of firm they suggested was “organic” with less formal hierarchy, better lateral communications and rapid redefinition of roles. They concluded that the mechanistic firm was less able to react to markets that were undergoing rapid change. Whilst this seminal work has found empirical support with larger firms, it has been questioned by Kimberly (1981) who suggests that centralisation and control may favour successful innovation. More recently, Sine, Mitsuhashi, and Kirsch (2006) presented research based on US internet ventures that indicates in new ventures, teams with a higher degree of formalisation and specialisation outperformed those with less formal and more organic structures. Cameron and Quinn (1983) observed that start-ups face different challenges to mature organisations.

Technology push and demand pull

The 1960s and 1970s saw increased competition in established industries. New types of firm based on new technologies in semi-conductors, synthetic materials and pharmacology further demonstrated the economic importance of the path from basic science through invention and innovation. Schmookler (1966) identified US patent records as a measure of inventive activity and analysed these from the 1800s onwards in an attempt to understand if invention and innovation was self-generating ("technology push") or if innovation could also be market led ("demand pull"). Although often cited as being the champion of "demand pull", Schmookler also acknowledged the importance of "technology push" and showed great academic rigour in his assessment of long-term innovation trends based on patent data (Freeman 1979). Mowery and Rosenberg (1979) also noted the importance of market demand as a stimulus for innovation, drawing attention to the fact that Schmookler's earlier analysis had been mainly focused on invention rather than commercialisation.

Research on the importance of science policy for innovation commenced in 1966 at the Science Policy Research Unit (SPRU) at the University of Sussex under the leadership of Chris Freeman. Freeman was a founder of the European tradition of probing the complexity of innovation processes, taking a more descriptive than econometric perspective. Freeman shifted the emphasis away from the generic introduction of any change and believed that successful innovation only occurred at the point of the *"first commercial transaction"* (Freeman 1974, p.22). This idea that innovation is only classed as successful once commercialised was later echoed by Camison-Zornoza et al. (2004) and Hobday (2005). Freeman took a policy centric view of innovation studies. Building on Schumpeter's research and integrating theory from other social sciences, SPRU demonstrated the importance of R&D and of innovation to economic development.

SPRU conducted a landmark research project titled Scientific Activity Predictor from Patterns with Heuristic Origin (project "SAPPHO"), through face-to-face interviews (Curnow and Moring 1968) looking at 58 technological innovations between 1968 and 1971, pairing innovations and noting factors that appeared to contribute to success or failure (Rothwell et al. 1974). The conclusions of the project were that supply and demand were complementary in respect of innovation and that smaller firms had an innovation advantage in the early stages of invention and in exploiting radical invention, whereas larger firms were dominant in later stage innovation and commercial scaling.

Technology push and demand pull models began to be thought of as an atypical representation of the more subtle processes associated with the interaction of developing technology and market need, resulting in the Coupling Model (Rothwell and Zegveld 1985) which unifies the market pull and technology push models (see figure 2.3 below). This more complete model better described contemporary innovation which made a determined use of R&D and invention whilst responding to the market challenges and opportunities of resource constraints, high inflation and two major oil crises that characterised the 1970s. Freeman (1979) noted that a range of cyclical factors, industry discontinuities and the impact of chance on firm survival all influence innovation. He also reconciled Schmookler's views by suggesting that technology push may dominate the early stages of innovation within an industry, and demand becomes more important once the industry is established (Freeman 1982). As Kline and Rosenberg (1986) noted, an innovation is rarely well-defined or homogenous and may well change in ways that transform it economically through subsequent improvements on the initial idea.

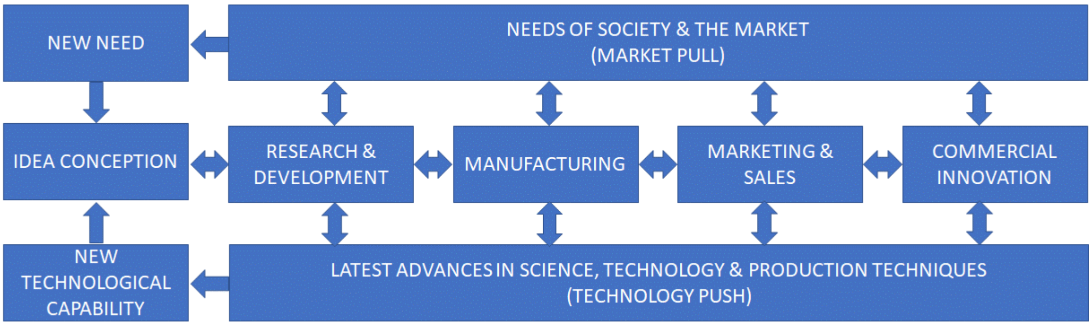


Figure 2.3 The Coupling Model (Rothwell and Zegveld 1985, p.50)

National systems of innovation

At the level of individual firms, theory suggests a range of complicated internal and external factors give rise to innovation. Beyond the activities of an individual firm, the interaction of organisations in the public and private sector within a nation state have been considered important to the development and diffusion of new technology (Freeman 1995). Although the idea of national systems of innovation (NSI) had been introduced in the 19th century (List 1841), renewed focus on NSI came through the work of Freeman (1987 and 1995), Freeman and Lundvall (1988), Lundvall (1992), Nelson (1993) and Edquist (1997). These works acknowledge the complex interaction of public and private institutional and individual actors within a nation state economy that determine the innovative output of that country. Socio-cultural factors are suggested to offer some explanation for differences in performance between nation states. Cycles of leadership may be established at a national level resulting in waves of innovation within a nation state, as less developed countries introduce technology from developed countries and then create a new wave of innovation (Nelson and Wright 1992). More recently, Fagerberg, Feldman, and Srholec (2014) have described how R&D policy alone is not sufficient to confer a national advantage in innovation and technological competitiveness, suggesting that wider territorial dynamics need to be considered.

Path dependency, absorptive capacity and diffusion

Technological change has been suggested to follow a path dependent endogenous trajectory (Arthur 1994) that is determined to some extent by prior art and culture and is based on costly but uncertain investment in R&D (Aghion and Howitt 1992). As SMSE develop, they may experience path dependency building new feature functionality on the foundation of an existing application (Boland, Lyytinen and Yoo 2007) and exploiting existing know-how (Romijn and Albaladejo 2002) resulting in waves of innovation related to a common software code base (Aerts et al. 2004).

The path dependent view of innovation is important in evolutionary economics (Nelson and Winter 1982). There are also examples where a technology becomes so embedded that even when a superior innovation appears it fails to displace the original. For example, David (1985) discusses how QWERTY keyboards designed in the 1870s have persisted despite demonstrable learning speed and usability advantages based on the later Dvořák configuration. Some workers have suggested that the adoption of new technology is an exogenous process subject to the whims of individual agents (Arthur 1989), but most empirical studies support an endogenous view (Redding 2002).

In the 1980s, organisational learning became an area of interest in innovation studies, and Cohen and Levinthal (1989) argued that the ability of a firm to take advantage of an innovation trajectory was in part determined by its absorptive capacity. This absorptive capacity is dependent on the routines and processes of a firm that allow it to acquire, assimilate, transform and apply new knowledge (Zahra and George 2002). Absorptive capacity has proved hard to measure, but Camisón and Forés (2010) have constructed scales for it based on literature and tested on Spanish firms. There have also been attempts to develop econometric models for absorptive capacity (Griffith, Redding and Van Reenen 2003).

The way in which new technology and ideas spread through a society has been described by Rogers (2003). He suggests that diffusion is a social process and the pace of adoption is dependent on the nature of the innovation, communication channels that are available within a society, the social system and time. Rogers believes that to become self-sustaining an innovation needs to achieve critical mass. He offers a diffusion model based on a four-phase adoption curve with the phases labelled "early adopters", "early majority", "late majority" and "laggards".

Disruptive innovation

Christensen (1997) investigated how incumbent firms suffer disruption through the innovation efforts of challengers. Christensen categorises innovations as being sustaining or disruptive. In his view, sustaining innovations do not impact existing markets even though they might be revolutionary or radical in nature. Disruptive innovations create new segmentation and may ultimately come to dominate an existing market, potentially displacing incumbents. Christensen discussed the dilemma that incumbents face when disruptors start to attack their market. Even if they have the cognitive competence in their management team to understand and respond to the challenger innovation, they may be unwilling to do so for fear of cannibalising their existing market at potentially lower margins.

Christensen's views on disruption are not universally supported. Lepore (2014) has challenged the quality of the data in Christensen's studies and even questioned his seminal study on the disc drive industry. King and Baatartogtokh (2015) researched 77 examples of what Christensen has called disruptive innovation finding that only 9% can be adequately explained by his theories. Christensen does not see Uber as disruptive, rather just an improvement on the existing taxi industry, whilst others conflate the concept of disruption with breakthrough or radical innovation (Moazed and Johnson 2016). Downes and Nunes (2013) have suggested that the slow processes that start with a low-price challenge to incumbents as detailed in Christensen's model can be accelerated, especially by digital disruptors.

Blue ocean strategy and adaptive space

In the battle for growth, established firms often try to extend their market or create new niches. In Blue Ocean Strategy, Kim and Mauborgne (2004) discuss how incumbents can establish new market space. They describe value innovation as the simultaneous pursuit of low cost and differentiation, providing a practical framework for strategy development and marketing. However, the concept has little empirical support and the product case studies offered could be criticised for interpreting events *post hoc* through a selective lens. Recognising the constraints that incumbents often feel and the difficulty they have in attracting new customers, Arena (2018) has developed the concept of adaptive space as a way for established organisations to enable a better flow of communication and ideas through the hierarchy of a business. Opening the innovation agenda to allow operational business units to connect with pockets of entrepreneurial activity is suggested to improve the agility of the organisation allowing the organisation to become a disruptor itself. Neither of these books is totally unique, repackaging and rebranding ideas that are already established in the academic literature. However, they do provide an accessible guide to managers that may stimulate new thinking and provide tools and a framework to develop strategy.

Innovation in the fourth industrial revolution

The advent of the fourth industrial revolution (4IR) was heralded by Klaus Schwab of the World Economic Forum in 2015:

> *"The First Industrial Revolution used water and steam power to mechanize production. The Second used electric power to create mass production. The Third used electronics and information technology to automate production. Now a Fourth Industrial Revolution is building on the Third, the digital revolution that has been occurring since the middle of the last century. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres."*

(Schwab 2015)

In the 4IR, digital technology allows people to move between virtual and physical domains (Schwab 2017; Lee et al. 2018). In our increasingly machine-readable world, self-learning software is supplementing human intelligence and creativity creating new trajectories for innovation (Alkhatib et al. 2015). Many industries are facing significant disruption as big data (Wessel 2016; Ylijoki et al. 2019) and the Internet of Things (IOT) (Ebersold and Glass 2015) create digital business models that challenge traditional views of markets. In this fast-moving digital economy, we see an increasing tendency for firms to collaborate across their natural enterprise boundaries undertaking what has been termed open innovation (Chesbrough 2003). The idea of open innovation is not necessarily new as the benefits of interfirm R&D cooperation have been acknowledged since the 1960s (Hartmann and Trott 2009). However, the interconnectedness of the digital era has created an increasing tendency for businesses to be less secretive and more open to the use of external cooperation in developing innovation (Chesbrough 2003). Distributed innovation processes require knowledge flows to be managed across firms (Chesbrough and Bogers 2014). These are complicated non-linear processes that bring together complementary forces from within the firm and from different participants in the wider ecosystem or "*value constellation*" (Fasnacht 2018, p.137).

Open innovation techniques have been suggested to be important in the facilitation of social innovation (Martins and de Souza Bermejo 2015). Although social innovation has occurred since the 19th century, it has become a more widely discussed topic in more recent decades (Christensen et al. 2006; Phillips et al. 2015; Stott, Fava and Slawinski 2019) despite a lack of agreement on a single definition (Franz, Hochgerner and Howaldt 2012; de Bruin 2012). Howaldt and Kopp (2012, p.47) consider a social innovation to be:

> *"a new combination and/or new configuration of social practices in certain areas of action or social contexts prompted by certain actors or constellations of actors in an intentional targeted manner with the goal of better satisfying or answering needs and problems than is possible on the basis of established practices".*

Pol and Ville (2009) believe that social innovation is connected to human welfare and improvements in life expectancy. Whereas Martinelli (2012) focuses on social outcomes in terms of satisfaction of need, empowerment and a change in social relationships. Social innovation appears to be an inherently collaborative process (Ziegler 2017) and communities are increasingly turning to social innovation as they attempt to solve significant societal problems, as we witness the emergence of social entrepreneurs who combine social and economic objectives (Stott, Fava and Slawinski 2019).

Agile product innovation has been linked to open innovation (Conboy and Morgan 2010) and is often wrongly thought of as an approach specific to information systems development. Rigby, Sutherland and Takeuchi (2016) have discussed how the origins of agile can be traced to the work of Walter Shewhart at Bell Labs who developed Plan-Do-Study-Act (PDSA) cycles to improve products and processes and how W. Edwards Deming applied this method in Japan in the years following World War II. The benefits of faster product development and release that make the technique attractive for software development can apply equally to other sectors, even in heavily regulated industries such as pharmaceuticals (Lodha 2016; Shah 2017; Berggren et al. 2018; Srikant et al. 2019).

User centred design approaches are well established in computing (Norman 1996), but design thinking as a process driven approach to innovation has application beyond information systems development. As innovation becomes more digital and complicated in nature, design thinking has developed into a structured approach closely linked to organisational creativity literature with one aspect being the creation of idealised conditions to encourage creativity. Brown (2008) discusses a process of overlapping activities moving from initial inspiration through ideation and finally implementation, with projects sometimes looping back through various stages. Plattner, Meinel and Leifer (2011) describe five stages of design thinking which they believe require management skill and judgement to execute. They believe that those skills can be learned and practiced. The stages they describe are defining/re-defining problems, identifying needs and benchmarking, ideating, building and testing. Liedtke (2018) argues that design thinking is effective because it provides structured and practical social processes that reflect human nature and help to overcome the bias and dominant logic of innovation teams. The immersion of innovators in trying to empathise with the needs of customers and subsequent sense making is a much more personal process than is typical of new product development. For Liedtka, the “acid test” for design thinking is the effectiveness she has observed in seven years of study exploring 50 projects in different sectors. However, the empirical support for design thinking is still at an early stage despite many attempts to analyse design thinking over many years. Cagan et al. (2013) suggest that academic study of this field may have suffered due to a lack of standardisation in data collection and analysis.

Summary

Innovation has underpinned economic growth from the pre-industrial era to the present day, creating great wealth (McClosky 2010). Joseph Schumpeter (1912/1934) drew a distinction between invention and innovation, considering innovation an endogenous economic process (Godin 2010). Over the last century innovation studies have evolved into a discrete discipline (Godin 2012) based on both US neo-classical economics and a descriptive analysis of the complex social processes involved (Godin 2012).

In this section, innovation theory has been set in the historical context of four eras of industrial revolution based on changing technologies and energy sources. The current industrial era has been labelled the 4IR (Schwab 2017) and is characterised by an increasing dependence on advanced computer software that allows the transition between physical and virtual digital domains (Lee et al. 2018). In addition to the well-known large technology companies participating in this industrial revolution, there are many thousands of SMSE that provide niche software solutions. These smaller businesses are redolent of the atomistic craft firms that

Schumpeter described in his first treatise. Their vulnerability to the "*gale of creative destruction*" (Schumpeter 1942, p. 82) is relevant to this thesis.

The next section considers some of the prescriptive and descriptive models that scholars have created to understand and explain the complex processes involved in organisational innovation.

2.4 Models of organisational innovation

Several scholars have developed prescriptive and descriptive models of the processes that organisations might employ to manage innovation.

Goffin and Mitchell (2017) consider the management of innovation to be a distinct organisational discipline. They have proposed the Pentathlon Framework (see figure 2.4 below) as a process that describes the five areas that they believe are important to organisational innovation. They suggest a pathway from ideation, through prioritization and to implementation that is moderated by innovation strategy and considers the innovation capacity of the organisation and people.

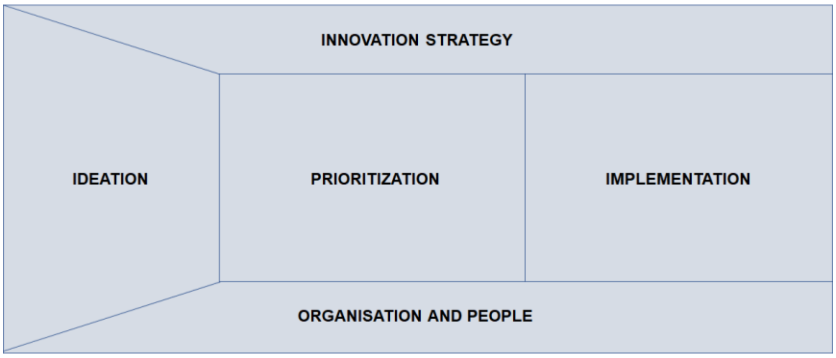


Figure 2.4 Pentathlon framework (Goffin and Mitchell 2017, p.29)

In practice, smaller firms may informally adopt aspects of the pentathlon framework. For example, Rose, Jones and Furneaux (2016) studied 19 UK SMSEs in Cambridgeshire and found that in these firms there was no prescribed process for the evaluation of innovation. Path creation was typically determined by owner/managers working closely with software developers. Ideation was discussed as a collaborative activity and software professionals tended to move away from the keyboard and onto the whiteboard when developing original ideas. As noted by Nambisan et al. (2017), the rise of the digital economy may challenge traditional views of how innovation arises, the best way to organise for innovation, and even the nature of innovation.

Goffin and Mitchell (2017) see innovation as being dependent on the underlying processes of their proposed pentathlon framework that addresses the various dimensions of the specific business resulting in commercial innovation. Figure 2.5 (below) applies Goffin and Mitchell's model to the case of software firms. This model links underlying innovation processes for new product and feature development, process improvements and the development of new commercial models, through specific dimensions of technical and commercial development which result in the output of commercial innovation.

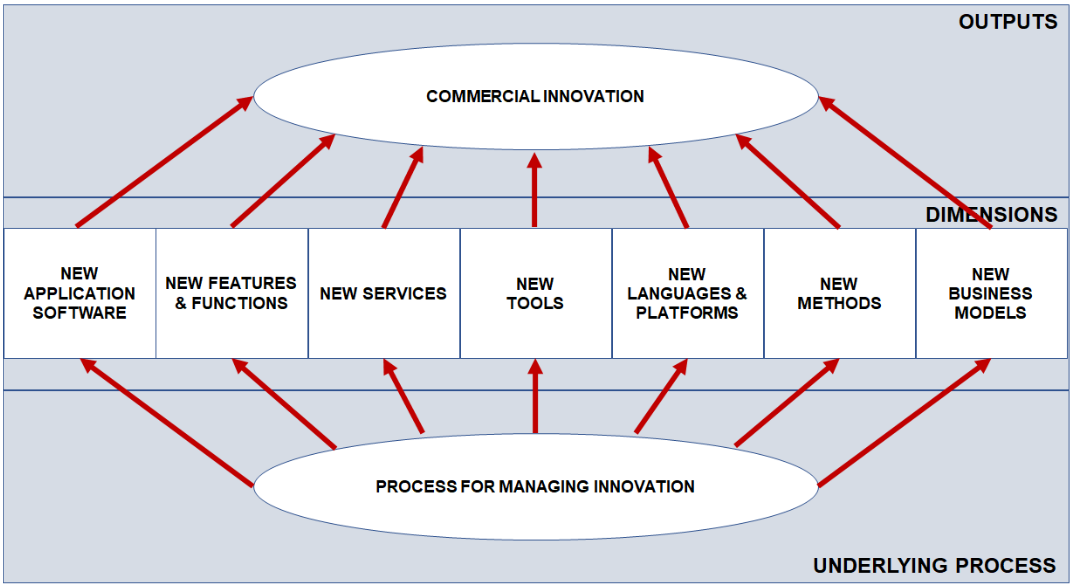


Figure 2.5 Pentathlon model applied to a software firm (adapted from Goffin and Mitchell 2017, p.6)

The path from ideation to commercialisation of innovation was explored in a longitudinal study of 14 different innovations in the Minnesota Innovation Research Program (MIRP) (Van de Ven, Angle and Poole. 1989). Van de Ven et al. (1999) suggest that leaders take on different roles within innovation. They define these roles as entrepreneur, sponsor, mentor, critic and institutional leader. MIRP suggests that although managers can learn to guide the innovation process, they cannot truly control it (Van de Ven 2017). Instead, they may increase the chances of success through an awareness of constraining and enabling factors within the innovation journey and managing what Van de Ven (2017) calls convergent and divergent behaviours (see figure 2.6 below).

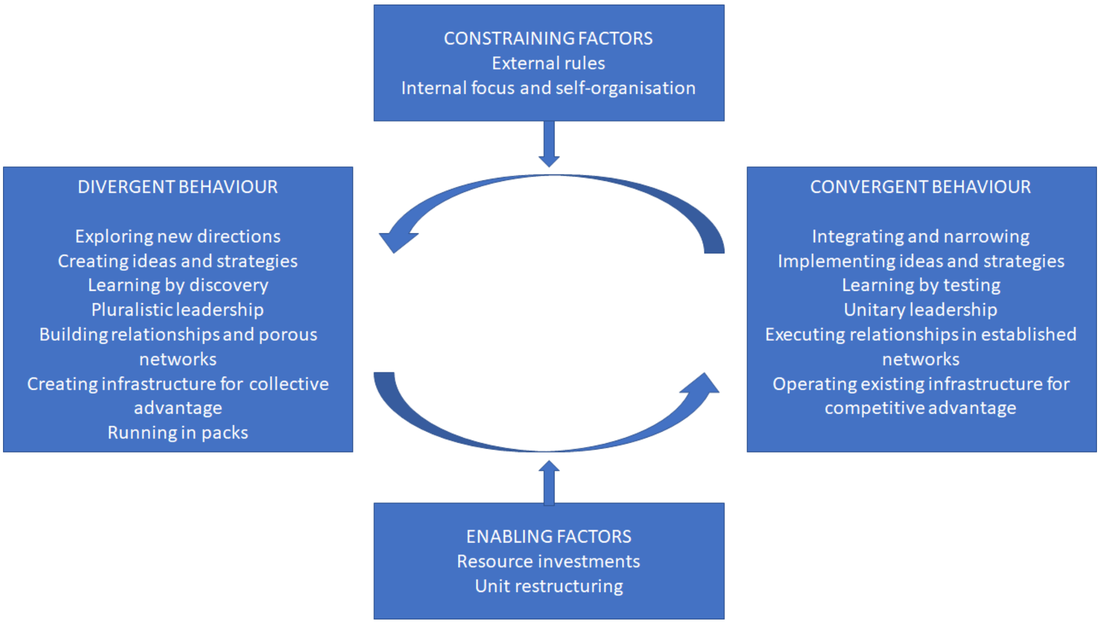


Figure 2.6 The cycle of the innovation journey (Van de Ven 2017, p.40)

The recognition of how management behaviours and decisions might influence the different types of innovation strategy pursued by an organisation is also evident in theories of ambidextrous innovation. Some scholars believe that firms pursue exploratory and exploitative innovation simultaneously (Duncan 1976; March 1991; Tushman and O'Reilly 1996), with managers influencing teams to balance the allocation of resources into distinct innovation activities that support organisational strategy (Cantarello, Martini and Nosella 2012). Whilst exploitative innovation may be primarily incremental and focused on optimising the organisation and its products to compete in the present, exploratory innovation is more likely to be radical, focused on developing new products, processes and businesses for the future and requires an organisation to embrace risk (Utterback 1994; Song and Montoya-Weiss 1998).

Larger firms tend to have well-defined processes for allocating resources through their strategic planning and budget processes. They may also have separate organisations focused on exploration such as R&D facilities (Love and Roper 2015). Internal competition for investment in innovation may therefore be more intense within the exploitation cycle as managers seek to prioritise their departmental needs to meet or exceed personal or organisational objectives (Tushman, Smith and Bins 2011). Simultaneous investment in exploration and exploitation is thought to be a trade-off in terms of the application of a firm's scarce resources (March 1991; Uhl-Bien and Arena 2018). Resource scarcity may be exaggerated in a smaller firm due to the more limited resources. The trade-off may be considered to represent an internal conflict (Hogkinson, Ravishankar and Fischer 2017; Uhl-Bien and Arena 2018).

The simultaneous cycle model of exploration and exploitation shown in figure 2.7 (below) illustrates how exploration and exploitation might be thought of as two interlinked cycles of activity:

- Cycle 1 is the exploration of products, processes and markets that are novel to the firm.

- Cycle 2 is the innovative work effort that goes into improving existing strategies, products or processes, and extending market reach.

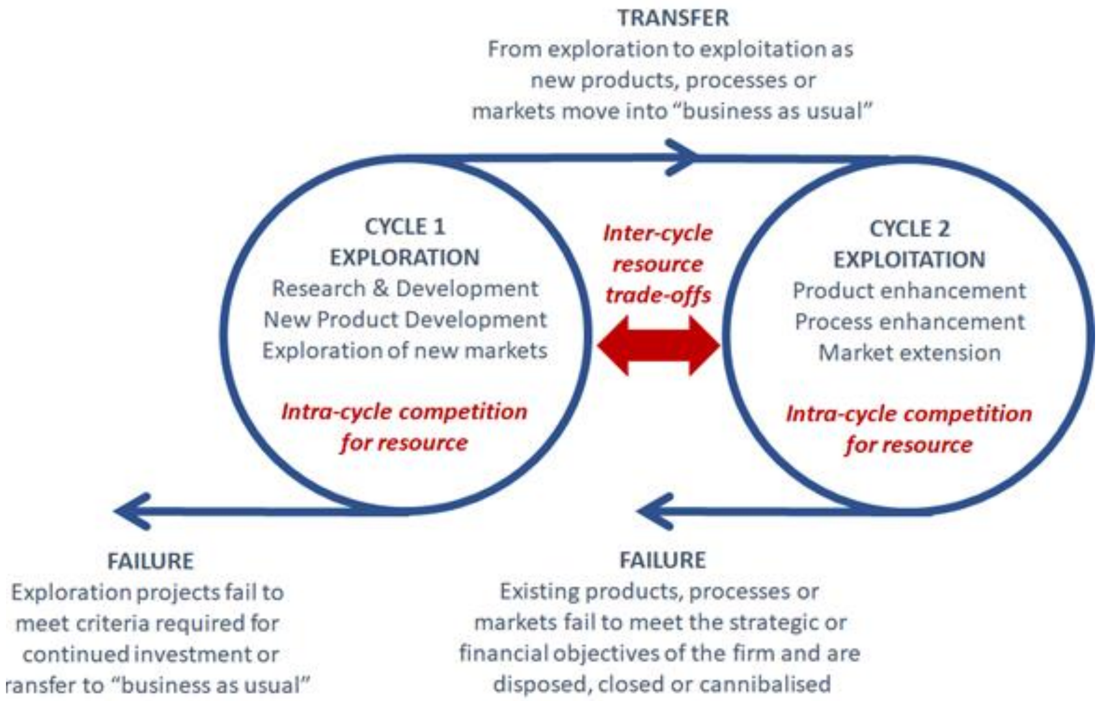


Figure 2.7 Cycles of exploration and exploitation

Within both cycles there will be failures where products, processes or markets do not meet the strategic, commercial or operational requirements of the organisation. Some of the innovations developed within the exploration cycle will achieve a level of commercial sustainability that allows them to transfer to "business as usual" and then enter a cycle of exploitation where the product, process or market may continue to be developed.

In larger firms, the CEO can play an important role in maintaining focus on investment in exploration, maintaining constructive conflict between exploration and exploitation in the senior leadership team (Tushman, Smith and Bins 2011). However, smaller firms may lack the resources or capabilities to engage in exploration and may invest a disproportionate amount of their innovative capacity in exploitation as they seek to find sustainable product-market fit for their capability. Smaller firms often focus their innovation efforts on cost and quality (Scozzi, Garavelli and Crowston 2005) building sustainably and incrementally on existing technology (Christensen and Overdorf 2000) rather than taking the risks associated with radical innovation (Taylor and Greve 2006).

Similar to the theory of ambidextrous innovation, Govindarajan (2016) suggests that firms should pursue what he terms a “three box solution” to innovation. The first box relates to the present, focusing on improving the performance of the firm within the existing market and might feature exploitative innovation. The second box relates to the past and is concerned with abandoning ideas and practices that might inhibit innovation. The third box is concerned with developing breakthrough ideas that will create products and businesses for the future and might feature explorative innovation. Govindarajan regards the unlearning process of box two as an essential component of enabling the firm to innovate for the future. The case studies that Govindarajan offers to support this theory relate to large US based firms like GE and IBM. However, Govindarajan and Tangri (2020) have produce a “playbook” that attempts to make the theory more accessible to firms of all sizes.

Hunter et al. (2011) identified 14 areas of tension between the requirements of general management and the needs of innovation management that they call paradoxes. Such paradoxes require leaders to balance seemingly competing priorities between individual, team and organisation to encourage innovative work behaviour and maintain operational momentum and commercial success. Recognition of these competing priorities is also found in the resource trade-off described in ambidextrous innovation (Uhl-bien and Arena 2018) and the balance between efficiency, unlearning and innovation described in the “Three Box Strategy” (Govindarajan 2016). To address these paradoxes, Hunter and colleagues challenge the current ontological framework for researching innovation leadership and suggest greater focus on collective goals, alignment and commitment.

This section has considered some of the prescriptive and descriptive models that scholars have offered to show how innovation might arise within an organisation.

Common to each of these models is an underlying assumption that innovation is a necessary function of the firm and that organisations will attempt to balance incremental innovation, improving products and processes for an existing market, with more radical innovation, creating opportunities for the future.

2.5 Innovation studies today

Over the last century, scholarly focus on innovation has evolved to become a distinct discipline with implications for policy, management, and economic growth. The significance of innovation as a basic function of business was emphasized by Drucker (1954, p.39-40) who suggested that there is:

> "*Only one valid definition of business purpose: to create a customer. Therefore, any business enterprise has two, and only two, basic functions: marketing and innovation*."

Despite the apparent significance of innovation, assessing the relative importance of scholarly contributions to the development of this subject is difficult because of the complicated multidisciplinary nature of the field. Fagerberg, Fosaas and Sapprasert (2012) have attempted to assess the top contributions to the literature through a meta-study of 277 innovation surveys undertaken between 1993 and 2010 to assess frequency of citation of literature. These studies cited over 15,000 pieces of literature. However, many of the citations occurred just once. Fagerberg and colleagues took the view that the more frequently literature was cited the greater the perceived contribution to the field. Taking this approach, they identified 130 contributions that they felt were most significant and published a "top 10" which is shown in table 2.1 (below).

As innovation studies matures to represent a distinct discipline, Steinmuller (2013) counsels that the field must remain accessible to a diverse multi-disciplinary community of interest that sees science, technology and innovation as important to solving humanity's problems and building a better world.

Innovation is viewed as an imperative in many different types of organisation and as society values innovation, sometimes for its own sake, then the leadership of innovation becomes an important topic (Mumford et al. 2014). However, as Schumpeter (1934) explains, innovation is often the result of entrepreneurial competitive pressure, meaning that many commercial organisations are reluctant participants in a real, or sometimes imagined, battle for survival that depends in part on improving their competitive position through innovation. This theme of reluctance was later acknowledged by Ahmed (1998, p.30), who noted:

> *“The reality is that innovation, for the most part, frightens organisations because it is inevitably linked to risk. Many companies pay lip service to the power and benefits of innovation. To a large extent most remain averse to the aggressive investment and commitment that innovation demands. Instead they dabble in innovation and creativity.”*

Table 2.1 Top 10 innovation studies (by citation frequency)

Rank	Author(s)	Country	Title	Type	Year
1	Nelson RR & Winter S	USA	An evolutionary theory of economic change	Book	1982
2	Nelson RR	USA	National Innovation Systems	Book	1993
3	Porter ME	USA	The competitive advantage of nations	Book	1990
4	Schumpeter JA	Austria USA	The theory of economic development	Book	1912 1934
5	Rogers EM	USA	Diffusion of innovations	Book	1962
6	Lundvall BA	Denmark	National innovation systems: towards a theory of innovation and interactive learning	Book	1992
7	Freeman C	UK	The economics of industrial innovation	Book	1974
8	Cohen W & Levinthal D	USA	Absorptive capacity	Article	1990
9	Pavitt K	UK	Sectoral patterns of technical change	Article	1984
10	Arrow K	USA	Economic welfare and the allocation of resources for invention	Book	1962

Source: Fagerberg, Fosaas, and Sapprasert (2012, p.1136)

2.6 Chapter conclusions

Innovation was once regarded as being an exogenous factor to economic progress. From Schumpeter’s early work through to current research, innovation studies made a distinction between invention and innovation and redefined the understanding of the complex endogenous processes that result in new products, processes, and methods. Over the last century, economic and sociological approaches to understanding innovation emerged as separate traditions.

The innovation studies literature plots a path of increasing sophistication and recognition of the complex multi-disciplinary perspective required to interpret phenomena and construct theory. Today, there is recognition that innovative ideas come from a variety of internal and external sources including customers, workers, and universities (Demircioglu, Audretsch and Slaper 2019). In the 4IR, innovation studies can be considered a process which is as dependent on psychological and sociological factors as it is on the economic necessity to achieve sustainable competitive advantage. Several scholars have provided models of the innovation process and drawn attention to different types of innovation.

Much of the research and literature relating to technology firms is based on the activities of larger organisations (Germain 1996; Fichman and Kemerer 1997; Grover, Fiedler and Teng 1997; Koberg, Detienne and Heppard 2003; Rose Jones and Furneaux 2016) and the field is often largely anecdotal, lacking a strong empirical base (McLean 2005). The assumption that creativity and innovation are important to maintaining competitive advantage and organisational success (Anderson, Potočnik, and Zhou 2014; Pisano 2019) may be true in larger firms, but small firms that successfully occupy a niche market of their own making may have different priorities.

This research looks specifically at the relationship of executive leaders and software engineer followers in SMSE who are engaged in innovative work behaviour. Creativity is regarded as an important antecedent to innovation and so in the next chapter we explore creativity in the context of how leadership is thought to influence culture and creative climate.

3 CREATIVITY, CLIMATE AND CULTURE

3.1 Chapter introduction

The role of leaders in establishing a creative knowledge environment is considered to be important to organisations that wish to encourage innovation (Denti and Hemlin 2012) and has been suggested to be a significant factor in business success (Chandler, Keller and Lyon 2000). Creativity is viewed as an antecedent to innovation and source of competitive advantage (Amabile 1988 and 1996; Shalley 1991; Oldham and Cummings 1996; Chandler et al. 2000; Zhou 2003). This chapter provides a short introduction to the role that many scholars believe leadership plays in supporting culture and creative climate (Amabile 1988; Kanter 1988; Shalley 1991; Amabile et al. 1996; Ekvall 1996; Oldham and Cummings 1996; Johnson 1996; McGourty et al.1996; Tushman and O'Reilly 1996; Judge et al. 1997; Tesluk, Farr and Klein 1997; Ahmed 1998; Ekvall and Ryhammer 1999; Chandler, Keller and Lyon 2000; Oldham 2003; Zhou 2003; Janssen and Van Yperen 2004; Isaksen and Tidd 2006).

The chapter begins by drawing a distinction between innovation and creativity and offering a simple definition of creativity. It then discusses the role of leaders in developing a culture and climate supportive of the efforts of creative people. The limited literature specific to the role of creative climate in software innovation is discussed. The chapter is included in this thesis because some innovation models refer explicitly to the importance of leader influence on creativity, culture and creative climate (Amabile 1996; Ekvall 1996; Mumford et al. 2002) and so this is pertinent to a discussion about the leadership of innovation.

3.2 Defining creativity

The literature sometimes treats innovation and creativity as interchangeable terms (Basadur 2004; Sousa, Pellissier and Monteiro 2012). West (1997) suggests that the synthesis of knowledge and experience from different sources can be considered as creativity, whereas the practical application of novelty better defines innovation. Sawyer (2011) suggests that definitions of creativity originate from consideration of individual characteristics or traits, the creative process, or creative outputs. Systems and processes feature in many definitions of creativity (Woodman et al.1993).

Koestler (1964) suggested that creativity arises when knowledge from different sources is combined in a novel manner. West (1997) believes that innovation is the practical application of novelty. Creativity is seen as an important antecedent to innovation and a source of competitive advantage (Amabile 1988; Shalley 1991; Wolfe 1994; Oldham and Cummings 1996; Ekvall 1996; Zhou 2003). There is agreement in the literature that the outputs of organisational creativity should be both novel and useful (Amabile 1998; Dean et al. 2006; Isaksen and Ekvall 2010) even though creativity may on occasions fail to deliver commercial value (Hughes et al. 2018).

Creativity is a broad term and has been defined in many ways (Amabile 1988) with Couger (1989) counting at least 100 definitions. Any original idea might be judged as creative to the thinker, but society seems to value original ideas when they prove useful to a wider community (Weisberg 1993; George 2007). Finke, Ward and Smith (1992) note that the systematic research of creativity has been considered difficult due to the personal and anecdotal nature of accounts of creativity, and so propose an experimental approach to investigating creativity. Creativity seems to be a complicated concept, and Sternberg (1985) suggests that this psychological complexity is a reason for the lack of consensus on a single definition.

Considering product or output-based definitions of creativity in relation to the unique nature of software development can be problematic. Novelty and utility provide two aspects to defining creativity that have been widely used in the literature and seem to apply adequately to traditional products and services (Stein 1974). The nature of innovation in software is viewed by some as being quite different to other products or services (Pikkarainen et al. 2011). Evidence of creativity may not be immediately apparent to the end user of a software application or system because the creative efforts of the individual or organisation may be deeply embedded within the development process or the software code base (Graziotin 2013; Jones and Rose 2016).

Amabile (1988, p.126) has offered a simple definition of creativity which seems appropriate to the case of SMSE developing commercial software in which both individual effort and group collaboration are evident:

> *“The production of novel and useful ideas by an individual or small group of individuals working together.”*

Amabile et al. (2004) draw attention to three theoretical schools of organisational creativity. The componential theory (Amabile 1988 and 1997) argues that creativity is supported by skills, processes, motivation, and social environment. The interactionist theory (Woodman and Schoenfeldt 1989; Woodman et al. 1993) considers creativity to result from the complex interactions between an individual and their environment. The multiple social domains theory (Ford 1996; Ford 2010) contrasts habitual and creative behaviours within a social context that brings meaning to activity as innovative and useful.

Executive leaders manage resources that facilitate individual and team creativity (Denti and Hemlin 2012). Successful innovation leaders are thought to display a degree of expertise and skill in employing direct and indirect influencing tactics that are consistent with the needs of creative people and teams (Mumford et al. 2002). Mumford and colleagues suggest a traits, skills and behaviours view of the leadership of creativity and they emphasize the importance of social skills, negotiating skills and personal empathy in creating engagement. Leaders of creative projects are often required to provide support for ideas, access to resources and establish a positive social environment (Mumford et al. 2002).

Beyond direct leader influence, the indirect effects of organisational culture have also been identified as important to creativity (Kanter 1988, Johnson 1996; McGourty et al. 1996; Tushman and O'Reilly 1996; Judge et al.1997; Tesluk et al. 1997; Ahmed 1998; Gaynor 2000; Tidd, Bessant and Pavitt 2005).

3.3 Culture

Some scholars suggest that leaders play a role in maintaining a culture that encourages commercial creativity (Amabile 1996; Amabile et al. 1996; Isaksen et al. 2001; Shalley and Gilson 2004; Hemlin, Allwood and Martin 2008). Culture is argued to be a determinant of organisational performance (Denison and Mishra 1995). Voelpel, Leibold and Streb (2005) believe that development of a culture which encourages and supports innovation is important to sustained value creation.

Schein (2017) recognizes that culture can be defined in many ways and is often subject to the perspective of the observer. He suggests that leadership plays a role in developing culture by mediating behaviour in a way that facilitates learning. He offers a definition of culture based on the accumulated learning of a group:

> *"A pattern or system of beliefs, values, and behavioural norms that come to be taken for granted as basic assumptions and eventually drop out of awareness."*
>
> (Schein 2017, p.6)

Schein (2017) considers culture to exist at three levels. First, artefacts are visible but observed behaviour can be difficult to interpret. Secondly, espoused beliefs and values are represented by ideals, ideologies, and rationalization, but may not always be consistent with behaviour and other artefacts. Finally, basic underlying assumptions that are taken for granted and determine behaviour. Former McKinsey Managing Director and partner Marvin Bower defined culture as, "*the way we do things around here*" (Bower 1966, p.22) Although acknowledging the difficulty of culture change, Handy (1999) notes that cultures do evolve with organisational maturity. History, technology, ownership, and other factors may impact the way in which firms choose to organise (Handy 1999).

Many writers believe that culture is deeply embedded in organisations and hard for management to change (Wiesenfeld, Raghuram and Garud 1998; Alvesson and Sveningsson 2008; Schein 2017). This interpretivist stance identifies culture as something that defines an organisation rather than an attribute that the organisation has (Bolman and Deal 2008). By contrast, functionalists consider determinants of culture to be attributes of the business that can be changed (Cameron and Quinn 2006). Martins and Terblanche (2003) identify strategy, structure, support mechanisms, behaviour and communication as determinants of organisational culture that they believe influence creativity and innovation. Ahmed (1998) believes that leaders bear responsibility for creating a culture and climate that acknowledges the importance of innovation at all levels.

The extent to which cultures align with the needs of individuals may be a significant factor in the engagement of those individuals (Brandi and Hasse 2010). Kenny and Reedy (2006) note that there is no single view of the best culture to promote creativity. Some writers believe that fluid and organic cultures may yield better results in innovation (Kanter 1985; Burns and Stalker 1994). However, there is also evidence that centralisation and control can favour innovation (Kimberly 1981). Csikszentmihalyi and Sawyer (1995) note that even if an organisation is successful in developing a culture and processes supportive of creativity, this does not guarantee innovation success.

Each organisation operates on individual assumptions that can highlight the depth and complexity of culture (Schein 2017) with resulting cultural models being regarded as different rather than better or worse (Handy 1999). Culture can define organisational norms through deeply held beliefs which moderate behaviour and are evident as tangible traits of an organisation. The intergenerational learning reflected in culture manifests itself through artefacts, symbols, values and deeply held beliefs (Schein 2017). Groups that have a shared organisational history develop myths and heroic characters, co-creating a specific cultural identity and attitude to work (Deal and Kennedy 2000). Members of an organisation will have individual perceptions of their experience (Griffin and Moorhead 2014). The aggregate of social variables creates a sense of how it feels to work within an organisation, and this reflects the climate (Churchill, Ford and Walker. 1976; Mullins 2010).

3.4 Creative climate

Organisational culture and climate are distinct concepts (Denison 1996; McLean 2005). Holbeche (2006) considers culture to be long lasting in comparison to the more transitory nature of organisational climate (Denison 1996). Climate has been defined as:

> *“the recurring patterns of behavior, attitudes, and feelings that characterize life in the organization.”*

(Isaksen et al. 2001, p.172)

Climate has been suggested to be an important determinant of creativity and successful innovation (Amabile et al. 1996; Ekvall 1996; Ekvall and Ryhammer 1999; Isaksen and Tidd 2006) representing an expression of culture through inter-related attitudes, behaviours and feelings (Ekvall 1996).

Amabile et al. (1996) developed the KEYS to creativity and innovation assessment approach which explores leader impact on culture and creative climate based on a number of positive (“stimulant”) and negative (“obstacle”) scalar relationships for a variety of mediating factors (see figure 3.1 below).

Establishing a creative climate that encourages dynamism, freedom, support, and trust has been shown to encourage high degrees of engagement and collaboration in certain environments (Ekvall 1996). Active support by management for new ideas and having time set aside for idea generation stimulates creativity as does a positive attitude towards playfulness and humour. Encouraging a broad debate can be helpful to creativity as it ensures diversity of opinion influencing final design and creates a spirit of inclusivity but allowing this to spill over into interpersonal conflict can be damaging. Intuitively, it seems that Ekvall's creative climate concept relates well to larger organisations. However, in a smaller business that may be more pressured for time and resource, some of the aspects associated with the creative climate model may seem like unaffordable luxuries.

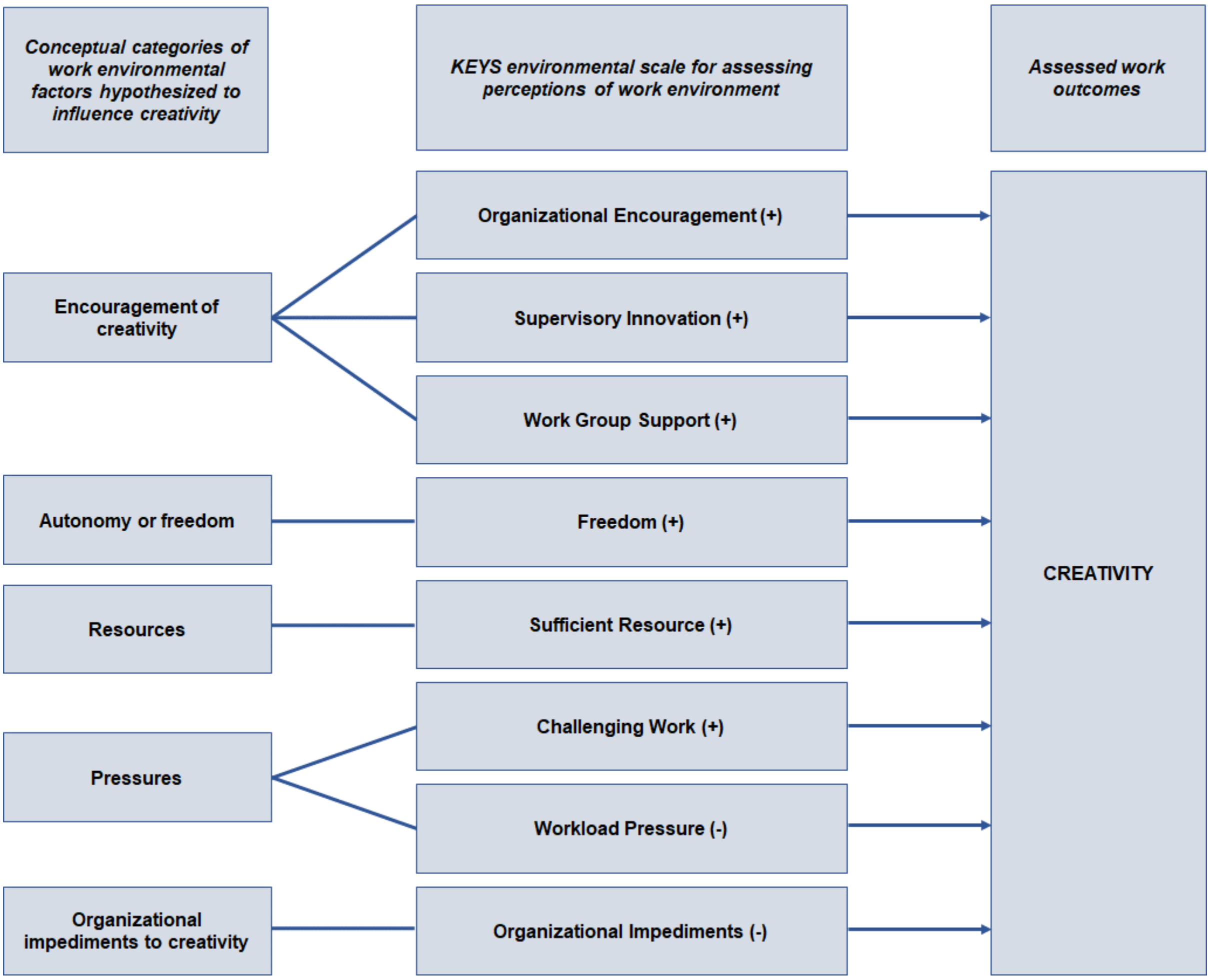


Figure 3.1 Perceived work environment for creativity (Amabile et al. 1996, p.1159)

There are practical constraints to creativity at work, such as availability of resources and other commercial or operational priorities (Shalley 1991). The availability of resource has been correlated to productivity in creative environments (Ekvall and Ryhammer 1999). Organising resources and prioritizing creative projects challenges leaders to manage ambiguity and contradictory objectives such as reducing stress whilst encouraging risk taking, exploration versus sticking to budgets, or promoting individual initiative whilst ensuring team cohesion (Mumford et al. 2002).

The role of creative climate in determining creative output has been shown to transcend differences of national culture (Lin and Liu 2012). Hunter, Bedell and Mumford (2007) believe creative climate to be important across sectors and organisation types, including the not-for-profit sector. Creative climate has been represented as having multiple dimensions of relationship, hierarchy, the nature of work, support and reward (Schneider, Gunnarson and Niles-Jolly 1996).

Even in organisations where creativity and innovation are assumed to be pre-requisites for the function of that organisation (for example, within R&D organisations), the relationships between climate and achievement is still evident. Whilst individual creativity has a dependency on the skill, experience and motivation of the individual, the receptiveness of the organisation to creative individuals has an impact on success (Leavy 2005).

Although not specific to software development, Moultrie and Young (2009) explored creative climate in small British firms in the creative industries. They used Amabile's KEYS model (Amabile 1996) and Ekvall's Creative Climate model (Ekvall 1996) to create a Likert scale questionnaire and followed up with semi-structured interviews. Although representing a relatively small sample size of ten survey responses and five interviews, Moultrie and Young's (2009) research found that both Amabile's (1996) and Ekvall's (1996) models had some degree of applicability and were complementary. However, some sectoral differences were noted, and further research specific to SMSE might provide a validation opportunity for their work.

This section has discussed the work of several scholars who believe that leaders can influence culture and climate and that this indirect leadership may have an impact on creativity and therefore innovation. In addition to the indirect impact of leadership on culture and climate, the support of colleagues and supervisors is considered important to promoting a creative climate (Amabile 1997). Leaders may also play a direct role in determining the level of control that team members have over their own work and how challenging and stimulating work is (Amabile 1997). Software engineering is regarded as creative problem solving (Glass 1995; Dybå 2000; Knobelsdorf and Romeike 2012; Crawford et al. 2012) and so culture and creative climate may have specific relevance for software engineers engaged in innovation.

3.5 Creativity and climate in SMSE

Dybå (2000) has emphasized the importance of adaptability and creativity in software development. Cattel (1971) sees creativity as problem solving which is a perspective familiar to software developers. Developing software is thought to require the individual creativity of software engineers (Knobelsdorf and Romeike 2012; Crawford et al. 2012) who use logic and ingenuity in the resolution of multiple complex problems (Glass 1995). In the context of an SMSE, creativity could be considered problem solving with an explicit aim of developing commercially valuable software.

Complex problems in computer science are thought to lend themselves to a heuristic approach, with a degree of trial and error commonly applied to their resolution (Simon 1981). Agile software development methodologies which break complicated development effort down into short manageable sprints have grown in popularity (Dybå and Dingsøyr 2008; Serrador and Pinto 2015) and tend to be favoured by smaller teams. Such methods have been suggested to aid creativity by reducing formal bureaucracy and encouraging the adoption of an inherently more experimental and iterative approach, although Conboy, Wang and Fitzgerald (2016) acknowledge that conclusive evidence has yet to be to be produced to prove its benefit.

Everyday behaviours exhibited by leaders can have a powerful impact on subordinates, but not all behaviours may be conducive to a climate that supports creativity and may therefore have negative implications for innovation (Amabile et al. 2004). For example, when faced with a leader who routinely offers early criticism of ideas, creative people may withdraw and their efforts may be undermined (Galluchi, Middleton and Kline 2000) meaning that leaders have to be reflexive and consider evaluation and feedback carefully and sensitively. Trust and passion have been identified as important components of organisational creativity (De Salvo 1999) and so a supportive environment that establishes trust, openness and a degree of fluidity may positively influence creativity (Kaplan 1960; Tesluk, Farr and Klein 1997; Ahmed 1998; Clegg et al. 2002; Buhler 2002).

Creative work is an iterative process (Sternberg and Lubert 1991) requiring a degree of resilience and tolerance of failure (Andriopoulos and Lowe 2000). Sternberg and Lubert (1991) suggest that creativity is an individual choice. Some people seem to display creative behaviour without the need for extrinsic reward

(Dweck 1999). For other individuals, extrinsic reward, public acknowledgement, the avoidance of criticism, or the emotional constructs related to competing and winning are equally important determinants of success (VandeWalle and Cummings 1997). Such symbols of recognition can be an important part of establishing a positive social context for some creative individuals (Redmond, Mumford and Teach 1993).

Whilst little evidence of primary research on creative climate in SMSE could be found in the extant literature, empirical work has shown that productivity of developers may be influenced by mood and emotion, with the experience of frustration within the work environment having a significant negative impact (Wrobel 2013). Wrobel (2013) surveyed 49 developers, linking mood and emotion to productivity and noting that feelings of frustration had the most negative impact on productivity. Further evidence of the correlation between positive mood or emotion and creative output has been explored and empirically demonstrated by Graziotin, Wang and Abrahamsson (2013 and 2014) who have explored a possible correlation between subjective measures of mood or happiness in software engineers linked to performance in terms of problem solving skills, creativity and productivity.

In an initial study of the relationship between mood, emotions and productivity Graziotin, Wang and Abrahamsson (2013) asked eight developers to self-assess their moods in 10-minute intervals whilst coding. The results suggested a positive correlation between self-assessed positive mood, emotion and productivity. Given that productivity in coding implies creative problem solving, mood and emotion may be important factors for further exploration. The researchers followed up on this study (Graziotin, Wang and Abrahamsson 2014) by asking a sample of 42 developers to explore the impact of mood on analytical problem-solving tasks like algorithm design. The results of the study suggested a correlation between positive mood and results. Leaders may play a transformational role in improving the mood of developers by creating an environment that is conducive to creative work and helping establish a clear path through organisational bureaucracy (Rose and Furneaux 2016).

Individual orientation and aspiration are thought to result in creative performance differences between people (Janssen and Van Yperen 2004; Hirst, Van Knippenberg and Zhou 2009). Moultrie and Young (2009) have observed that organisational creativity generally relates less to the traits or contribution of a single individual and more to processes and outputs with a defined intent. At both a team and an individual level, the factors which motivate creativity seem to vary widely, creating a significant challenge for leaders tasked with exploiting the creative output of individuals within a team (Hirst, Van Knippenberg and Zhou 2009). If people feel unsupported than they may not best express their creativity (Scott 1995) and there is thought to be a need for active support of idea generation (Sessa 1998).

Some software developers consider themselves to have predominantly artistic and creative traits, rejecting the idea that software development is primarily an engineering science (Moad 1990). The design approach espoused by Winograd (1996) emphasises the importance of creativity in software development and notes that the initial design phase is where the importance of creativity is most evident.

Whilst individual creativity is important, software is often developed by multi-disciplinary technical teams (Glass 2006) and so there is a social aspect to the work (Dybå 2000). Different phases of a development project may require differing levels of creativity from different members of the team (Gu and Tong 2004). Gu and Tong (2004) challenged 12 student development groups with software projects and analysed their perceptions of relative time invested in creative activities compared to disciplined development activity. They also explored how the use of a modelling language tool called Unified Modelling Language (UML) enhanced the perception of time spent on creative activities. This empirical approach allowed Gu and Tong to propose four hypotheses about creativity in development projects which could be the subject of future research. First, creativity appears to be most evident in the earlier part of projects. Secondly, the use of the modelling tool to aid documentation promoted creativity in the specification and design phase of the project. Thirdly, the balance of creative and disciplined work did not appear to impact the speed of development. Finally, developers express a preference for the creative phases of software development projects. However, these findings are yet to be validated in a professional software development organisation.

Many software firms believe that applying some measure of structure and discipline to their development process is an important determinant of success (Glass 2006). Hierarchical or mechanistic organisations that focus on control and administration have been suggested by some authors to be less successful in promoting creativity (Katz and Tushman 1979; Quinn 1985 and 1989; Damanpour 1991; Mumford et al. 2002). However, other studies have shown that greater control and centralization is positively correlated with measures of innovation success, which may be different to creativity (Kimberley 1981; Sine, Mitsuhashi and Kirsch 2006). Dybå (2000) claims that in smaller software businesses that may suffer higher degrees of unpredictability and a tendency to improvise, effective development requires the firm's leadership to establish an appropriate balance between discipline and creativity. The phases of a software project may not be as rigid in practice as in theory (Zelkowitz 1988). Within larger organisations, there will be some role demarcation between members of development teams but in smaller firms, multiple roles might be performed by a single individual (Ciborra 2004).

3.6 Chapter conclusion

This chapter discusses creativity as an antecedent to innovation and draws attention to some of the theories of how leaders may influence culture and creative climate. Although the literature on creativity in SMSE is limited, a cadre of scholars consider software development to be creative problem solving (Glass 1995; Dybå 2000; Knobelsdorf and Romeike 2012; Crawford et al. 2012) and so understanding how culture and climate might impact software engineers is relevant to this thesis.

The literature suggests that innovation arises from the creative collaboration of a group working in a conducive environment (Kanter 1988; Woodman, Sawyer, and Griffin 1993; Amabile 1996). Commercial creativity may start with the framing of ill-defined problems (Baughman and Mumford 1995) but developing a creative idea beyond this is thought to require broad organisational support (Mumford et al. 2002). Organisational leaders are thought to have a role in encouraging creativity directly through the provision of resources and active encouragement, and indirectly by developing a climate that is conducive to creative work (Amabile 1996; Ekvall 1996).

Many SMSE lack access to capital or are private equity backed and so funded through aggressive debt structures. The impact of real or perceived cash constraints on organisational creativity has not been fully evaluated in the literature. The idea that organisations that are open, trusting, fun and well-funded should support successful innovation has intuitive appeal and has found some empirical support (Jung, Chow and Wu 2003). However, there are also compelling arguments for discipline and structure in software firms (Dybå 2000; Glass 2006).

There is a large body of literature and prior research covering the possible effects of leadership on creativity, culture, and climate (Hughes et al., 2018) that makes a strong case for the creative climate ideas of Amabile (1996) and Ekvall (1996). However, there is limited primary research testing these theories in the British

SMSE sector. Andriopolous (2001) notes that in addition to climate and culture, other factors may also be important in determining the creative propensity of an organisation. These include structure, systems, skills, resources, and leadership. The next chapter introduces the literature on leadership and the leadership of innovation. Aspects of creativity, culture and climate are features of some of the theories and models of innovation leadership that will be discussed.

4 LEADERSHIP OF INNOVATION

4.1 Chapter introduction

The first part of this chapter discusses the approach taken to searching for literature on innovation leadership specific to SMSE. Leadership and innovation have been studied in a variety of different organisational contexts, but specific focus on innovation in the software development industry is relatively recent (Rose, Jones and Furneaux 2016). Even less work has been done on SMSE (Carlo, Lyttinen and Rose 2011; Rose, Jones and Furneaux 2016) and a very small subset of that work concerns the impact of leadership on innovation in SMSE (Rose and Furneaux 2016). In common with the experience of Rose, Jones and Furneaux (2016), literature searches retrieved few articles specific to the case of SMSE and even fewer relating to the leadership of innovation in such firms.

In the absence of specific literature relating to innovation leadership in SMSE, this chapter considers literature that forms part of the canon of general leadership theory or is related to the leadership of innovation in contingent situations that are not specific to SMSE. The chapter continues with a discussion of the difficulty of deriving consensus on definitions of leadership. It then provides some historical context to how leadership theories have developed since the 19th century, considering both a chronological and a taxonomic approach to understanding the literature and summarising theories in a chronological table. Although a timeline of the development of leadership theories is presented for context (see figure 4.1, below), the review does not re-tread the well-worn path of providing a detailed review of general leadership theories. Only a brief description of general theories of leadership is provided as this is a large topic about which many thousands of words have already been written (e.g. Bass and Bass 2008; Northouse 2019; Yukl and Gardner 2020).

The chapter then focuses on theories that are thought to have application to the leadership of innovation and highlights some of the more complex models that integrate direct and indirect leadership influence on innovation.

Given the lack of literature specific to innovation and leadership in SMSE, the chapter also explores the more established base of literature on leadership in SMEs, considering how they learn and innovate.

Building on Yukl's (2013) integrative model of innovation leadership, the chapter brings together elements of the literature to create a syncretic model of innovation leadership which is logically deduced and offers eight constructs of innovation leadership which are founded on the intersection of leadership styles with the concept of organisational ambidexterity.

The chapter concludes that current research and literature specific to the leadership of innovation in SMSE is nascent, fragmented, and limited in quantity and scope. There seem to be many peculiar aspects specific to the nature of SMSE that mean innovation leadership theories and models that apply well to larger technology firms do not resonate quite so well in these smaller organisations. Common with the research into SMEs the ability and preferences of SMSE leaders are key determinants of strategy and innovation, rather than profit maximization. Transactional and transformational leadership and ambidextrous leadership feature in much of the literature on SME innovation. Although smaller firms may be resource and capital constrained, size alone does not seem to be the major determinant of innovation capability and may be offset by agility, entrepreneurial spirit, and the direct influence that leaders have over their organisations.

4.2 Literature searches

Any Boolean search of digital repositories that includes search terms relating to innovation leadership in smaller software firms returns few results. Throughout the research, regular searches of multiple literature sources have been made, most recently in June 2020. Search terms were evolved through trial and error and although they often scored many thousands of "hits", manual review of titles and abstracts resulted in a low number of articles being identified with any direct relevance to the research topic. In the search for articles that explicitly discuss innovation leadership in SMSE, the terms used included 'software AND lead* AND innov*', 'software AND innov*', 'software AND small and medium sized enterprise', 'software AND SME', 'software and SMB'. Initial searches used a date range of 1970 to 2020. With nothing specific to the leadership of software development in SME being retrieved prior to 1990 and in the interests of recency/currency, later searches used a date range of 1990 to 2020. The IEEE Xplore Digital Library holds a broad collection for computer science related literature but returned nothing of direct relevance to this research. Moving to business and social science data sets, Business Source Premier and Emerald returned a small number of journal articles but they were not directly related to the leadership aspects of innovation and were more general in their consideration of innovation processes in software firms rather than being specific to smaller firms. The archives of Research Policy, a four-star journal focused exclusively on innovation studies, did not document research specific to the leadership of innovation in SMSE.

The journals that Rose and Furneaux (2016) identified by searching the ISI Web of Knowledge in a systematic review of the literature on innovation drivers and outputs for software firms were explored for relevant content. Each of the 93 journal articles that Rose and Furneaux identified as being of relevance to their review were retrieved and analysed. Rose and Furneaux identified 27 articles that acknowledged the role of innovation leadership in software firms. Of these 27 articles, 16 discussed the impact of innovation leadership on process innovation and 13 discussed the impact of innovation leadership on product innovation. However, most of the articles retrieved were not focused on SME. Rose, Jones and Furneaux (2016) note how few writers have turned their attention to SMSE, listing just six articles that were explicitly focused on SMSE (Raffa and Zollo 1994; Romijn and Albaladejo 2002; Koc 2007; Weterings and Koster 2007; Tjornehoj and Mathiassen 2010; Carlo, Lyttinen and Rose 2011).

This research sits at an interesting intersection of scholarship which brings together innovation studies, leadership theory, creativity, culture, ownership structures and high technology SME. It addresses a neglected area of study into the perceived impact of leadership on the innovative work behaviour of software engineers in smaller firms. The lack of literature in this area emphasizes the unique nature and contribution of this research.

4.3 Defining leadership

The topic of leadership has created an industry in academia, publishing and consulting (Pfeffer 2015), attracting extensive research resulting in a rich base of literature. Despite this rich base, academics over many years have failed to reach agreement on a single definition of leadership (Bennis 1959; Stogdill 1974; Burns 1978; Bennis and Nanus 1985; Rost 1993; Alvesson, Blom and Sveningsson 2017; Northouse 2019; Yukl and Gardner 2020). Some definitions consider leadership to be about facilitating consensus on what needs to be done and how it can be achieved, then marshalling individual and collective efforts in the service of a shared objective. For example:

> *"Leadership is the process of influencing others to understand and agree about what needs to be done and how to do it, and the process of facilitating individual and collective efforts to accomplish shared objectives."*
>
> (Yukl and Gardner 2020, p.26)

Influence, alignment, and facilitation are features of many definitions. The use of a process in the pursuit of a common goal is often cited within definitions of leadership. For example:

> *"Leadership is a process whereby an individual influences a group of individuals to achieve common goals."*
>
> (Northouse 2019, p.5).

Drucker considered leadership to be a skill of management. He regarded management as a "*creative rather than adaptive task*" (Drucker 1954, p.47) requiring vision and an awareness of the external environment as well as the organisation's capabilities. He believed that managers need to also be leaders. Mintzberg (1973) identified leadership as one of ten managerial roles. Increasingly, we see that in modern organisations people at all levels of hierarchy are required to lead and executive leaders invariably must be equally concerned with the tasks of professional managers reflecting Mintzberg's view that leadership is one of several skills that are expected of professional managers.

Zaleznik (1977) suggested management and leadership to be distinct activities. He viewed managers as rational, detached, and concerned with process and tactics rather than with substance. Kotter (1990) considers leadership and management to be distinct processes. He suggests that management processes are concerned with planning and budgeting, organising, staffing, controlling and problem solving whereas the process of leadership is concerned with establishing direction, aligning people, motivating and inspiring. Kotter believes that leadership is an active process that promotes activity in others through personal influence to create an organisational ambience which influences behaviour and results. Isaksen and Tidd (2006) question the idea that management and leadership are somehow fundamentally different. They suggest the concept of management has been devalued by an assumption that leaders provide a new and inspirational vision whilst managers focus on marginal improvements. Instead, they state that it is better to consider leadership and management as part of a continuum and believe that effective leaders of innovation will display concern for task, people and change.

Rost (1993) sees the failure to find consensus on a precise definition of leadership as a contributory factor in what he considers a lack of rigour and poor progress in leadership studies. Yukl and Gardner (2020) acknowledge the narrow focus of most leadership research. They point out the historical lack of integration between theories based on traits, skills and values with theories based on behaviour. They are also critical of situational theories, which they suggest should go beyond an attempt to explain contingent impact on traits and behaviours, and instead should consider the broader interaction of traits, power, behaviour and situation on effectiveness.

There is evidence of frustration with methodological issues in leadership research which have been dominated by simplistic surveys that frequently ask respondents to recollect leader behaviours over time (Yukl and Gardner 2020). The quantitative and positivistic approach originating from the field of psychology (Parry and Bryman 2006) attempts to achieve objectivity (Alvesson 1996) and employs scientific techniques of conjecture and refutation to achieve greater accuracy and clarity. However, the quantitative approach has been suggested to over-simplify the interpretation of phenomena by focusing on a limited number of possible mediating and moderating variables (Alvesson and Deetz 2000). As an alternative, some researchers have promoted qualitative methods to better understand the complex social processes involved in leadership (Parry et al. 2014; Schilling 2017). Qualitative methods also have well-documented limitations (Parry et al. 2014) such as concerns about subjective bias, selective memory and interpretation, and other attribution errors (Yukl and Gardner 2020). The methodological dilemma that researchers face in choosing between quantitative and largely positivistic approaches and qualitative inductive research seems bridged by the emergence of mixed methods (Parry et al. 2014; Cresswell and Cresswell 2018) which allow theory to be developed, tested and triangulated using complementary processes.

Alvesson and Sköldberg (2017) have suggested that researchers may have become institutionalized into seeing leadership through a power relationship lens and therefore become closed to alternative non-hierarchical approaches to understanding coordination and influence as they cling to a widely accepted orthodoxy. Alvesson (1996) draws attention to problems of written definition due to the diversity of interpretation of what the concept of leadership represents in various contexts. Despite this, some years later Alvesson, Blom and Sveningsson (2017) attempt a definition based on what they suggest is a "*more restrained view of leadership*" (Alvesson, Blom and Sveningsson 2017, p.8), suggesting leadership to be,

> *"about people involved in an asymmetrical (unequal) relationship (formally or informally, permanently or temporarily, but not only momentarily) involving followers. Leaders are interpersonally trying to define meaning/reality for others who are inclined to (on a largely voluntary basis) accept such meaning-making and reality-defining influencing acts."* (Alvesson, Blom and Sveningsson 2017, p.8).

The complexity of this definition seems to underline the nature of the definitional problem. Like quality or beauty, each of us might think we know leadership when we see it, but to define it requires such conceptual breadth that clarity of meaning becomes elusive. The definition offered by Alvesson, Blom and Sveningsson (2017) stops short of saying "leadership is" and instead says "leadership is about", before reeling off a list of adverbs that may or may not be essential to understanding the act and experience of leadership. Grint (2005) concludes that the entire concept of leadership may be contested, with subjective interpretation compromising any attempt at a taxonomy. Grint's own perspective is that leadership is generally considered from the perspective of the individual, the results that they achieve, their position within an organisation and the process through which they exercise their leadership. These different contextual perspectives may contribute to the difficulties of establishing a universal definition.

For many years, academics have been critical of the rate and quality of progress in leadership studies towards developing a full description and understanding of leadership phenomena that can be applied practically and form a basis for theory (Mintzberg 1982; Rost 1993; Storey 2004; Western 2008; Tourish 2015; Wilson et al. 2017). The definition of leadership offered by Yukl and Gardner (2020) and cited above is appealing because of its breadth, but for practical reasons, in this thesis leadership is narrowly defined. This thesis explores small organisations that typically have a limited hierarchy and focuses on the inter-subjective experience of executive leaders and software engineer followers. SMSE represent a specific contingent leadership situation. Therefore, for the purpose of this research, leadership of innovation in SMSE will be considered as:

a specialised process in which executive leaders of SMSE influence and may also facilitate the creative and productive efforts of software engineer followers with the objective of delivering commercially valuable software.

4.4 A chronology and taxonomy of leadership theories

This section considers the development of leadership theories over the last century from a chronological and taxonomic perspective. Several theories that are specifically relevant to the leadership of innovation are described to provide context for the research.

Leadership theories may be categorised as being either universal in their applicability to all situations or contingent on the specific context of a situation (Jago 1982). The main variables underpinning different leadership theories can be thought of in terms of characteristics of the leader, the follower, or the situation (Yukl and Gardner 2020). Yukl and Gardner (2020) note that leadership exists at multiple levels within an organisation from individual and dyadic, through groups and to the entire organisation. They draw the distinction between descriptive theories, which attempt to explain observed behaviour and prescriptive theories, which attempt to specify how leaders should respond to situations to be most effective (Yukl and Gardner 2020).

Some writers have taken a chronological approach to explaining the development of leadership theory (King 1990; Bryman 1996; House and Aditya 1997). This review summarises some of the major leadership theories chronologically in figure 4.1 (below) to give a sense of the evolution and trends in thinking evident from the 2IR of the 19th century to the present day. Rost (1993) provides a cautionary note to the literature. When presented chronologically there is a danger of assuming progress in understanding and theoretical validity which may not be warranted. Definitional issues continue to cause confusion and hamper progress and the methodological orthodoxy that originates in psychology may have closed researchers off from other ethnographic and environmental interpretations of phenomena (Parry and Bryman 2006; Alvesson and Sköldberg 2017).

The chronological approach to categorising theory has limitations. The eras are not entirely distinct as writers have sometimes introduced an idea then come back to it at a later stage, refining or altering their original concepts. Sometimes, their work has been revisited in a later era by other academics.

Many of the leadership theories that have developed over the last century have been grouped into one of five theoretical categories described by Yukl (2013) as traits theories, behavioural theories, power and influence theories, situational theories, and integrated theories. In a more recent book, Yukl and Gardner (2020) add values-based approaches to the categories of theory, in which the values of a leader are important in influencing followers and include ethical, authentic, servant and spiritual theories of leadership in this category. Within and beyond each of these categories, there has been a proliferation of theories and constructs that attempt to define and explain leadership in both general and specific terms resulting in a

> *"large and fragmented field of concepts, models and theories that presents rather a confusing picture"* (Alvesson, Blom and Sveningsson 2017, p.5).

The earliest leadership theories related to traits, which in the 19th century and earlier were believed by many to be innate (Carlyle 1840; Galton 1869). Ridley (2018) has pointed out that many people cling to the Great Man theory when it comes to innovation, discussing Edison and the lightbulb as an example of a historical myth that one great man alone delivered a ground- breaking innovation. Modern leaders of some large technology firms gain a reputation for innovation and achieve similar celebrity status (Tidd and Bessant 2018). However, as Ridley (2018) points out, there are often many people working in a field before a company breaks through and achieves notable commercial success. He suggests that significant innovations are often a product of their time and build on scientific, cultural and economic factors recognised by many individuals who contribute but fail to be recorded for posterity. More recently, the implicit gender bias in the term "Great Man" has been criticized (Spector 2016). Grint (2011) notes that attributes that might prejudicially be associated with masculinity are often assumed within Great Man theories.

Some traits-based studies are concerned with an individual's propensity to lead (Stogdill 1974; Lord, de Vader and Alliger 1986). Others are more concerned with leader effectiveness (Boyatzis 1982; Bass 1990). Many studies have been conducted into traits-based leadership over the last century identifying a range of traits and skills that may be relevant to effective leadership (Yukl and Gardner 2020).

1840s to 1940s	1950s	1960s	1970s	1980s	1990s	2000s	2010s
Great Man Carlyle 1840 Galton 1869	**Behavioural** Katz & Kahn 1951 Hemphill & Coon 1958s Tannenbaum & Schmidt 1958	**Behavioural** Cartwright & Zander 1960 Likert 1961 Blake & Mouton 1964	**Transformational** Downton 1973 Burns 1978	**Transformational** Bass 1985 Bennis & Nanus 1985 Kouzes & Posner 1987	**Transformational** Bass & Avolio 1993 Bass 1996 Lowe et al. 1996	**Transformational** Judge & Bono 2000 Judge & Piccolo 2004	**Neuro** Rock & Schwarz 2006 Rock & Ringleb 2009
Scientific Management Taylor 1911	**Skills** Katz 1955	**Achievement** McClelland 1961, 1965	**Transactional** Dansereau, Green and Haga 1975	**Transactional** Bass 1985	**Implicit** Hanges, Braverman & Rentsch 1991	**Flexible** Yukl & Lepsinger 2004 Mumford et al. 2007	**Complexity** Lichtenstein et al. 2006 Uhl-Bien et al. 2007
Bureaucratic Management Fayol 1911/1949 Follet 1926	**Contingency** Woodward 1958 Fiedler 1958	**Contingency** Fiedler 1967	**Contingency** Tannenbaum & Schmidt 1973	**Self-leadership** Manz 1986	**Followership** Kelley 1992	**Distributed** Gronn 2002 Spillane 2006	**Followership** Uhl Bien et al 2014
Charismatic Authority Weber 1905 and 1922	**Social Influence & Power** French & Raven 1959	**Social Influence & Power** French & Raven 1965	**Normalized** Vroom & Yetton 1973	**Charismatic** Conger & Kanungo 1987	**Change Centred** Ekvall 1991	**Instrumental** Antonakis & House 2002 & 2004	**Instrumental** Antonakis & House 2014
Contingency Lewis, Lippett and White 1939		**Theory X & Y** McGregor 1966	**Leader Member Exchange (LMX)** Graen & Cashman 1975 Burns 1978	**Leader Member Exchange (LMX)** Dienesch & Liden, 1986	**Full Range** Bass & Avolio 2004	**Spiritual** Fry 2003	**Complex Adaptive** Obolensky 2010 Ford 2010
Participative Lewin, Lippitt & White 1939		**Participative** Likert 1967	**Participative** Yukl 1971		**Emotional Intelligence** Goleman 1996	**Discursive** Fairhurst 2007	**Integrative** Yukl 2013
Traits Allport & Allport 1921 Crowley 1931 Stogdill 1948 & 1974		**Situational** Hersey & Blanchard 1969	**Path Goal** Evans 1970 House 1971 House & Mitchell 1974		**Ambidextrous** Tushman & O'Reilly 1996	**Ambidextrous** O'Reilly & Tushman 2008	**Reflexive** Alvesson, Bjorn and Sveningsson 2017
			Servant Greenleaf 1970 & 1977		**Servant** Spears 1995	**Authentic** Luthans & Avolio 2003 George 2003 Avolio & Gardner 2005	
					Authentic Cashman 1998		

Figure 4.1 Timeline of leadership theories

Mumford et al. (2000a) make a link between the effective development of certain skills being at least partially moderated by the interaction of traits and experience. Mumford et al. (2000b) consider a typological approach to understanding which traits might influence leader development in US Army officers, finding statistical correlation between typologies that include social skills, thoughtfulness and innovative capability, and career progression to more senior ranks. A relatively homogenous group of US military officers may be culturally different to executive leaders found in a British SMSE. However, sociability, empathy and innovative capability seem intuitively relevant to the success of a technology company CEO.

Stogdill (1948) noted leadership traits could not be seen in isolation to situational context or to the acceptance of followers. Traits based theories have been criticized on methodological and conceptual grounds (Alvesson, Blom and Sveningsson 2017; Yukl and Gardner 2020) and the approach is claimed by some to be too simplistic (Conger and Kanungo 1998) with a case being made for a more holistic approach (Quinn 1988; Kaplan and Kaiser 2006). Nonetheless, traits-based leadership theories have enjoyed a resurgence (Zaccaro 2007). Studies of toxic leadership also show a return to traits-based theories (Reed 2004; Lipman-Blumen 2005).

Behavioural theories focus on what leaders do and typically contrast the task and relationship orientation of people (Cartwright and Zander 1960; Likert 1961; Blake and Mouton 1964; Katz and Kahn 1978). Tannenbaum and Schmidt (1958) presented a continuum of leader behaviours based on extending increasing levels of autonomy to team members. Behavioural theories have so far failed to identify a universal list of ideal behaviours and have been criticized for being US centric and not considering outcomes (Northouse 2019). High task/high relationship behaviours are sometimes assumed to be best, but this fails to consider the situational complexity that many leaders face. The behavioural approach has been criticized because of the emphasis on managing organisations rather than the act of leadership (Bryman 2013).

Power and influence theories consider the dynamics of relationships between leaders and followers and the psychological and sociological mechanisms through which power is exercised (French 1956; French and Raven 1959). Whilst top down leadership was historically thought to dominate the dyadic relationship between leader and follower (Schenk 1928) and transactional coercion was used to explain compliance, power and influence theories began to assess the source and nature of leader power to better understand the impact on followers. However, Podsakoff and Schriescheim (1985) suggest methodological weaknesses in the approach to data gathering and analysis in French and Raven's field studies, and so question the underlying descriptions of the powerbases identified in this theoretical framework.

Situational theories (Hersey and Blanchard 1969; Vroom and Yetton 1973) and contingency theories (Tannenbaum and Schmidt 1973) put leadership in the context of circumstance and consider situational variance. Fiedler's (1967) contingency model assumes that leaders have a preferred style which will either be biased towards relationships or tasks and that situational circumstances such as the level of follower support, relative level of structure to the task and level of formal authority vested in the leader will impact outcomes. The combination of these factors results in followers displaying differing levels of sensitivity to leader intervention (Mitchell et al. 1970). Situational approaches have been criticized for poor questionnaire design, limited empirical support, and subjectivity in assessing follower competence levels (Northouse 2019).

Despite the convenient typological approach to categorising leadership theories, there is a recognition that there has been a historical lack of integration between theories (Avolio 2011; Yukl 2013; Yukl and Gardner 2020). The increasing acknowledgement of the complementary nature of leadership theories has resulted in academics exploring a fifth theoretical category that is an integrative approach bringing together two or more leadership variables and combining aspects of different theoretical schools (Yukl 2013).

Any artificial attempt to categorise leadership based on common features will inevitably yield examples of imperfect fits, theories that defy categorisation and theories that overlap between categories. Graen and Uhl-Bien (1995) have suggested that a source of weakness for existing typological approaches is that the focus of theory has been the leader, and other levels of analysis relating to followers and relationships have been inadequately researched.

The five groups provide a convenient taxonomy of leadership that is often used in textbooks and teaching (Northouse 2019; Yukl and Gardner 2020). However, they omit specific theories that are important in the context of innovation leadership and therefore important to this research. Some of these theories are discussed in the next section.

4.5 Leadership of innovation

Executive leaders are empowered by their stakeholders to exert an influence over the structures, systems, and processes within organisations that are enablers of innovation (Munshi et al. 2005; Oke, Munshi and Walumbwa 2009; Mokhber Khairuzzaman and Vakilibashi 2011). Executive leader impact on organisational strategy and outcomes has received significant scholarly attention (Adams, Almeida, and Ferreira 2005; Tang, Crossan and Rowe 2011; Lee, Park and Park 2015) but research specific to executive leadership of innovation is still at an early stage (Sariol and Abebe 2017). This section discusses established theories of leadership that have been related to creativity and innovation.

Transactional and transformational leadership

Burns (1978) describes two forms of leadership. He considers transactional leadership to be most prevalent and describes it as a process of negotiation and exchange. In this process, leaders seek to negotiate an exchange with followers, such as exchanging their labour for money, and making electoral promises in exchange for votes. Burns also describes a less common form of leadership that he labels transforming in which a leader, "*recognises and exploits an existing need or demand in a follower*" (Burns 1978, p.4). In this construct of leadership, the relationship between leader and follower is not solely based on transactional exchange and the leader becomes a moral agent. Burns believes that this second and more potent form of leadership is a process by which:

> *"leaders and followers raise one another to higher levels of morality and motivation."*
>
> (Burns 1978, p.20).

Downton (1973) researched the impact of charisma and activism in new religious movements and was first to use the term transformational leadership in the literature, in contrast to the term transforming leadership used by Burns. Downton's term was adopted by Bernard M. Bass who researched the psychological basis of transactional and transformational leadership (Bass 1985). Bass and Avolio (1990) subsequently developed a Multifactor Leadership Questionnaire (MLQ) to measure leader influence on followers. The collaborative relationship between leaders and followers is thought to depend on an alignment of their interests which may be enhanced or facilitated through the motivation of contingent rewards (Judge and Piccolo 2004; Bass and Bass 2008; Yukl and Gardner 2020).

Some scholars relate transactional leadership to traditional definitions of management (Kouzes and Posner 1995; Bass and Bass 2008). Whereas some leaders seem able to use charisma and emotional intelligence to influence followers to exceed performance levels implied by a purely transactional relationship (Bass 1985; Bass and Bass 2008; Avolio 2011). The transactional and transformational influence of leaders in shaping perceptions and responses to change has been a dominant leadership theory of the last 35 years.

Although Bass was not specifically focusing on innovation, there are aspects of the theory that have direct relevance to innovation. Bass (1985) believes that increasing the awareness of followers to the value and importance of a task and getting them to focus on the wider goals of the team and organisation rather than their own needs has a transformational impact. Bass (1985) defined the main components of transformational leadership to be based on charisma (or idealised influence), inspiration, intellectual stimulation and individual consideration. In later work (Bass and Steidlmeier 1999), theory shifts from an amoral perspective on leadership to include aspects of moral character where ethical values espoused by the leader are embraced or rejected by followers.

Bennis (1982) surveyed 90 leaders and identified common strategies based on vision, shared meaning, trust and positive self-regard. In the foreword to the second edition of their book, Bennis and Nanus relate leadership to innovation:

> *"To keep organizations competitive, leaders must be instrumental in creating a social architecture capable of generating intellectual capital."*

(Bennis and Nanus 2007, p xii)

Bennis and Nanus (1985) note that in the interviews with leaders none mentioned charisma, but many mentioned the importance of learning. They suggest a link between individual and organisational learning and innovation. They propose that leaders can transform rigid organisations to become more open to interacting with and reacting to the external environment to become both participative and anticipative.

Alimo-Metcalfe and Alban-Metcalfe (2006) believe transformational leadership encourages organisational engagement. However, demonstrating evidence of causation between transformational leadership and innovation has proved difficult (Basu and Green 1997; Pieterse et al. 2010). Nonetheless, Jung, Chow and Wu (2003) demonstrated a correlation between innovation success and empowering transformational leadership in mature mid-sized Taiwanese technology firms. In addition, García-Morales, Jiménez-Barrionuevo, and Gutiérrez-Gutiérrez (2012) found evidence that transformational leadership may shape innovation outcomes in larger firms, but effectiveness is moderated by firm size. Vaccaro et al. (2012) believe transactional leadership to be more positively correlated with the management of innovation in smaller organisations. Mumford and Licuanan (2004) suggest that this confusing picture may arise because the leadership literature is not specific to the complex processes involved in innovation and we may need to account specifically and separately for the leadership of creative ventures, making a distinction between leader influence on initial creativity and leader influence on implementation. Rosing, Frese, and Bausch (2011) conducted a meta-analysis of transformational leadership studies, finding that transformational leadership alone was less effective at promoting creativity than when leaders also engaged in positive exchanges and provided structure.

Entrepreneurial leadership

Latif et al. (2020) note that theories based on transformational and transactional styles are not designed to regulate follower behaviour and nor do they describe the exact behaviour of leaders. They draw attention to theories of entrepreneurial leadership (Cunningham and Lischeron 1991; Freeman and Siegfried 2015) and define entrepreneurial leadership as:

> *"a unique leadership style that is focused on making heterogeneous talents work more creatively and innovatively in collective processes to respond to the uncertain business environment to create a coherent strategy and novel outcomes".* (Latif et al. 2020, p.239)

In common with the earlier work of Bennis and Nanus (1985), Latif et al. (2020) relate entrepreneurial leadership to knowledge management and organisational connectivity, which they also see as important antecedents to successful innovation in high-technology firms. Although entrepreneurial leadership theories are still at an early stage of development (Dean and Ford 2017; Harrison, Burnard and Paul 2018; Strobl, Bauer and Matzler 2018), the environment in which SMSE compete seems intuitively relevant to this construct.

Visionary innovation leadership

Caridi-Zahavi, Carmeli, and Arazy 2016 offer a construct of visionary innovation leadership that has roots in the work of Bass (1985) on transactional and transformational leadership, visionary leadership as originally conceived by Bennis and Nanus (1985), and also the specific roles that leaders of innovation are thought to undertake (Van de Ven, Angle and Poole 1989). Market knowledge is suggested to be an important leader attribute to select the most opportune path for innovation. The vision and behaviour of CEOs are thought to influence knowledge creation and integration by establishing social context and connectivity through a climate that is conducive to openness, collaboration, and generativity (Caridi-Zahavi, Carmeli, and Arazy 2016).

Leader-member exchange theory (LMX)

Dansereau, Graen and Haga (1975) considered leadership exchanges to be based on both personal influence and the authority vested in the leader. This reminds us that the act of leadership takes place in a social context (Stogdill 1948) and involves a relationship between the leader and follower. Burch and Guarana (2014) contrast transformational leadership, which inspires and motivates groups, with Leader Member Exchange (LMX) theory (Graen and Cashman 1975), which they suggest works at a more personal level. Hughes et al. (2018) performed a meta-analysis of literature on the leadership of creativity and innovation and found that many scholars noted a positive correlation between high quality LMX and the positive direct or indirect moderation and mediation of creativity and innovation.

LMX takes a dyadic view of leadership (Dansereau, Graen and Haga 1975) based on mature leader-follower relationships (Graen and Uhl-Bien 1991) which develop incrementally through continued interaction or exchange (Katz and Kahn 1978). Higher quality exchanges between leaders and followers are thought to have positive implications for an organisation in terms of engagement, participation, commitment, staff turnover and career progression (Graen and Uhl-Bien 1995). Dulebohn et al. (2012) relate the traits and characteristics of followers and leaders through LMX to follower outcomes in terms of engagement and role satisfaction.

Path-goal theory and instrumental leadership

Leader behaviour has been shown to establish a path that will impact follower motivation to achieve a desired outcome or goal (Evans 1970). House (1971 and

1996) developed path-goal theory through recognizing the importance of the acceptability of leader behavior to followers through facilitation, support, coaching, and performance rewards. House and Mitchell (1974) noted the positive impact of direction, support and engagement with followers, and House (1996) extended this to relate to the engagement of work groups and networks. Path-goal theory assumes that leaders have the flexibility to respond to contingent situations by changing style and contributed to the development of instrumental leadership theory (House and Antonakis 2002, 2004 and 2014). Antonakis and House (2014) define instrumental leadership as:

> "*the application of leader expert knowledge on monitoring of the environment and of performance, and the implementation of strategic and tactical solutions.*" (Antonakis and House 2014, p.749).

Although instrumental leadership is not specific to innovation, Antonakis and House do explicitly state that in their view, leadership is "*essential for organisational innovation, adaption and performance*." (Antonakis and House 2014, p.746). Antonakis and House (2014) believe that practical elements of leadership and management may be ignored by transformational leadership theory and so the model of instrumental leadership completes a full-range leadership model. They suggest that there are two aspects to instrumental leadership. The first relates to monitoring the internal and external environment of the firm and using experience and expertise to formulate strategy. The second relates to the monitoring and management of followers, providing feedback, practical support, and aligning resources within the firm to facilitate the achievement of objectives.

Pragmatic leadership (Mumford et al. 2008; Bedell-Avers, Hunter and Mumford 2009) has a similar focus to instrumental leadership on solving current problems through a combination of expert knowledge, rational persuasion and support for the functional needs of followers. Instrumental and pragmatic leadership theories seem relevant to innovation leadership, where practical aspects of support and resource availability are enablers of innovative work behaviour. Antonakis and House (2014) suggest that instrumental leadership is not dependent on emotion, ideology or contingent reward, but may be used in combination with both transformational and transactional behaviours.

Path creation

Garud and Karnøe (2001) developed the theory of path creation in response to theories of path dependency (discussed in chapter 2). Originally, they considered path creation in the context of the role of a single entrepreneur but the theory has developed to consider the nuanced role of multiple actors in a complex socio-technical environment (Garud and Karnøe 2003; Boland, Lyttinen and Yoo 2007; Garud 2008).

In research specific to UK SMSE, Rose, Jones and Furneaux (2016) discuss how SMSE leverage technical and market knowledge to influence innovation. Smaller software firms will generally have limited access to capital and so usually have a small range of software products or solutions that they sell into well-defined niche markets, often of their own making (Rose, Jones and Furneaux 2016). The research identified path creation as being the most significant leadership impact on innovation. However, the leaders interviewed did not see themselves as the source of inspiration for ideation, rather they moderated creativity and engaged colleagues in conversations to determine the innovation path.

Ambidextrous leadership

The simultaneous cycle of ambidextrous innovation was discussed in chapter 2 (above). Ambidextrous leadership contrasts how leaders use different behaviours to empower, support and direct others in the pursuit of incremental and radical innovation (O'Reilly and Tushman 2013; Zacher and Rosing 2015; D'Souza, Sigdyal, and Struckell 2017). Opening leader behaviours (OLB) encourage independent thinking and challenge the status quo; closing leader behaviours (CLB) focus on achieving goals and reducing variance (Rosing et al. 2011). Directive leadership may be evident in CLB, as the leader asserts authority to establish focus on a specified outcome. Directive leadership is one of the four styles of leadership proposed by Evans (1970) that formed a basis for the development of path-goal theory by House (1971), discussed above. Incremental innovation is thought to be delivered through exploitative CLB, whereas radical innovation stems from OLB (Tushman and O'Reilly 1996). The concepts of OLB and CLB have similarities to the divergent and convergent behaviours described by Van de Ven (2017) and discussed in chapter 2. OLB may also embody some aspects of relations-oriented behaviour found in participative leadership.

Participative and distributed leadership

Participative leadership traces its origins to seminal work by Lewin, Lippitt and White (1939) who considered the response of children to varying levels of autocracy, democracy and laissez-faire leadership. There are several descriptive case studies that support the positive effects of participative leadership in organisations (Yukl and Gardner 2020). However, studies by Lam, Huang and Chan (2015) indicate that there may be a threshold level of participation required before a positive impact on performance is noted.

Whilst many leadership theories assume a dyadic leader-follower relationship (Rost 1993), a leader centred perspective is not the only way to understand leadership (Gronn 2015). There are several different ontological and epistemological perspectives that relate to a more distributed view of the leadership process (Jackson and Parry 2018). What they have in common is some degree of sharing of leadership responsibility between members of a group (Yukl and Lepsinger 2020). Somech (2005) considers participative leadership to involve joint decision making or shared influence in decision processes between leaders and followers.

Gronn (2002) considers distributed leadership from multiple perspectives. He notes that the division of labour that originally led to a defined hierarchy may change over time, requiring different skills and expertise to come to the fore. He also highlights the enabling effect of modern computer and communications technology. Gronn argues that distributed leadership may arise through concertive action in three different ways: collaboration, intuition and institutionalised practice. He believes that cross-hierarchical leadership processes resulting in conjoint-agency may arise spontaneously rather than necessarily being planned or designed, and he also acknowledges the importance of high quality personal relationships, similar to LMX, in developing the friendship and trust that he believes evident in such relationships.

Spillane (2006) argues that distributed leadership becomes the sum of the products of interaction between group members rather than a supplemented leadership model that is still dependent on the authority, expertise and experience of a single individual or small leadership group. Bolden, Petrov and Gosling (2008) consider leadership to be potentially dispersed and dynamic between multiple actors. Chreim (2015) notes in her research that the process of leadership distribution may remain under the control of an individual anointed with formal authority.

Followership

The construct of leadership exists in the presence of followers. Northouse (2019, p. 295) defines followership as:

> *"a process whereby an individual or individuals accept the influence of others to accomplish a common goal".*

The nature of followership may be role or relationally based (Uhl-Bien et al. 2014). Role based followership is based on formal or informal positions occupied within a group or organisation. Relational based followership is based on a co-created constructivist dyad between leader and follower. Leadership style may be linked to the relative empowerment of followers (Tung and Yu 2016; Wipulanusat, Panuwatwanich and Stewart 2017) and follower empowerment may moderate the effectiveness of different leadership styles (Pieterse et al. 2010; Tung 2016).

Kelley (1992) provides a model of followership that is based on the levels of critical thinking and relative passivity of followers creating two axes that create five follower roles: passive followers; conformist followers; alienated followers; pragmatists; and exemplary followers as shown in figure 4.2 (below).

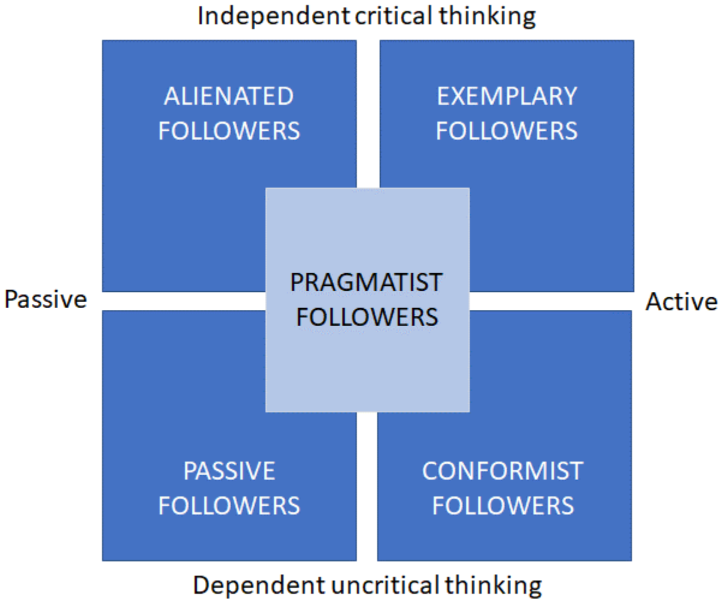


Figure 4.2 Follower typologies (Kelley 1992)

Summary

This section has considered several dominant leadership theories that are relevant to the facilitation of creativity and innovation in organisations. Many of the theories are based on a hierarchical dyadic view of leader-follower interaction, although there is an increasing recognition of participative and distributed leadership (Gronn 2002; Spillane 2006) and the important role of followership (Kelley 1992). The leadership of innovation appears complex and multi-faceted, requiring an inter-disciplinary perspective to appreciate the breadth of influences at work.

As discussed in section 1.3, SMSE are a subset of small and medium sized enterprises (SME). In the UK, there are almost 6 million SMEs making up around 99% of all private sector firms (Ward 2021). The literature specific to SMSE is limited (Carlo, Lyttinen and Rose 2011; Rose, Jones and Furneaux 2016), and so the next section explores the extent to which general theories of leadership apply to the contingent context of the larger population of SMEs and outlines specific theories that have emerged for these smaller firms, reflecting on SME leader learning and development.

4.6 Leadership and learning in SMEs

Many scholars agree that effective leadership is an important factor in SME success (Andersson and Tell 2009; Franco and Matos 2013). This section considers the applicability of general leadership theories to the contingent case of SMEs, noting the prevalence of ambidextrous, transformational and transaction leadership theory in the SME literature.

The importance of a vibrant SME sector to the health of an economy has been highlighted by scholars and governments (Lubatkin et al. 2006; OECD 2017; OECD 2018). Rothwell and Zegveld (1982) describe the economic and social benefits of a thriving SME sector which they believe responsible for driving the adoption of new technology and creating new employment opportunities. However, Bessant and Tidd (2016) draw attention to methodological issues that may have resulted in the innovation contribution of SMEs being overstated in earlier studies and point out the wide variety of firms included in the broad definition of SME which include micro-businesses, family businesses, manufacturers, and high growth technology ventures. Despite the economic importance of SMEs, their study has been described as a “Cinderella subject” (Gold, Thorpe and Mumford 2010, p133). The unique nature of SMEs (Devins and Gold 2002) can yield interesting research insights (Short and Greener 2014) but Blackburn and Kovaleinen (2009) consider the developing literature on SMEs to be inconclusive in areas.

In large organisations, complex structures and hierarchies limit the number of employees that come under the direct influence of executive leaders. In the relatively flat organisational structure of most small firms, owner-managers and executive leaders are often highly visible and can exert personal influence over colleagues (Lubatkin et al. 2006; Ladzani, Smith and Pretorius. 2010; Saunila and Ukko 2014; Goffee and Scase 2015; Mihai 2015). Andersson and Tell (2009) believe experience, education, personal traits, motivations and behaviours contribute to leader effectiveness in SMEs. They observe that the leaders of small firms frequently switch between strategic and operational leadership, integrating entrepreneurial behaviours related to vision and culture with operational performance management. Other scholars also link SME performance to leader styles and behaviours (Franco and Matos 2013). Cope, Kempster and Parry (2011) make a case for the benefits of distributed leadership in mature SMEs but note organisational constraints on leader learning and follower expectations as barriers to this. Gibb (2009) notes that the degree to which an SME leader chooses to share leadership responsibility with followers often reflects personal preference rather than a considered strategic choice. Ling et al. (2008) note that the full-range leadership model (Bass and Avolio 1994) is commonly discussed in SME literature and Langowitz (2010) believes that transactional and transformational leadership behaviours are particularly impactful in smaller organisations.

Leaders of SMEs often have sole discretion on strategic direction and so their individual orientation can be a determinant of strategy (McAdam, McConvery and Armstrong 2004). Although generally considered to be more resource constrained (Saunila and Ukko 2014), SME leaders have been suggested to have more freedom and discretion over strategy than leaders of larger organisations (Cao, Simsek, and Zhang 2010) who are thought to face more complex power constraints (Cao, Maruping and Takeuchi 2006). SME leaders are more likely to play both a strategic and operational role and so there is an increased dependency on their competence (Lubatkin et al. 2006; Cao, Simsek, and Zhang 2010). Hayton (2015) believes that the strategic choices that SME leaders make are often based on personal comfort and risk appetite rather than profit maximisation. Similarly, Ahn, Minshall and Mortara (2017) note the strategic and performance impact of SME leader preferences and capabilities. Although entrepreneurial orientation was originally conceived as an organisational construct relating to an appetite for risk taking, innovation and proactivity (Miller 1983; Covin and Slevin 1989), the organisational manifestation of this is thought to be influenced by the traits and behaviours of leaders (Simsek, Heavy and Veiga 2010; Keil, Maula and Syrigos 2017). Angel, Jenkins and Stephens (2018) suggest that there are multiple dimensions to entrepreneurial behaviour that are influenced by how leaders contextualise personal success. They suggest that these can be individualist (doing what I like); tribalist (emotional connection with customers); evolutionist (transforming market paradigms); or revolutionist (transforming social paradigms). Murnieks, Klotz and Shepherd (2020) discuss how entrepreneurial motivation can change during the life of a venture, from initiation, through growth and to exit. They note that the nature and pathways of this motivation remain ill defined. Personal identity and personal motivation may be factors in determining leader behaviour and strategy in smaller firms. However, a significant driver of behaviour may also be that some SME leaders are simply struggling to survive (Gold and Thorpe 2010) and so may have a short-term and goal-orientated planning horizon.

Wang (2016) has pointed out that access to affordable capital or debt is often a barrier to growth for SMEs in developing countries. However, in the UK there are well-established channels to obtaining reasonably priced funding. The British Business Bank (2018) has noted that it is not that UK entrepreneurs lack ambition. It is just that they lack confidence and experience in accessing funding for growth, highlighting the importance of knowledge, learning and access to external expert advice for SME leaders.

Ambidextrous leadership (Tushman and O'Reilly 2006) is discussed extensively in the SME leadership literature (Oluwafemi, Mitchelmore and Nikolopoulos 2020). Just as in larger firms, SME leaders are confronted with a strategic choice between exploitation and exploration (Lin, Yang and Demirkan 2007) which represents investment trade-offs of the scarce resources of the firm (March 1991; Benner and Tushman 2003; Uhl-Bien and Arena 2018). Achieving a strategic balance between exploration and exploitation may be beyond the resources or capability of some SME (Yang, Zheng and Zhou 2014) and trying to do both at once may even be detrimental (Lin, Yang and Demirkan 2007). SME leaders need to balance operational and strategic demands on their time and achieve behavioural integration across their teams to manage the competing knowledge processes of exploration and exploitation (Lubatkin et al. 2006). Lubatkin et al. (2006) suggest that exploitation and exploration represent the use of different types of knowledge within SMEs. Nonaka (1994) offers constructs of explicit or codified knowledge and tacit knowledge which can be related to ambidexterity. Lubatkin et al. (2006) associate exploitation with explicit knowledge and a top-down process, suggesting exploration to be associated with tacit knowledge and bottom-up learning that causes changes in behaviour and strategy (Nonaka and von Krogh 2009), drawing attention to the importance of learning and development for SME leaders.

Pittaway and Cope (2007) believe that the learning mechanisms of entrepreneurs are complicated and involve the synthesis, analysis and reflection upon experience and theoretical learning, that result in self-awareness and insights that change their approach to managing their business. Markowska and Wiklund (2020) note that entrepreneurial leaders adopt different learning styles based on perceptions of complexity and self-efficacy. They propose that in complex situations or where the entrepreneur feels less confident there will be a preference for trying to model scenarios and outcomes, contrasted to situations where the entrepreneur feels confident which are more likely to result in experimentation. SME leaders may struggle to commit time to formal learning (Clarke et al. 2006; Gold and Thorpe 2010) and find it difficult to open-up to external help after many years of independence (Thorpe et al. 2009), reflecting an emotional component to the way smaller firms are run (Gibb 2009). Clarke et al. (2006) provide research evidence that engagement with others with whom they share common ground in a setting away from the day-to-day work environment was helpful to some owner-managers of SMEs. Others have also noted that the external social ties of SME leaders have been identified as relevant to organisational learning (Cao, Maruping and Takeuchi 2006). These relationships with the wider business community allow leaders to acquire knowledge and resources from other organisations (Petruzzelli 2011). Thorpe et al. (2009) put SME learning in a social context that includes the wider stakeholder community of the firm, such as family members, staff, customers, suppliers, and financiers.

Although many leadership theories have been applied to the research of SMEs, those most frequently discussed by scholars seem to be the full-range model (Franco and Matos 2013) and ambidextrous leadership (Lubatkin et al. 2006; Yang, Zheng and Zou 2014). Oluwafemi, Mitchelmore and Nikolopoulos (2020) identify a link between these two models in the literature and the direct relevance of these models to smaller firms. The literature suggests traits and behaviours are evident in

SME leadership and that decisions may be based on personal choice rather than strategic or profit maximising considerations. Behaviours may change through experience and learning, but SME leaders find it difficult to engage with formal learning processes and so leader development in SMEs is often informal and achieved through interaction with external networks.

The next section of this chapter considers some of the models proposed by scholars that attempt to integrate innovation, creativity and leadership literature and reflect upon the relevance of these models to innovation in SMEs.

4.7 Models of innovation leadership

Traditionally, the role of leadership within the field of innovation was not thought to be significant (Jung 2001). However, innovation is now considered a competitive imperative (Pisano 2019) and so executive leaders aspire to develop organisational processes and frameworks supportive of creativity and innovation (Robbins 1996; Ahmed 1998; Hughes et al. 2018). Innovation leadership research has often focused on trying to understand mediating variables; the contingency factors that determine when leaders influence innovation, and moderating variables; that determine how leaders influence innovation (Denti and Hemlin 2012). However, a more integrated approach to leadership theory has developed (Yukl 2013; Yukl and Gardner 2020).

Although innovation is broad and multi-faceted, many studies probe a single dimension of innovation and it has been suggested that this has resulted in a fragmented literature which is disconnected between the academic disciplines of innovation, economics and business (Crossan and Apaydin 2010). Based on an extensive literature review, Crossan and Apaydin have constructed a multi-dimensional framework for organisational innovation linking many disparate aspects of innovation, considering both determinants of innovation and dimensions of innovation (see figure 4.3 below).

By nature, SMSE have relatively low numbers of staff and shallow organisational hierarchies, so the structural proximity of executive leaders to software engineers is inevitably closer than in much larger organisations. Crossan and Apaydin's (2010) multi-dimensional framework may be conflated in a smaller organisation, meaning aspects of upper echelons theory (Hambrick and Masons 1984; Hambrick 2007) could become less relevant than the direct influence of executive leaders on their teams.

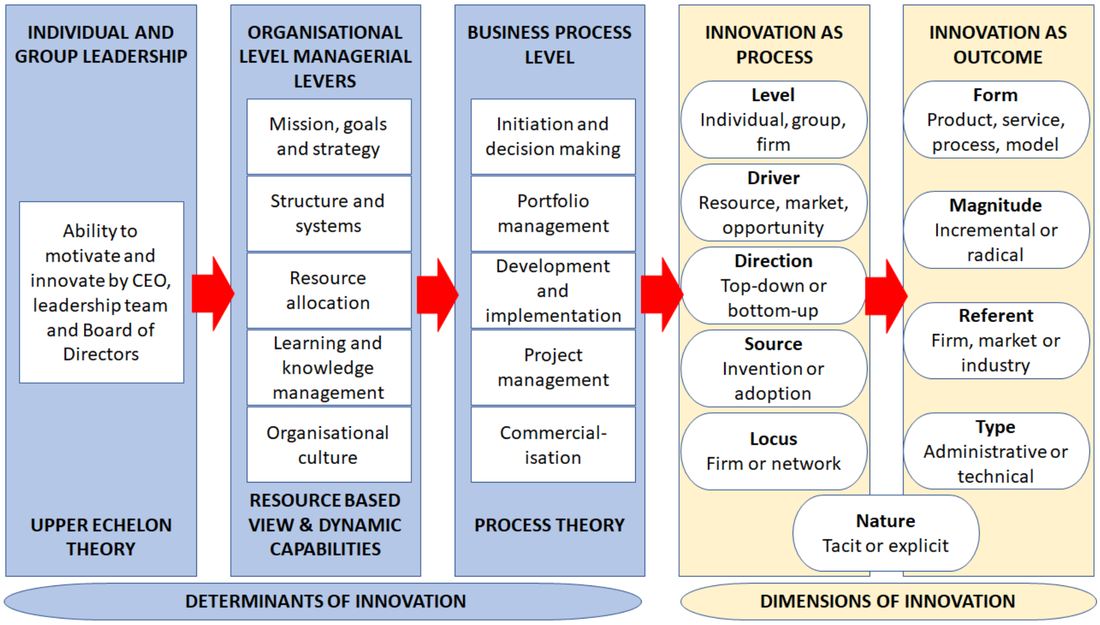


Figure 4.3 Multi-dimensional framework of organisational innovation (Crossan and Apaydin 2010, p1167)

Innovation capability is considered important to the success of SMEs (Saunila and Ukko 2014; Ali et al, 2020). Love and Roper (2015) argue that innovation success in smaller firms is linked to technical, managerial and leadership skills rather than the material advantages associated with scale and capability of larger firms and owner managers. In a systematic review of the SME innovation capability literature, Saunila (2020) concludes that whether innovation is conceptualized as a process or an output (Crossan and Apaydin 2010) it is positively correlated with firm success and that this is important to small firms seeking to establish competitive advantage against larger less resource constrained businesses.

Organisational learning and knowledge management is highlighted in the Crossan and Apaydin (2010) model. Grandinetti (2016) has observed that absorptive capacity is an important factor in enabling SMEs to exploit knowledge outside of the firm. The efficient integration of existing knowledge with external socially derived knowledge is considered an important influence on absorptive capacity (Jones, Macpherson and Thorpe 2010). Absorptive capacity has been suggested to be an indicator of the extent to which an organisation can combine exploitative and explorative innovation (Jansen, van den Bosch and Volberda 2005). Some SME studies have identified a bias towards learning and knowledge acquisition processes associated with exploration (Busenitz and Barney 1997; Zahra, Ireland, and Hitt 2000). Coetzer, Kock, and Wallo (2017) believe that contingent factors affect learning in SMEs, including the distinctive characteristics of the organisation, the external environment and the role of the owner. They believe that these factors can be considered in terms of job characteristics, type of work, relationships and social interactions.

Crossan and Apaydin (2010) suggest that innovation can be viewed as a process. Process models of innovation were described in section 2.4 (e.g. Goffin and Mitchell 2017). Lindgren (2012) notes that most SMEs do not pursue a formalised process when embarking upon business model innovation and may miss many innovation opportunities by focusing resource on just a few areas of potential innovation. Similarly, Faherty and Stephens (2016) found that micro-enterprises pursued innovation but had little awareness of theory or systematic innovation processes.

Crossan and Apaydin (2010) identify a link between entrepreneurship and innovation, based on the exploration or exploitation of opportunity and development of novel products and solutions which they link to Schumpeter's (1934) theories of entrepreneurial behaviour. Leitch and Volery (2017) note that some scholars believe that there is something special and distinctive about the leadership of innovation in entrepreneurial firms. For example, Gupta, MacMillan and Surie (2004) consider entrepreneurial leadership to be a distinct construct. However, Vecchio (2003), contends that the entrepreneurial environment represents contingent context rather than a different approach to leadership. As firms transition from start-up, through going concern and then to exit, Vecchio believes that leaders adapt their behaviour based on personal traits, experience, and changing economic factors.

The structural proximity typical of smaller organisations may be a factor in the impact of direct and indirect leader behaviours proposed by Hunter and Cushenberry (2011). Hunter and Cushenberry (2011, p.248) argue that leaders play a "*primary role*" in encouraging successful innovation. They note that leading innovation is complicated and propose a multi-level process model that shows how indirect and direct leader influences over various aspects of organisational activity, structure and processes might affect creativity and innovation (figure 4.4 below). This model highlights the role of individual and team creativity in the innovation process.

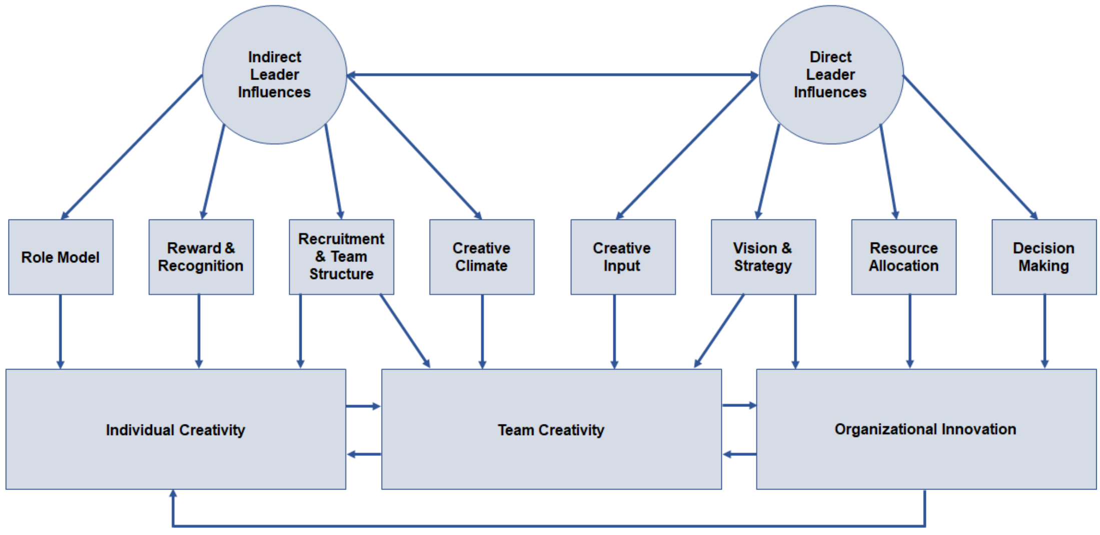


Figure 4.4 Leader influence on innovation (Hunter and Cushenberry 2011, p.251)

Hunter and Cushenberry (2011) draw attention to the breadth of direct and indirect influence that leaders have on innovation within their organisations. Similar to the conclusions reached by Van De Ven et al. (1999), Hunter et al. (2011) note that leaders are required to fulfil a variety of roles when working with innovation teams, and exercise judgement when moving between roles, for example moving from critic to promoter of an innovation. They suggest that leading innovation requires unique behaviours which include developing dual expertise in technical domain knowledge and leadership skills. Other studies have shown that this ability to develop both technical domain expertise and leadership skills may influence success in creative projects (Thamhain and Gemmill 1974; Vincent, Decker and Mumford 2005). Several scholars have identified planning skills as being of importance to successful innovation leadership (Marta, Leritz and Mumford 2005; Bujis 2008; Stockstrom and Herstatt 2008). SME leaders are thought to play an important role in determining the workplace conditions that result in expansive or restrictive learning environments (Fuller and Unwin 2003).

Beech et al. (2020) have identified idiosyncratic aspects to family businesses which can have positive or negative implications for strategy and execution and are not adequately understood through existing management theory. Schulze, Lubatkin, and Dino (2002) have suggested that family ownership may mitigate against innovation, as family stakeholders seek to avoid the risk of investment in what might be considered speculative projects. The level of investment in innovation in a family business may be linked to the relative levels of family control compared to overall family wealth. Sciascia et al. (2015) argue that if the relative proportion of family wealth invested in the family business is low, then the attitude to investing in innovation may be more positive. Laforet (2016) conducted a cross-sector survey of SME family firms in the UK, noting that an externally focused and flexible entrepreneurial culture was more likely to result in innovation success than a paternalistic culture. Gibb (2009) has pointed out the flaws of drawing a distinction between owner-managed and entrepreneurially led firms. Entrepreneurial behaviour can be present in small businesses irrespective of size or ownership structure and in the battle for survival, entrepreneurial behaviour can be stimulated by challenges in the commercial environment.

Research shows conflicting results on the effect of company size and age on process and product innovation. Baregheh, Rowley and Hemsworth (2016) suggest that organisational engagement with position (context) and paradigm (underlying models) is not affected by company size and age. However, the effects of transformational leadership on innovation outcomes have been suggested to be moderated by firm size, with smaller firms showing evidence of transactional leadership (García-Morales, Jiménez-Barrionuevo, and Gutiérrez-Gutiérrez 2012; Vaccaro et al. 2012). Matzler et al. (2008) present evidence from 300 Austrian SMEs to suggest a positive relationship between transformational leadership, innovation and firm success. Dunne et al. (2016) surveyed small business leaders in Tennessee finding correlation between successful innovation and what they term inspirational leadership, negotiating skills and operational efficiency.

The integrated models of innovation leadership described in this section (Crossan and Apaydin 2010; Hunter and Cushenberry 2011) bring together a complex array of influences, determinants, and dimensions of innovation. However, these models are based on the experience of innovation in larger firms. The applicability of such models to SMEs is less well documented in the literature. Some academics have noted that the search for a prescriptive generic model of SME innovation is elusive because the effectiveness of many innovation leadership processes and practices varies considerably by industry and sector (Babkin, Lipatnikov and Muravev 2015; Tidd and Thuriaux-Alemán 2016; Du Plessis and Pretorius 2017). Research into innovation in SMEs suggests that success is based on complex contingent factors related to management, resource, and capability (Ibarra et al. 2020) which are often specific to industry sector and geography (Pertuz and Pérez 2020).

Through direct and indirect influence, resource allocation, process control and explicitly setting an innovation agenda, Crossan and Apaydin (2010) and Hunter and Cushenberry (2011) both provide models that illustrate how leaders might affect innovation. Although research has often focused on trying to understand cause and effect through enquiry into moderating and mediating variables, it seems likely that the complexity of innovation leadership will be better understood through an integrated model that brings together relevant aspects of multiple theories. It also seems likely that contingent situation will influence both leaders and followers and so a single construct of innovation leadership that is universal may be impossible to identify.

The next section brings together theories of innovation leadership from the literature and proposes a logically derived matrix of possible constructs that reflect different contingent situations specific to innovation leadership in SMSE.

4.8 Towards an integrated model of innovation leadership

Although the link between leadership, creativity and innovation has been researched, there is little evidence that specific leadership styles deliver predictable innovation outcomes (Rosing, Frese and Bausch 2011). Indeed, Van De Ven (2017) notes that leaders do not seem to control innovation, but rather influence it. A comprehensive theory of the influence of leader behaviours on innovation remains elusive, suggesting a subtle and complex relationship that may integrate different aspects of existing theory and emphasizing the lack of cross referencing of theory and interdisciplinary collaboration.

Following Yukl's (2013) example, exploring the inter-relationship of theories allows the construction of integrated models of innovation leadership through a process of logical deduction. Such a model might be more accessible to practitioners than trying to read and synthesize the significant body of literature that exists on the topic.

Yukl's (2013, p.401) integrating conceptual framework of leadership can be adapted to create a logically deduced model specific to the context of innovation leadership (see figure 4.5). In this model, traits, styles, behaviours, and contingent situations are integrated with mediating variables to build a more complete model of innovation leadership. Yukl's "mediating variables" (Yukl 2013, p.401) relate to aspects of both leadership and followership. The constructs are mediated by the skills of the leader understood in the context of Katz's three dimensions of technical, conceptual and human skills (Katz 1955), and aspects of followership based on the level of critical thinking and relative activity of followers (Kelley 1992) along with the competence, experience, relative seniority and motivation of followers.

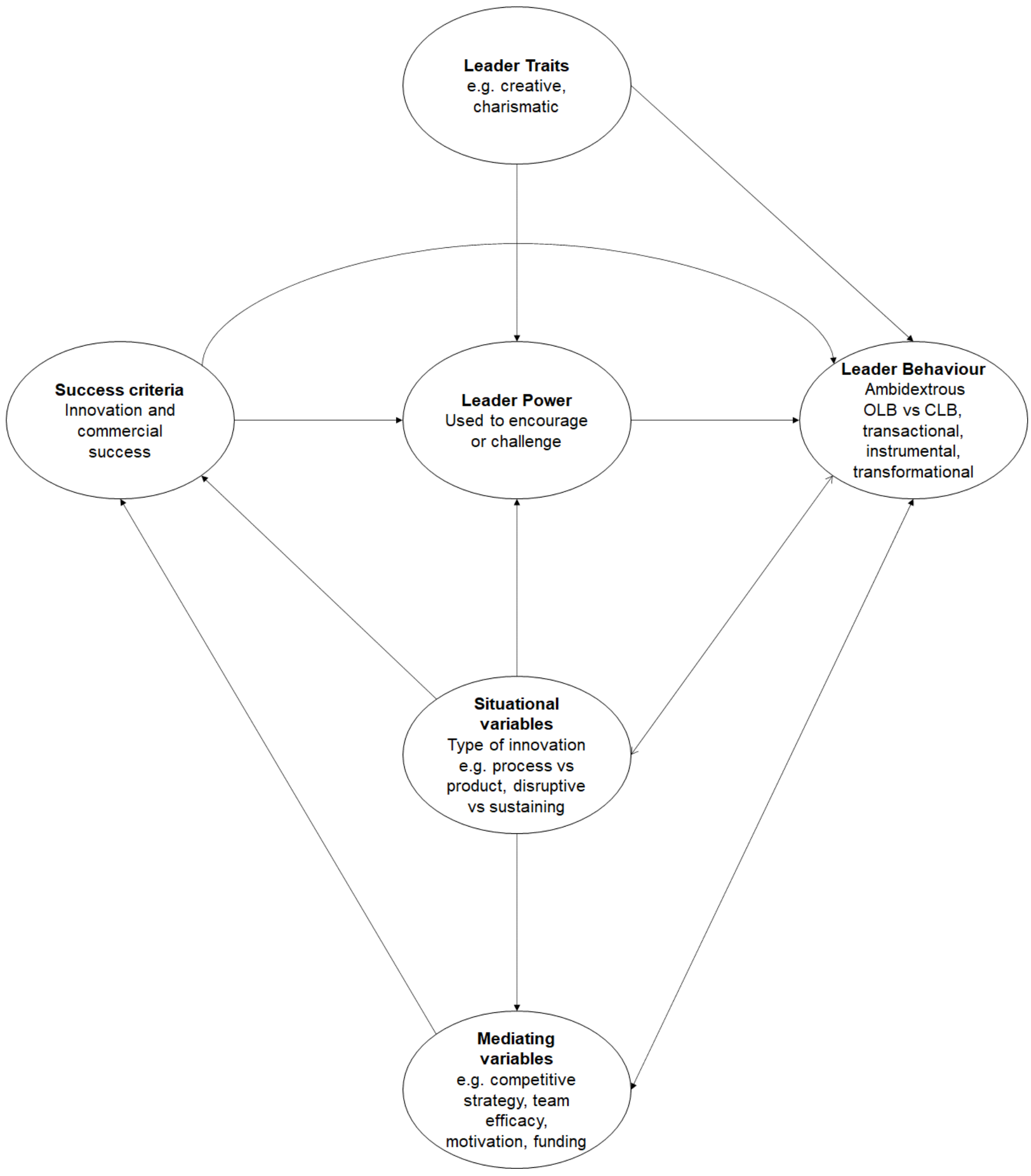


Figure 4.5 Integrated view of innovation leadership based on Yukl (2013)

Building on Yukl's (2013) integrated conceptual framework, the model of innovation leadership offered in figure 4.6 (below) integrates some of the best established and empirically supported theories discussed in this literature into a logically deduced syncretic framework.

The concept of the syncretic model began as a simple two-by-two matrix contrasting transactional and transformational leadership (Bass 1985) against exploitative and explorative innovation (Tushman and O'Reilly 1996). The opening and closing leader behaviours described by Zacher and Rosing (2015) have similarities to the divergent and convergent innovation leader behaviours described by Van de Ven (2017). This first matrix suggested four constructs of innovation leadership and prompted thoughts about both leader and follower (Kelley 1992) behaviour under each construct. Considering the application of these constructs in practice led to more detailed the definition of their attributes:

- Project Innovation Leadership: transactional and exploitative based on short-term project delivery of agile sprints, bug fixes and small enhancements.
- Programme Innovation Leadership: transactional and explorative in developing new applications and significant software version revisions and upgrades.
- Structural Innovation Leadership: transformational and exploitative, supporting major strategic or structural change in the organisation whilst sustaining the existing code base but perhaps applying it in new ways or to new markets.
- Visionary Innovation Leadership: transformational and explorative, engaging emotional connectivity with software teams to generate support and promote creativity to achieve entirely new objectives.

Kestin et al. (2015) observe that beyond transactional and transformational leadership, other styles might be appropriate for different stages and types of innovation. In their paper, the constructs of transactional and instrumental leadership are presented together. However, Antonakis and House (2004) contend that the full-range theory (Bass and Avolio 1994) does not take account of instrumental leader functions related to both strategy and task orientation which they believe are required to sustain the performance of followers. Based on this, an additional bridging segment was added to the syncretic model to acknowledge the active intervention of leaders in support of practical aspects of innovation delivery. The additional constructs are defined as:

- Tactical Innovation Leadership: instrumental and exploitative for execution of medium-run innovation projects when additional resources and leader support may be required.
- Strategic Innovation Leadership: instrumental and explorative for the development of strategy and supporting software architectures.

Based on literature and analysis of the early interviews in the field research, the syncretic model felt incomplete in that it did not recognise the occasions when the executive leader was not providing technical leadership to the software team or when the business was facing significant operational and strategic challenges and the leader needed to share power and responsibility with members of the software development team. This prompted a review of the literature on distributed leadership (Gronn 2002 and 2015; Spillane 2006; Chreim 2015) and participative leadership (Lewin, Lippitt and White 1939; Yukl 1971; House and Mitchell 1974) which led to the development of two more constructs:

- Critical Innovation Leadership: distributed and transactional approach to share leadership between the best qualified team members in responding to an operational problem, delivery problem of strategi crisis in the business.
- Collaborative Innovation Leadership: distributed and transformational approach to facilitate collaboration and consultation on creative phases of product or business development, drawing on the combined experience and expertise of the leadership team and the software development tea,.

In this syncretic framework, what Yukl describes as "situational variables" (Yukl 2013, p.401) constitute the theoretical use cases of a leadership construct based on the intersection of behaviour based on ambidextrous leadership theory (Tushman and O'Reilly 1996) with transactional (Bass 1985; Bass and Avolio 1993), instrumental (Antonakis and House 2014), distributed (Gronn 2002; Spillane 2006), and transformational leadership (Bass 1985; Bass and Avolio 1993). Opening and closing leader behaviours (Zacher and Rosing 2015) provide an axis of contingent situational variables. Closing leader behaviour (CLB) is considered goal orientated and best suited to exploitative innovation and opening leader behaviour (OLB) is thought more expansive and related to explorative innovation (Zacher and Rosing 2015). Each of the resulting constructs contains elements of other discrete theories, showing how they might have relevance within specific contingent situations.

Contingent on situation, each construct may also include leader roles consistent with those observed by Van de Ven et al.(1999) of entrepreneur, sponsor, mentor, critic and institutional leader which may impact the intersubjective experience between leaders and followers and follower roles consistent with Kelley's (1992) model.

The construct of visionary innovation leadership in this syncretic model has some similarities to that proposed by Caridi-Zahavi, Carmeli, and Arazy (2016), but focuses on opening leader behaviours and transformational style rather than connectivity and knowledge integration.

Although intuitively appealing, this framework is untested, creating an interesting opportunity for future research. In addition, as existing theories develop and new theories are offered, the model can evolve, perhaps adding further dimensions or extending the range of axes. The purpose of the model in the context of this literature review is to summarise how a number of the theories of innovation leadership can be related to each other in the type of integrated framework envisaged by Yukl and in a way that might prove useful for practitioners.

Table 4.1 (below) indicates which elements of theory find relevance in each of the proposed constructs.

Table 4.1 Relating extant theory to the proposed syncretic model

Leadership Style	**Exploitative** (Tushman and O'Reilly 1996) **Closing Leader Behaviours** (Zacher and Rosing 2015)	**Explorative** (Tushman and O'Reilly 1996) **Open leader behaviours** (Zacher and Rosing 2015)
Transformational (Bass and Avolio 1993) **Charismatic** (Conger and Kanungo 1987)	**Structural Innovation Leadership** Primary leader role (Van de Ven et al.1999): Institutional leader Primary follower role (Kelley 1992): Pragmatist	**Visionary Innovation Leadership** Primary leader role (Van de Ven et al.1999): Entrepreneur Primary follower role (Kelley 1992): Pragmatist
Distributed (Gronn 2002 & 2015; Spillane 2006; Chreim 2015) **Participative** (Lewin, Lippitt and White 1939; Yukl 1971; House and Mitchell 1974)	**Critical Innovation Leadership** Primary leader role (Van de Ven et al.1999): Mentor Primary follower role (Kelley 1992): Exemplary	**Collaborative Innovation Leadership** Primary leader role (Van de Ven et al.1999): Sponsor Primary follower role (Kelley 1992): Exemplary
Instrumental (Antonakis and House 2002) **Supportive** (House 1971; House and Mitchell 1974)	**Tactical Innovation Leadership** Primary leader role (Van de Ven et al.1999): Institutional leader Primary follower role (Kelley 1992): Conformist	**Strategic Innovation Leadership** Primary leader role (Van de Ven et al.1999): Institutional leader and Mentor Primary follower role (Kelley 1992): Conformist
Transactional (Bass 1985) **Directive** (Evans 1970; House and Mitchell 1974)	**Project Innovation Leadership** Primary leader role (Van de Ven et al.1999): Critic Primary follower role (Kelley 1992): Passive – risk of alienation	**Programme Innovation Leadership** Primary leader role (Van de Ven et al.1999): Institutional leader and mentor Primary follower role (Kelley 1992): Conformist

Opening Leader Behaviours (Explore)	**Programme Innovation Leadership** When leading change programmes the leader may need to challenge status quo and share new ideas, allowing followers to operate within a broad corridor with a degree of independence and flexibility. Incentives will most likely be linked to milestones and project success and the leader will most likely act as a mentor and institutional leader.	**Strategic Innovation Leadership** Suitable for developing innovation strategy. Leader reviews the internal and external environment to establish clear goals. Followers establish trust to accept the results of the leader's analysis Incentives based on self-actualization achieved through successful execution of a shared strategy.	**Collaborative Innovation Leadership** Suitable for product development and growth initiatives in an established business where the institutional leader is not a subject matter expert. Collaborative and consultative leadership approach. Clear commercial goals agreed in partnership with other colleagues and stakeholders. Incentives are based on sustained economic success (e.g. equity participation and bonus).	**Visionary Innovation Leadership** Suitable for strategic innovation as a competitive imperative, delivery of "moon shots" and start-ups. Clear direction. Vague on methods and details. and for gaining momentum in start-ups. Incentives based on inspiration and high levels of team motivation.
Closing Leader Behaviours (Exploit)	**Project Innovation Leadership** Suitable for short task focused projects. The leader may set specific objectives (e.g. SMART objectives). Strong focus on achieving the short-term plan. Real or assumed/imagined sanctions for failure. Transactional incentives linked to task completion.	**Tactical Innovation Leadership** Suitable for execution of agreed medium run strategy. Leader offers guidance and support. Leader removes barriers to progress and provides resources. Clear objectives set and performance outcomes monitored Feedback and support given by the leader. Incentives will be based on self-efficacy.	**Critical Innovation Leadership** Suitable for dealing with a problem or crisis. Shared honesty and realism about scale and impact of problems to be resolved. Leaders exploit the specific expertise of expert individuals. Selective sharing leadership responsibility based on expertise. Incentives based on shared interest in overcoming challenge and the organisation surviving the crisis.	**Structural Innovation Leadership** Suitable for delivery of major projects or supporting sustaining innovations to accelerate growth using existing products or processes. Broad agreement on strategy. Clear objectives. Well-established methods of execution. Incentives based on establishing shared. interest in success beyond just financial reward.
	TRANSACTIONAL/ DIRECTIVE LEADERSHIP STYLE	**INSTRUMENTAL/ SUPPORTIVE LEADERSHIP STYLE**	**DISTRIBUTED/ PARTICIPATIVE LEADERSHIP STYLE**	**TRANSFORMATIONAL/ CHARISMATIC LEADERSHIP STYLE**

Figure 4.6 Syncretic model of innovation leadership

4.9 Chapter conclusions

This chapter has introduced theories of leadership from both a chronological and taxonomic perspective. Many of the descriptive and prescriptive theories and models discussed have intuitive appeal, but the empirical evidence for their existence or general applicability is sometimes contradictory (Northouse 2019). There is a continuing acknowledgement by some academics that issues relating to definition, methodology and orthodoxy impede progress in developing theory (Parry and Bryman 2006; Alvesson and Sköldberg 2017). Much of the literature considers leadership as a dyadic power relationship (Rost 1993) and may not adequately consider followers (Kelley 1992), other stakeholders, or broader environmental considerations. Many leadership theories are simplified to account for a limited number of moderating and mediating variables and so struggle to scale or achieve broad applicability (Alvesson and Deetz 2000). The variety of contingent situations in which leadership is considered may contribute to the difficulty in establishing consensus on a general theory (Yukl and Gardner 2020). Broadening the research approach beyond quantitative and positivistic psychological methods may offer an opportunity to gain new perspectives (Cresswell and Cresswell 2018).

Scholarly interest in innovation leadership in software and technology organisations is evident in the literature, but work relating specifically to SMSE remains limited and fragmented with little cross referencing (Rose Jones and Furneaux 2016). What literature does exist seems to be focused on processes and outputs rather than taking an ethnographic perspective and trying to understand leadership or the inter-subjective experiences of actors. The understanding of human factors and creativity within SMSE appears to be in the early phase of development and is still somewhat isolated from supporting disciplines in economics, psychology, sociology, and strategy.

Executive leaders may have to manage complex social and interpersonal relationships in a way that supports and promotes innovation (Mumford et al. 2002). Whilst leaders may have dominant or preferred styles based on their life experience (Fiedler 1967), some researchers have suggested that leaders mix and match elements of style and behaviour in response to a range of conditions such as organisation size, culture, sector, relative seniority, and project phase (Oke, Munshi and Walumbwa 2009).

The literature recognizes the complexity of innovation leadership and attempts have been made to integrate elements of theory into coherent models (Crossan and Apaydin 2010; Hunter and Cushenberry 2011). Yukl (2013) argues that there is a growing acceptance that an integrative perspective that brings together traits, skills, behaviours with situational contingency may be more representative of lived experience. Building on this, a syncretic model of innovation leadership pertinent to SMSE is proposed that integrates ambidextrous leadership theory (Tushman and O'Reilly 1996; Zacher and Rosing 2015) with the full range model (Bass and Avolio 1990), instrumental leadership (Antonakis and House 2014) and distributed leadership (Gronn 2002; Spillane 2006).

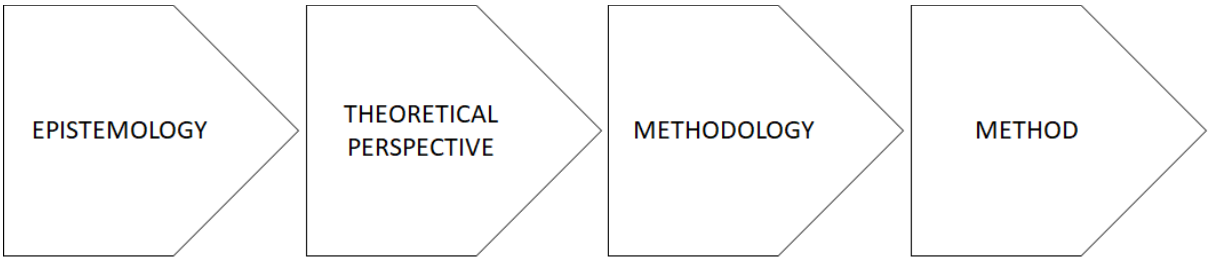
Given the economic and social importance of SMSE to the UK economy and the assumed innovation imperative for such firms, there may be value in trying to better understand how leaders can influence their creative and innovative output. Specifically, the interaction between leaders and the led in such organisations is an area worthy of further exploration. The extent to which leaders of SMSE are conscious of trying to create a specific culture and climate that encourages creativity and innovation, and the resulting receptiveness of software engineers to these efforts seems to offer a potentially rich line of enquiry for primary research. This is the focus of the research question posed by this thesis and the next chapter summarises a methodology employed to investigate this specific area.

5 RESEARCH METHODOLOGY

5.1 Chapter introduction

This chapter begins by clarifying the research question to be answered before highlighting the origins of my own interest in this subject and discussing the philosophical basis for the research. It discusses the relative merits of alternative theoretical perspectives and methodological approaches that were considered before deciding to adopt Constructivist Grounded Theory Methodology (CGTM). The strengths and weakness of CGTM are considered with reference to the extant literature. The ethics clearance required for this research is discussed and the approach to remaining compliant with the ethics standards required by York St John University is outlined. The method of design and execution of the research project is then discussed in detail.

My approach to determining methodology and method is based on the four elements to be considered in developing a research project proposed by Crotty (1998) and illustrated in diagram 5.1 below. The first consideration is epistemology, which in turn leads to an evaluation of theoretical perspective, which informs choice of methodology and method. This approach has also been used to provide the framework for this chapter.



(Based on Crotty 1998, p.4)

Figure 5.1 Four elements to consider in developing a research project

This chapter concludes that there are many ways to approach social research, but because the study of innovation leadership in SMSE is a nascent and relatively under-researched area with limited existing theory, an inductive and interpretive approach to the research represents an appropriate way to discover new theoretical perspectives. CGTM offers a legitimate way into this nascent area and can offer a route to theory building and the development of hypotheses which may be evaluated through further research using alternative methods.

5.2 Research question

An important measure of research success is evidence of clear conclusions being drawn from the data (Saunders, Lewis and Thornhill 2016). In developing this research proposal, I was conscious of framing a question that would guide the methodological approach and lead to the development of specific conclusions (Cooper and Schindler 2008).

From the original research proposal through to the transfer, the research question went through several iterations until I felt that it was suitably refined to ensure that the required clarity could be achieved. Figure 5.2 below shows the major iterative steps in the evolution of the research question from the research proposal into the final form. The research question for this thesis is, how are executive leaders of British SMSE perceived to influence the innovative work behaviour of software engineers?

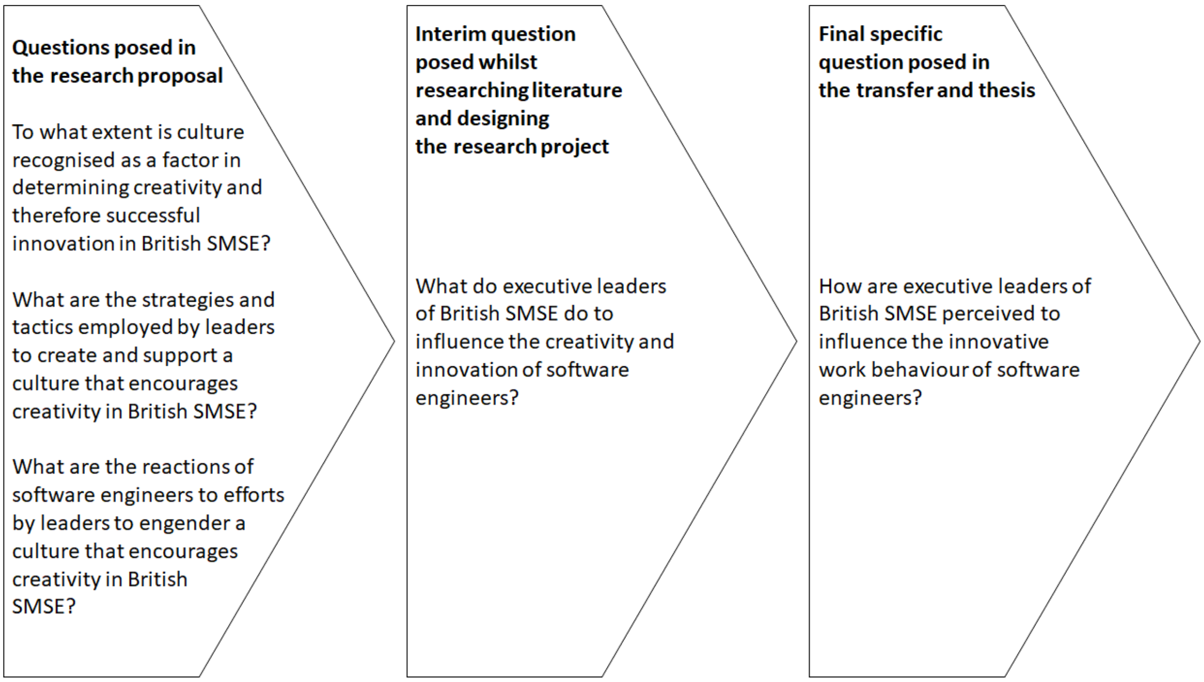


Figure 5.2 Evolution of the research question

In addressing the primary question, two subsidiary questions are implied which were explicitly phrased to help focus the research process. These questions are:

> What do executive leaders believe that they do and say to influence the innovative work behaviour of software engineers within their organisations?
>
> What do software engineers believe that executive leaders do and say to influence their innovative work behaviour?

To answer these questions, I conducted interviews with executive leaders and with software engineers. These interviews are discussed in more detail later in this chapter. At an early stage of the fieldwork for this research a theme emerged that suggested behavioural differences between owner-managers and private equity backed CEOs. This raised further questions which required engagement with an additional cohort of respondents from the UK private equity community that invests in SMSE:

> In those SMSE with external private equity investors, are there specific behaviours and experience related to the leadership of innovation that the investors explicitly select for when recruiting executive leaders to run their portfolio SMSEs?
>
> Do the behaviours and experience that private equity firms identify as important in executive leaders differ from the behaviours, traits and experience found in owner-managers?

Although all the research was focused on SME scale businesses, the data from the first phase of the research suggested that there might be a further segmentation of relative firm size that could be of relevance. This indicated a final question:

> Does firm size and ownership influence the innovation leadership behaviour of SMSE executives?

5.3 Axiology

Despite the professional desire to maintain an objective stance, we each bring something of ourselves to research (Korukonda and Hunt 1991). Research interests and methods will be influenced by our personal histories (Smith 2002) and the richness of our past endeavours and experience supports our ability to analyse the data that our inquiry presents (Alvesson and Sköldberg 2017).

Educated as a natural scientist with subsidiary studies in the philosophy of science, I still have well-thumbed original copies of Kuhn (1962) and Popper (1963) on my bookshelves. For many years, I considered myself a logical positivist, finding comfort in an established dependency on empirical verification. This was an unfashionable position when I was an under-graduate in the 1980s, and Paul Feyerabend was gaining popularity for his epistemological anarchy in the philosophy of science (Feyerabend 1987).

After an academic “re-tread” in business studies at master’s level and having spent more than twenty years leading technology businesses, I have maintained a “cause and effect” based realist ontology and positivist epistemology for practical purposes. Approaching research that is searching for new theory, with the possibility to develop practical recommendations, has moved me away from an ingrained preference for quantitative methods and allowed me to explore a different epistemology and an inductive methodology.

In my early career, I occupied executive leadership roles in large US owned global technology firms. These firms enjoyed substantial free cashflow and regarded radical innovation as a strategic necessity. In one of the firms, I was involved with the creation of a knowledge laboratory to experiment with human and computer interaction and a discovery centre for the development of interactive digital technology beyond the next generation. In the second firm, I had global responsibility for patents and intellectual property, and so was closely involved with the explorative innovation agenda and partnerships with universities and research establishments. I have also been privileged to lead four private equity backed technology businesses through to successful exits and have personally experienced the importance of innovation in creating both shareholder value and job satisfaction. I therefore believe that innovation has cultural significance within a technology business because, in my experience, creating and building new and useful solutions gives work meaning and supports worker and customer engagement. This personal experience has left me curious to understand how other executive leaders and software engineers perceive the leadership of innovation in British software businesses.

5.4 Ontology and epistemology

> *Epistemology: the theory of knowledge embedded in the theoretical perspective and thereby in the methodology.* (Crotty 1998, p.3)

The acquisition of knowledge is founded on the twin pillars of ontology and epistemology. Ontology concerns our belief in the nature of existence. Epistemology is concerned with how such beliefs are validated and justified through inquiry. Ontology and epistemology inform the theoretical perspective of a piece of research and it is hard to discuss one without the other (Crotty 1998).

Researchers adopt different ontological positions, ranging from realism through to nominalism. These are linked to different epistemological positions that range from strong positivism through to strong constructionism. The ontological and epistemological position that a researcher takes has consequences for the selected methodology and data collection methods (Saunders, Lewis and Thornhill 2016). In determining my own research paradigm, I found it useful to refer figure 5.3 below which is taken from a text by Easterby-Smith et al. (2015, p.54) and summarises this complicated area of theory.

Ontology / Epistemology / Methodology	Realism / Strong positivism	Internal realism / Positivism	Relativism / Constructionism	Nominalism / Strong constructionsim
Aims	Discovery	Exposure	Convergence	Invention
Starting points	Hypotheses	Propositions	Questions	Critiques
Designs	Experiments	Large surveys; multi cases	Cases & surveys	Engagement & reflexivity
Data types	Numbers & facts	Mainly numbers, some words	Mainly words, some numbers	Discourses & experiences
Analysis & interpretation	Verification/falsification	Correlation & regression	Triangulation & comparison	Sense making & understanding
Outcomes	Confirmation of theories	Theory testing & generation	Theory generation	New insights & action

(Easterby-Smith, Thorpe and Jackson 2015, p.54)

Figure 5.3 The link between ontology, epistemology and methodology

It has been suggested that management research has an ontological and epistemological breadth and does not conform to a single research paradigm (Tranfield and Starkey 1998). Yet, despite this, others have observed that business research often takes an objectivist stance (Johnson and Duberley 2000) based on an ontology of realism (Crotty 1998). Leadership is often assumed to possess characteristics of an entity that exists awaiting discovery through a positivistic epistemology (Korukonda and Hunt 1991).

My perspective on this research is that in exploring leader and follower interactions, we are dealing with phenomena that arise at the point of interaction between independent sentient individuals rather than exploring a physical entity that exists awaiting discovery. We are not dealing with philosophical noumena and there is no metaphorical tree growing somewhere that exists, whether or not humans are conscious of it (Crotty 1998). Nor are we considering a sociological construct that exists independently, such as race or class, with associated internal realism (Easterby-Smith, Thorpe and Jackson 2015).

A nominalist stance would offer a post-modernist interpretation of phenomena where the ontological beliefs of participants in the leader-follower interaction are entirely of human creation (Easterby-Smith, Thorpe and Jackson 2015). In this research, the perceptions of the actors can be observed, recorded, coded and analysed and so there is an argument for a degree of realism. However, the leaders and followers interviewed in this research co-construct their perception of reality which may change with contingent situation, evolving inter-subjective experience, and the passage of time, influenced by the interaction of different actors, locations or other circumstances (Collins 1983). This suggests that there are many aspects to the lived experience of leading and being led which are open to discovery from a variety of legitimate theoretical perspectives.

The epistemology of social research contrasts two different perspectives: positivism and social constructionism (Easterby-Smith, Thorpe and Jackson 2015). Positivism holds that there is an external reality that can be measured objectively. However, this research considers perceptions of reality that have been constructed by individuals through their personal interpretation of their lived experience (Berger and Luckmann 1966; Garfinkel 1967). Social constructionism argues that societal reality is determined by people rather than by objective and external factors. Using the framework of table 5.3 (above), this research has been developed from a constructionist epistemological perspective and considers the experience of leaders and followers from an ontological position of relativism (as described by Easterby-Smith, Thorpe and Jackson 2015, p.54), also often known as subjectivism (Saunders, Lewis and Thornhill 2016).

The subtle difference between social constructivism and social constructionism seems to attract debate. Whilst Bryman and Bell (2011) suggest that the terms can be used interchangeably, Crotty (1998) argues that there are important differences. Constructivism is a psychological construct in which individuals establish meaning from knowledge in a social context. Constructionism is a sociological construct in which phenomena are developed and understood in a social context. This may sound like fussy semantics and it does seem that there is a contemporary trend to simply use the terms interchangeably (Andrews 2012). However, in this research I choose to be specific and I believe that constructionism better describes the epistemological position of the research, which is fundamentally sociological, driven by an interpretation of perceptions of phenomena.

5.5 Theoretical perspective

> *Theoretical perspective: the philosophical stance informing the methodology and thus providing a context for the process grounding its logic and criteria.* (Crotty 1998, p.3)

Social constructionism developed from American pragmatism, which contends that self-awareness may result in people adapting their behaviour (Mead 1934). It is based on theories of symbolic interactionism developed by Mead's student, Herbert Blumer (1969). This approach puts research in a social context and focuses on the interactions between individuals and the world around them (Crotty 1998).

Developing a relativistic understanding of the interactions between leaders and followers in selected SMSE requires an interpretation of phenomena from the perspective of the interviewees (Smith 2007). The study of conscious experience through interpretation and analysis is known as phenomenology and was first developed in the early twentieth century based on the work of Husserl which was later elaborated by Heidegger, Sartre, Merleau-Ponty and other existentialists (Grosman 1984). Heidegger (1962) has suggested that such experiences are based on existence in the real world. However, the way individuals observe this so-called real world may not be an accurate representation of an objective reality and may be coloured by individual senses and the psychology of personal perception (Easterby-Smith, Thorpe and Jackson 2015).

In this research, I am interested in how individuals perceive their experience of specific phenomena related to the leadership of innovation, understanding what they might have in common (Creswell 2012) and seeing their "*behaviour as determined by the phenomena of experience rather than by external, objective and physically described reality*" (Cohen, Manion and Morrison 2011, p.18). Crotty (1998) notes that social constructionism is "*at once realist and relativist*" (p.63). The social construction of the inter-relationship between leaders and followers in this research is real to those actors. The theoretical perspective of the research is interpretevist: following Mead (1934) and Blumer (1969) the researcher has to be able to interpret the narrative data gleaned from the interviews from the perspective of the interviewee.

5.6 Methodology

> *Methodology: the strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and use of methods to desired outcomes.* (Crotty 1998, p.3)

Theoretical perspective frames methodological options (Crotty 1998). Having established a social constructionist approach and a theoretical perspective of symbolic interactionism, a qualitative methodology is a credible option. Ultimately, the methodology and method must be able to answer the research question (Becker, Bryman and Sempik 2006). In the absence of significant extant literature on innovation in SMSE, a more inductive approach to discover or construct theory based on observation (Gill and Johnson 2002) seemed most applicable.

Inductive approaches have rarely been employed in researching SMSE (Hill and Wright 2001; Piperopoulos 2010). There is limited extant literature, and research into innovation leadership and processes in SMSE is still in the phase of discovery and theory building (Rose, Jones and Furneaux 2016). Rather than just provide a thematic description of phenomena, this inductive study aims to contribute to the construction of theory based on the experience and perceptions of participants in the research (Starks and Trinidad 2007). I have selected Constructivist Grounded Theory Methodology (CGTM) for this research as it offers a pragmatic, reflexive and qualitatively critical approach (Charmaz 2017) to developing theories about how leader behaviours affect the innovative efforts of software engineers. I considered other methodologies and methods at the outset of the research and explored approaches to understanding the leadership of innovation that other researchers have employed. The choice of methodology is discussed in the next section.

The research context was the purposeful sampling of executive leaders, software engineers and private equity investors who are working in UK SMSE. In addition to considering what happens and why it happens in the encounters between executive leaders and software engineers engaged in innovative work behaviour, the research also explored possible underlying causal relationships. The selected methodology needed to be consistent with developing an in-depth understanding of the perspectives of the interviewees.

Although there is limited extant literature specific to the leadership of innovation in British SMSE, more general studies on leadership and innovation are rich areas of research and have been approached using a variety of methodologies. In considering this research question I looked at many articles from high quality journals to understand the methodologies and methods adopted by other experienced researchers when researching leadership and innovation. This section includes a short description of alternative approaches that I evaluated before settling on my choice of methodology and method.

My first instinct based on my own experience was to adopt a positivistic stance to the research. I also considered a case study approach, and some elements of case study method undoubtedly influenced my research approach. Each of these possible approaches is discussed further below in the context of research that is related to the leadership of innovation in technology firms. Each of the approaches has a degree of merit, but my reasons for rejecting them for my own research is noted.

5.7 Methodologies consistent with a positivistic theoretical perspective

The leadership of creative people has been researched in a variety of seminal studies (examples being Amabile 1983a; Amabile 1983b; Amabile 1988; Ekvall 1996, Ekvall 1997; Mumford et al. 2002; Krause 2004; Friedrich et al. 2010). In a compelling and wide-ranging paper, Mumford et al. (2002) suggest that the areas of leader support required by creative people relate to "*(1) idea support, (2) work support, and (3) social support*." (Mumford et al. 2002, p.723). Hypotheses around the relative importance of these areas of support could be developed and tested using surveys and quantitative, qualitative or mixed methods within a target group of SMSE. However, my concern was that in testing generic hypotheses there is a risk of missing important nuances that relate to the esoteric features of software development within SMSE.

Quantitative approaches have been employed to assess how leadership style affects innovative behaviour. For example, Kang et al. (2015) used a multi-level structural modelling approach to assess how CEO leadership styles affect the innovative behaviour of managers, taking data from 39 CEOs and 105 managers. This quantitative approach looked at transactional and transformational leadership as independent variables in relation to innovation climate and innovative behaviour. The research demonstrated a possible link between transformational leadership and innovation, identifying a degree of confluence between CEO perception and management perception (which is of particular interest in the proposed research). However, the researchers acknowledge that their quantitative approach did not allow a full exploration of potential causal relationships. Investigating causality is an important feature of my own research.

Dobni (2008) used a seven-point Likert scale survey consisting of 86 statements to analyse innovation culture in the Canadian financial services industry and obtained 282 usable responses. This approach explored pre-defined areas that the researcher felt might be important to innovation within a specific workplace relating to intent, infrastructure, influence and environment. The surveys yielded interesting and usable data but did not provide deep insight into the impact of leadership or the meaning attributed to the actions and behaviours of leaders by those being led.

Moultrie and Young (2009) explored creativity in British creative businesses using Likert style surveys and combining this approach with follow-up interviews with a subset of selected firms. The firms studied represented a broad spread of industries, although all qualified as creative based on a UK Government definition of the creative industries. The base was relatively heterogenous when considered in the context of a small sample size, and so the results should be treated cautiously. However, Moultrie and Young do position their research as exploratory, perhaps implying that there is intent to conduct either a larger or a more focused study in due course. A mixed method of survey with follow-up structured interviews was considered for this research. However, to understand what is happening within the SMSE selected for study requires a deep analysis of how leaders and software engineers attach meaning to their interactions (Saunders and Townsend 2016) and more in depth interviews were felt to be a better source of data than surveys with targeted follow-up.

5.8 Single organisation case study

Case studies are a useful way of answering “how” and “why” type questions (Yin 2018). Yin (2018) also notes that multiple sources of evidence tend to strengthen the case study. Case studies can be a good way to open a new area of research (Eisenhardt 1989). Although often faced with a criticism of generality, any other method that was based on a small sample would be open to similar observations.

A good example of how case studies have been used to investigate technology firms is provided by Heracleous and Papachroni (2012) who developed an influential case study which analysed Apple Inc’s revival from near bankruptcy in the 1990s to the subsequent success after the turnaround under the resumed leadership of Steve Jobs. The case study calls particular attention to culture, Apple’s deep collaboration model, and unusual product strategy when compared to major competitors. Apple developed an integrated proprietary hardware and software architecture in contrast to other major hardware and software vendors that have tended to favour more open systems. I believe that this case study worked for a well-known large firm that could offer a depth and breadth of internal and external historical documentation and literature for review and analysis, but would not be appropriate for the much smaller privately owned businesses that I am investigating.

A well-defined multi-case methodology would be a legitimate starting point for this research question and in some ways, the interviews with executives and engineers in multiple SMSE have common elements with a case study approach. However, my intention in this research was to go beyond a rich description of observed phenomena and instead to discover and construct theory. This requires a more structured approach that results in a coded hierarchy from which grounded theory can be developed and may offer more methodological rigour.

5.9 Structured interviews

In a rare piece of research that focuses on the UK SMSE market, Rose, Jones and Furneaux (2016) conducted a series of structured interviews and workshops with 19 SMSE in a high-technology cluster in Cambridgeshire (colloquially known as "Silicon Fen"). Data was gathered through 16 preparatory interviews and 25 in-depth interviews with executives, and workshops with 33 software developers. With a relatively homogenous group, this sample size would be considered towards the upper end of the range typical for this type of organisation and workplace (O&W) research (Saunders and Townsend 2016). Software engineers were asked to rank possible influences on innovation within their own experience and to tell a story related to what they considered to be a successful innovation. Product, service, and process innovations were discussed in the research. Interviewees were also encouraged to suggest additional influencing factors themselves. Content analysis was used to identify recurring themes using the DEDOOSE software tool. A degree of open coding was employed to derive new themes. Code frequency across the data set was deemed a determinant of validity.

Given the unique access available to me, a more inductive approach was selected for this thesis. Rose and colleagues are experienced researchers and felt confident to commence their research with strongly stated assumptions based on a thorough and detailed literature review. For this project, I wanted to take a more inductive and grounded process to discovering theory that started with no assumptions.

Given my professional background, I was acutely conscious of the risks of starting the interview process with any assumptions that could reflect the bias of my personal experience. Although I have professional competence in developing and using tools for digital analysis of meta-data and often use NVivo for basic thematic analysis, I decided to take a manual approach to coding to ensure that I became more immersed in the narrative data.

5.10 Grounded theory methodology

The origins of grounded theory methodology

Grounded theory methodology (GTM) is an approach to social research that involves the systematic collection and manipulation of data resulting in the discovery (Glaser and Strauss 1967) or creation (Charmaz 1990) of a theory. It is inductive and systematic, putting emphasis on social processes, and is not dependent on a mathematical analysis of the data (Rand 2013). Locke (2001) suggests that grounded theory is popular because it allows the discovery of new theory, is of direct use to practitioners, and provides insight into complex scenarios.

Discovered and developed by Glaser and Strauss in the 1960s, grounded theory has evolved into many different forms. The original method described by Glaser and Strauss (1967) is based on two key concepts of constant comparison and theoretical sampling. The influence of symbolic interactionism (Blumer 1969) was important to the development of GTM (Bowers 1988; Stern and Porr 2011), as it emphasizes the way humans "*try to construct meaning from their intersubjective experience*" (Suddaby 2006, p.634). In GTM, researchers attempt to discover or construct a social reality through interpretation and analysis of the data provided by interactants.

Decisions about which data to collect next are influenced by the emerging theory (Suddaby 2006). According to Cutcliffe (2004), researchers often select the elements of the theory that suit their purposes, with little thought for ontological or epistemological consistency. Four major GTM schools have emerged: Classical (Glaser and Strauss 1967) or Glaserian (Glaser 1978); Straussian (Strauss and Corbin 1990); feminist (Wuest 1995); and constructivist (Charmaz 1990).

Kenny and Fourie (2015) contrast the frameworks of Classical, Straussian and Constructivist Grounded Theory, noting the differences in each approach in terms of coding framework, treatment of literature and underlying philosophy (figure 5.4 below).

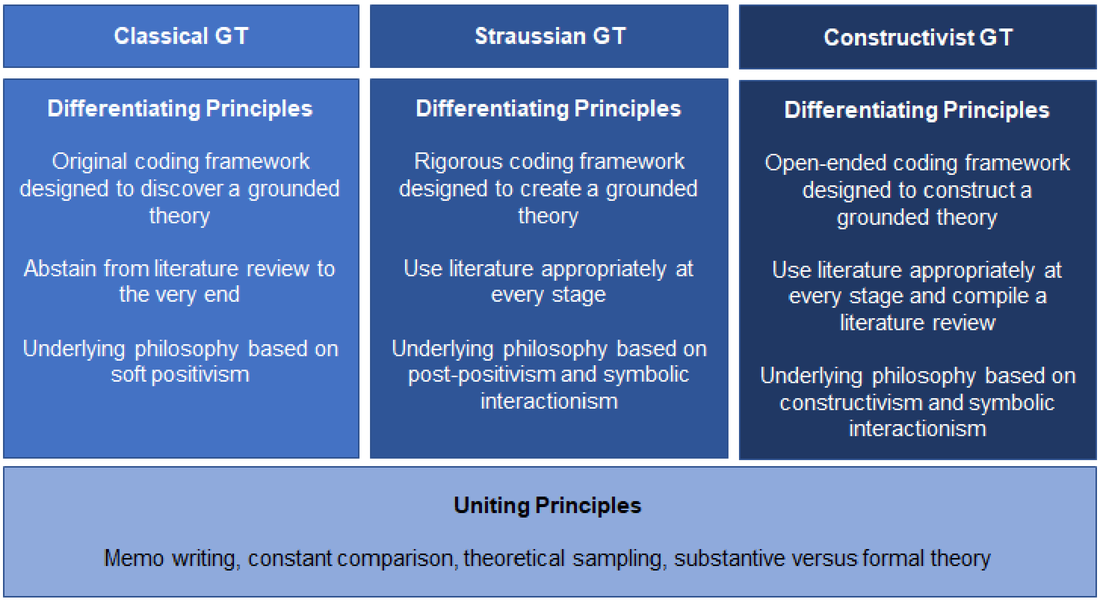


Figure 5.4 Contrasting grounded theory approaches (modified from Kenny and Fourie 2015)

The coding frameworks for each of these interpretations of the method vary. Kenny and Fourie (2015) have provided a contrasting description of these different coding frameworks summarised in the diagram below (figure 5.5).

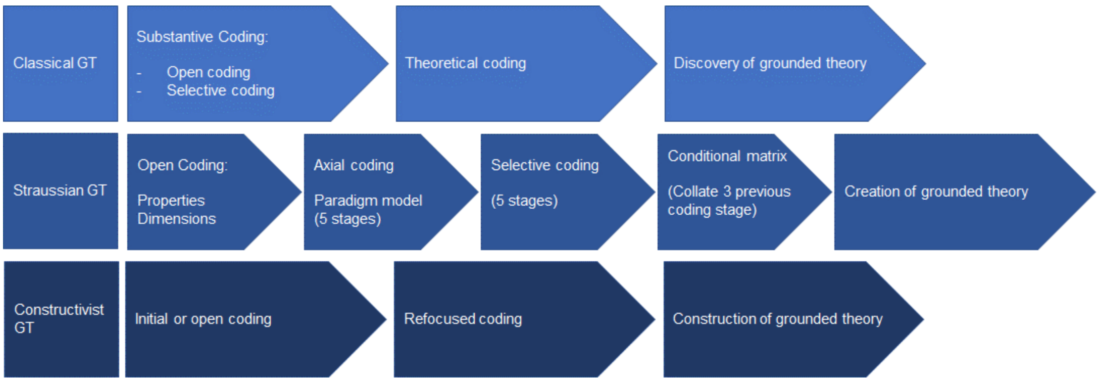


Figure 5.5 GT coding frameworks (modified from Kenny and Fourie 2015)

Within this research, we are trying to understand phenomena that arise in the interaction between leaders and software engineers, so that a theory can be proposed that may prove useful for future intervention (Glaser 1978). The interactions between leaders and followers represent social processes, and the research will probe contextual factors that influence behaviour (Crooks 2001).

Constructivist Grounded Theory Methodology (CGTM)

The original practitioners of GTM considered that theories would emerge from the data, but an alternative approach has been offered by Charmaz (1990) where the researcher actively constructs a theory as the data is analysed. This has become known as constructivist grounded theory methodology (CGTM) (Charmaz 2014). Charmaz (2014, p.14) is careful to point out that although she selected the word "constructivist" to describe her approach to GTM based on a dissatisfaction with the social constructionism in her own discipline at the time, her approach is entirely consistent with a modern social constructionist stance.

Charmaz (2003) considers CGTM to be a pragmatic approach that sits between the positivism of classical or Glaserian grounded theory and the post-modernist approach of the Straussian school. Unlike classical grounded theory based on realism, CGTM embraces a degree of relativism, but it is important to also acknowledge that at an epistemic level (rather than ontologically) this does not equate to a rejection of realism (Andrews 2012). In fact, Bryant and Charmaz are explicit that they do not subscribe to complete relativism which they suggest would "*accord equal status to all and any representations of reality*" (Bryant and Charmaz 2010, p.37). Instead, they support a view of social constructionism that is consistent with Giddens' (1981) social theory of "structuration", where social reality is embodied by and through the social system that it represents without giving primacy to either structure or agency.

Classical grounded theory is focused on behaviours and patterns, whereas CGTM also seeks to recognise the lived experience of participants and gives them a narrative voice (Breckenridge et al. 2012). Charmaz believes that the researcher should establish a shared reality with the participants (Charmaz 2003), co-constructing knowledge between the researcher and the participants (Lincoln, Lynham and Guba 2011). Glaser (2002), continuing to champion the classical and ontologically objectivist approach, warns of the danger of the researcher's views transcending those of the participant. However, Charmaz believes that this risk can be mitigated and counsels "*methodological self-consciousness to turn a deeply reflexive gaze back on ourselves and the research process as well as on the empirical world*" (Charmaz 2017, p.35).

Criticisms and limitations of grounded theory

The methodological schism between the founders of grounded theory (Glaser and Strauss 1967) has generated controversy and their individual interpretation of the methodology has diverged over time. Strauss and Corbin (1990) published a book which they dedicated to Glaser and which provides a "how to" manual of GTM for researchers. Glaser subsequently published a polemic refutation of the Strauss and Corbin book (Glaser 1992). Whilst there are various aspects of methodology that the two camps disagree on, the core of the fundamental disagreement relates to how the researcher approaches the coding paradigm. Strauss and Corbin seek to define a methodology for establishing causality, whilst Glaser remains convinced of the benefits of allowing theory to emerge through GTM (Urquhart 2013).

Glaser came from a positivistic research tradition. Annells (1996) has suggested that Glaser perceives that a researcher can establish a neutral perspective in relation to an objectivist ontology, contrasted with Strauss and Corbin (1990) who maintain a more relativistic position. Glaser (1998) argues for larger sample sizes believing that this will underpin a more generalized application of emergent theory, whereas Strauss and Corbin seem more interested in the analytical process itself.

Locke (2001) suggests that grounded theory does not fit easily into a particular research paradigm because it has been used in both an objectivist and interpretative manner. Beyond the split into Glaserian and Straussian schools, grounded theory has been revised by many researchers to the extent that some studies are barely recognisable as grounded theory (Bryant 2009). Jones and Noble (2007) believe that this pliant approach threatens the integrity of the methodology. Robson and McCartan (2016, p.162) suggest that there are tensions between the "*evolving and inductive style of flexible study and systematic approach of grounded theory*". The founders of grounded theory set out to provide an alternative to positivistic quantitative approaches of the natural sciences but have been criticised for replacing these with a rigorous objectivist methodology (Tolhurst 2012).

Robson and McCartan (2016) note that it is not possible to start a grounded theory study without some pre-existing ideas and assumptions, which could introduce bias. In this research project there is little extant literature specific to innovation in SMSE. The issue of the literature review is related to the difficulty of finding a starting point for the research. It is helpful to note Glaser's (2009) exploration of opinions on literature reviews within GTM projects, with some researchers considering them a pre-requisite (citing Schreiber 2001) and others suggesting that they might cloud or bias judgement (Glaser cites Morse 1993). Glaser's own opinion seems to favour "suspending" (Glaser 2009, p.6) the literature review arguing that the literature will still be there at the end of the project. He suggests that researchers do not know where GTM might take them and therefore do not know what literature to read (Glaser 2009).

Suddaby (2006) makes a case for GTM not being an excuse to ignore the extant literature. He makes observations about researchers in well-established areas, specifically mentioning research into leadership, seeking to avoid the "*ruts that early travellers have worn*" (Suddaby 2006, p.634). He draws attention to the origins of GTM and the recognition by Glaser and Strauss (1967) that GTM is stimulated by substantive theory. Like Glaser, Suddaby is alert to the risk that a literature review could force the researcher into testing a hypothesis rather than allowing a theory to emerge or be constructed. In common with Dey (1999), Suddaby simply counsels an open-minded approach.

Thomas and James (2006) are critical of grounded theory, suggesting that it "*misses the best*" (Thomas and James 2006, p.27) of qualitative research and that coding loses the "*original voice*" (Thomas and James 2008, p.28) of those being interviewed. They question the validity of theory derived by methodology and the basis by which the theory is actually grounded, suggesting the "*methodological alchemy*" (Thomas and James 2006, p.29) should not give higher confidence in "*epistemic status*" (Thomas and James 2006, p.29). However, Strauss and Corbin (1990) suggest that grounded theory should be judged on whether it fits the phenomena, provides understanding, is comprehensive enough to provide generality, and is clear on the conditions under which the theory applies.

Why select grounded theory for this research

The original approach to GTM developed by Glaser and Strauss (1967) emphasizes the generation of theory from comparative analysis. Glaser has remained true to this original approach. However, in later work, Strauss and Corbin (1998) have adopted a greater dependency on deduction and verification. Whilst GTM has taken many forms (Dey 1999) and has been subject to an "*adopt and adapt*" approach (Glaser 1999, p.837), sometimes mixing it with other methods (Glaser 1999), the real test is whether the methodology has the potential to answer the research question (Becker, Bryman and Sempik 2006).

Glaser (2009) considers PhD students to be relative novices who are still learning the professional researcher's trade. He believes that grounded theory is a well-established methodology that offers a higher degree of certainty of producing good quality research. Although I am a novice in academic research, I do have prior professional experience of conceptualizing data, and have a tolerance for complicated regression analysis in the context of database analytics applied to textual meta-data (data in an unformatted narrative format rather than an orderly numerical format). By combining my prior experience of handling large volumes of narrative data with an established qualitative methodology I am hopeful that my coding goes beyond "*pure impressionism*" (Glaser 1999, p.838) allowing the identification of meaningful relationships, hierarchies and paradigms within the transcripts.

In the original GTM research conducted by Glaser and Strauss which commenced in 1965, (Glaser and Strauss 1967), there was limited extant literature from which to construct a hypothesis and so an empirical positivistic approach was not adopted. Similarly, in the research case proposed here, at the start of the project it was not known if and how leaders affect innovation through their interaction with software engineers within SMSE. Therefore, a reflexive stance offers the opportunity to grapple with the empirical problems that such an esoteric research case might produce (Charmaz 2009). Idiosyncrasies may emerge from the data that will be accommodated by this methodology (Bryant and Charmaz 2010), allowing contextual complexity to be captured and analysed (Locke 2001).

Although Charmaz is not overly prescriptive in defining method, I have taken a structured and process-oriented approach to using the methodology. The detailed application of CGTM will discussed in section 5.12 (below).

5.11 Ethics

Ethics approval for the field research was received on 26 September 2017 from the Chair of the Cross School Research Ethics Committee at York St John University. The ethics reference number is 110102252/26092017.

The research interviewees are all adult professionals who gave explicit consent to participate in the research. The Research Consent Form (based on a format suggested by Braun and Clarke 2013) is attached as Appendix 1 and the Participant Information Sheet (also based on a format suggested by Braun and Clarke 2013) is attached as Appendix 2.

Ethical considerations relate to individual and company anonymity and confidentiality, and the storage of recorded and transcribed materials. York St John University published protocols for the secure storage and management of data have been followed as defined in the Research Data Management Policy (York St John University 2016).

5.12 Method

> *Method: the techniques or procedures used to gather and analyse data related to some research question or hypothesis.* (Crotty 1998, p.3)

The Interviewees

Participants were identified through my own relationships with UK private equity (PE) firms that invest in SMSE and through wider software industry relationships. I have not been personally involved with any of the businesses as an investor, director or employee.

The firms selected have all reached a degree of maturity, being established from five up to 25 years, so although some are still early stage, none of them would be regarded as start-ups. Each business is regarded as successful within its niche, having managed to grow revenue and market share in a competitive industry. Having grown revenue and market share, it is reasonable to assume that the software and services provided are of a competitive standard. The firms all provide business to business (B2B) rather than consumer software and are engaged in the provision of critical software solutions in maritime, offshore engineering, healthcare training, security, fraud analytics and financial services.

Sample size is hard to predict in grounded theory research because data saturation conditions are uncertain at the outset. Sample size should be large enough to ensure data saturation conditions can be achieved and small enough to ensure that in-depth analysis remains possible (Onwuegbuzie and Leech 2007). In any type of research, if the sample size is too small there may be legitimate concerns about the lack of triangulation (Altrichter et al. 2008). As limited secondary sources exist that are specific to innovation in SMSE, it was not possible to gain comfort on validity from existing studies and so this places a greater burden on the researcher to demonstrate a defensible chain of evidence. Charmaz (2014) suggests that bigger is not necessarily better when it comes to sample size and that smaller samples can "*produce an in-depth interview study of lasting significance*" (Charmaz 2014, p.108). However, it is important to ensure that there is sufficient data to enable the CGTM process and help the researcher to determine "*how meanings, actions and social structures are constructed*" (Charmaz 2014, p.285).

Guidance and empirical support for ideal sample size in organisation and work (O&W) studies are limited. However, Saunders and Townsend (2016) have offered a view based on a review of 248 empirical studies found in 244 articles selected from top 10 and tier two academic journals in the areas of general management, human resources and organisational studies. The quality of the journals was assessed using accepted quality guides in the UK and Australia. They found 12 interviews commonly used for homogenous groups, and between 12 and 30 participants in heterogenous groups. Morse (1994) suggests that in ethnographic research, a sample size of between 30 and 50 participants is generally adequate. Based on their own review of qualitative research, Creswell and Creswell (2018, p.186) suggest a "*rough guide*" of between 20 and 30 participants in grounded theory research. In this research, the concept of saturation reflected the traditional grounded theory perspective of fresh data not resulting in new insights or new properties emerging within categories, rather than the narrative becoming repetitive (Charmaz 2014). I found saturation of the categories that I was exploring occurred with 12 SMSE, seven PE firms and 34 individual interviews in total.

Where it is necessary to quote or refer to a specific firm or interviewee, a standard notation has been adopted. Each of the 12 SMSE studied is numbered sequentially in date order of interview from F1 though to F12. Of the owner-managed businesses, 2 of them (F4 and F9) were of comparable medium size to the 4 PE backed businesses (F1, F5, F6 and F8), all having prior year revenue more than £10 million. The remaining 6 firms (F2, F3, F7, F10, F11, F12) had prior year revenue of less than £5 million. The fact that none of the firms had annual revenues between £5m and £10m was not an intentional feature of the research.

The 14 executive interviews consisted of 12 Chief Executive Officers (CEOs) and 2 Chief Operating Officers (COOs) from the 12 SMSE, with firms F1 and F9 offering 2 executives to interview, taking the codes F1EX1, F1EX2 through to F12EX1. Of these, 9 of the leaders interviewed were owner-managers and 5 were experienced PE CEOs or COOs with track records of success in prior businesses who had been recruited into the enterprises after PE investment.

The engineer cohort consisted of 13 engineers interviewed from the 12 firms, with 2 engineers being interviewed in F12, taking the codes F1ENG1 through to F12ENG2. The investment executives of the 7 PE firms interviewed are sequentially coded by date order of interview as PE1EX1 through to PE7EX1.

The interviews were conducted between 4 January 2018 and 30 January 2019. Interviews were mainly conducted at the offices of each company or in private rooms at the Institute of Directors in London. One interview was done at breakfast in a London restaurant which presented unique recording challenges, but a small lapel microphone was used to solve the problem. Further anonymised data about the firms and interviewees are summarised in table 5.1 below.

The demographics across the cohorts were relatively homogeneous, being mainly white male graduates with a large majority aged between 30 and 50 years old. Sadly, this *"male, pale and stale"* (F6EX1) demography reflects the existing bias in both the computer industry and in private equity. The lack of diversity is the subject of an overdue public and industry debate in both sectors (British Computer Society 2017; Private Equity Wire 2019).

Table 5.1 Interviewee demographics

Age range	**Leaders**	**Engineers**	**Investors**
21-30	0	3	0
31-40	3	6	2
41-50	5	3	5
51-60	5	1	0
Over 60	1	0	0
Total	14	13	7
Ethnicity	**Leaders**	**Engineers**	**Investors**
White European	9	10	7
White non-European	2	1	0
Black/African	1	0	0
Asian	2	2	0
Total	**14**	**13**	**7**
Gender	**Leaders**	**Engineers**	**Investors**
Female	2	1	0
Male	12	12	7
Total	**14**	**13**	**7**
Qualifications	**Leaders**	**Engineers**	**Investors**
A level	2	1	0
First degree	6	5	2
Master's degree	4	7	5
Doctorate	2	0	0
Total	14	13	7

At the time of writing the thesis in September 2020, all the SMSE were still trading. Since the interviews, two of the firms that were already PE backed had received further investment to support continued expansion. Since the interviews, two of the executive leaders had left their positions. One executive had resigned for personal career reasons, and the other had been exited after a disagreement with the PE backers about strategy. However, all the software engineers interviewed for this research were still employed by the same SMSE at the time of writing. In addition, all the PE executives interviewed were still with their original firms.

The interviews

Semi-structured interviews were designed to explore how leaders and software engineers perceived leader influence on innovation within their firms. Corbin and Strauss (2015) suggest that semi-structured interviews allow the researcher to retain a degree of control over the consistency of topics covered. Adams (2015) notes that although semi-structured interviews are time consuming, they allow a mix of both closed and open questions which enable the interviewer to then open up specific areas of enquiry that are more pertinent to the research question.

The interview process and coding of responses were tested with the Chief Information Officer (CIO) and software engineers within my own software business. This data was not used as part of the research. This experience enabled the refinement of interview frameworks for the executives and engineers (Appendix 3 and Appendix 4).

It became apparent in the test interviews that an explanation was required to distinguish between process innovations (where improvements in efficiency or quality are delivered by changing the way things are done) and product or service innovations (where new products, solutions or feature functionality are delivered). Both were relevant to the research, but in the test interviews there seemed to be a tendency for participants to focus only on new product development.

The experience of the test interviews conducted suggested that each interview would be expected to run for around one hour. In practice, most interviews with executive leaders and software engineers were of around an hour in length. One of the software engineer interviews was noticeably shorter (F3ENG1) than others at just over half an hour but was no less rich in content. F3ENG1 just proved more articulate and precise in discussing her perceptions within the smallest business in the cohort. The PE executive interviews also tended to be shorter in length, but equally rich in content. Reading the transcripts suggests that this is because the PE executives were not as inclined to share a detailed history of the firm and its products as the executive leaders and software engineers. They focused more closely on the specific questions posed in the semi-structured interviews.

In the interviews with executives and engineers, I guided interviewees to discuss their own ideas about what constitutes innovation within their organisations, the way in which innovation arises from ideation through to commercialisation, their views on what promotes or inhibits innovation, and the support for and resourcing of innovation within their organisations. The discussion was developed by asking interviewees to consider successful and unsuccessful innovations within their own organisations. On two occasions this proved difficult and so I prompted them to consider examples from their prior career history working in similar firms. Throughout the interviews I was consciously listening for and exploring explicit and implicit statements that related to the interaction and intersubjective experience of leaders and engineers.

Grounded theory research is based on a process of constant comparison and theoretical sampling (Glaser and Strauss 1967) which should influence decisions about which data to collect next (Suddaby 2006). New ideas should be evident in the incremental data collected before the research concludes. Having interviewed firms F1 to F9 and coded the transcripts, the coding revealed that the owner-managers and PE backed CEOs interviewed demonstrated some significant differences in thoughts and behaviours which are discussed in the more detailed analysis in the following chapters. Of the PE backed executive leaders, four had been recruited by their current PE firms to replace the owner-managers who had founded the businesses. In one PE-backed business, one of the co-founders had been retained, but in a specialist technical role, and was no longer a board member or involved in general management. I wanted to understand if there were specific behaviours, skills or experiences that the PE firms looked for in SMSE CEOs, particularly in relation to how they managed innovation and interacted with engineers. This resulted in a decision to contact PE investors who have experience of investing in SMSEs. The PE investor interview structure is shown in Appendix 5. It was used to guide discussions on the experience of innovation in investee SMSEs and to consider perceptions of leader interaction with software engineers within those organisations. I also asked them to discuss how they selected CEOs to run portfolio companies and to discuss their experience of working with owner-managers.

After the first nine firms had been interviewed, it was evident that the executive leaders in the more mature and larger firms showed some similarities to the PE backed firms in thought and behaviour when compared to smaller earlier stage firms with annual revenue of less than £5 million. This resulted in a decision to prioritise interviews with a further three smaller owner-managed businesses to explore the implications of smaller size and ownership structure on leader behaviour.

The interviews were simultaneously recorded on a small interview recording device and my own laptop. The audio files were password protected, stored securely and backed up in an off-line environment. Once transcribed and anonymised, the original recordings were deleted.

Handling the data

I manually transcribed the data into Microsoft Word files and anonymised the narrative content removing references to companies, products, and individuals. Samples of interview transcripts are shown for an executive leader (Appendix 6), an engineer (Appendix 7) and a PE investor (Appendix 8). The Word files were also password protected and stored securely with off-line back-up. At no point was any of the data held in a “cloud” or networked environment. At all times, the data protection regulations laid down in the Research Data Management Policy (York St John University 2016) were complied with.

Transcription took approximately seven hours for each hour of interview. The text was then prepared for export to an Excel file so that each line became a single cell within a spreadsheet. This was done by adding a paragraph marker “¶” at the end of each row prior to copying the data from Microsoft Word into Microsoft Excel.

Having attended NVIVO training and used the software on other projects, I considered using Computer Assisted Qualitative Data Analysis Software (CAQDAS) (Lee and Fielding 1991) to simplify analysis and organisation of the data (Morrison and Moir 1998; Davidson, Thompson and Harris 2017) and noted the view that this approach may help to promote reflexivity (Woods, Macklin and Lewis 2016). However, this is my first foray into using grounded theory and I wanted to experience a more immersive and personal interaction with the data. The effective use of Excel was invaluable in ensuring that my data was well organised and easily cross referenced and meant that I did not miss the benefits of the data organisation features that CAQDAS might have offered.

Each worksheet within the Excel file represented a single interview and the data was organised into the following columns:

- Column A: line number.
- Column B: summary of questions or comments.
- Column C: interview response.
- Column D: open coding.
- Column E: category ideas.
- Column F: initial memo notes and observations.

This data structure is illustrated in the screen shot of transcribed data of software engineer F3ENG1 (Figure 5.6 below).

The coding process stayed close to the description offered by Charmaz (2014, p.109 to p.161). However, as is often the case, it was far from linear (Urquhart 2013), as it was necessary to re-evaluate data through the process of constant comparison. Each progression between phases of coding resulted in a need to go back to prior phases and re-evaluate the data. This was the stage at which many large sheets of blank paper were consumed with scribbled notes and many corrections, as experienced by other grounded theory practitioners (Urquhart 2013). This experience of re-evaluating and validating codes is consistent with observations made by Charmaz (2014, p.18).

Each interview transcript was first subject to initial open coding (Glaser 1978, p.56). This was done line by line, staying close to the original data. As advised by Glaser (1992), gerunds were used where possible. As tentative categories and themes were identified, memo writing, and theoretical sampling allowed emerging concepts to be explored and initial categories developed (Charmaz 1990). Focused coding developed these ideas, resulting in many focused codes for each cohort that could be grouped into categories allowing major themes to be identified.

My supervisors have always proved generous in sharing their time, experience and knowledge. They reviewed a sample of the early transcript material with me and provided some guidance on coding and codes. This caused me to re-code the initial interviews, trying to stay even closer to the data and creating more initial categories such that every line of narrative received an initial open code. The main benefit of coding each line in this way was that it became more obvious which sections of narrative were specific to the research question.

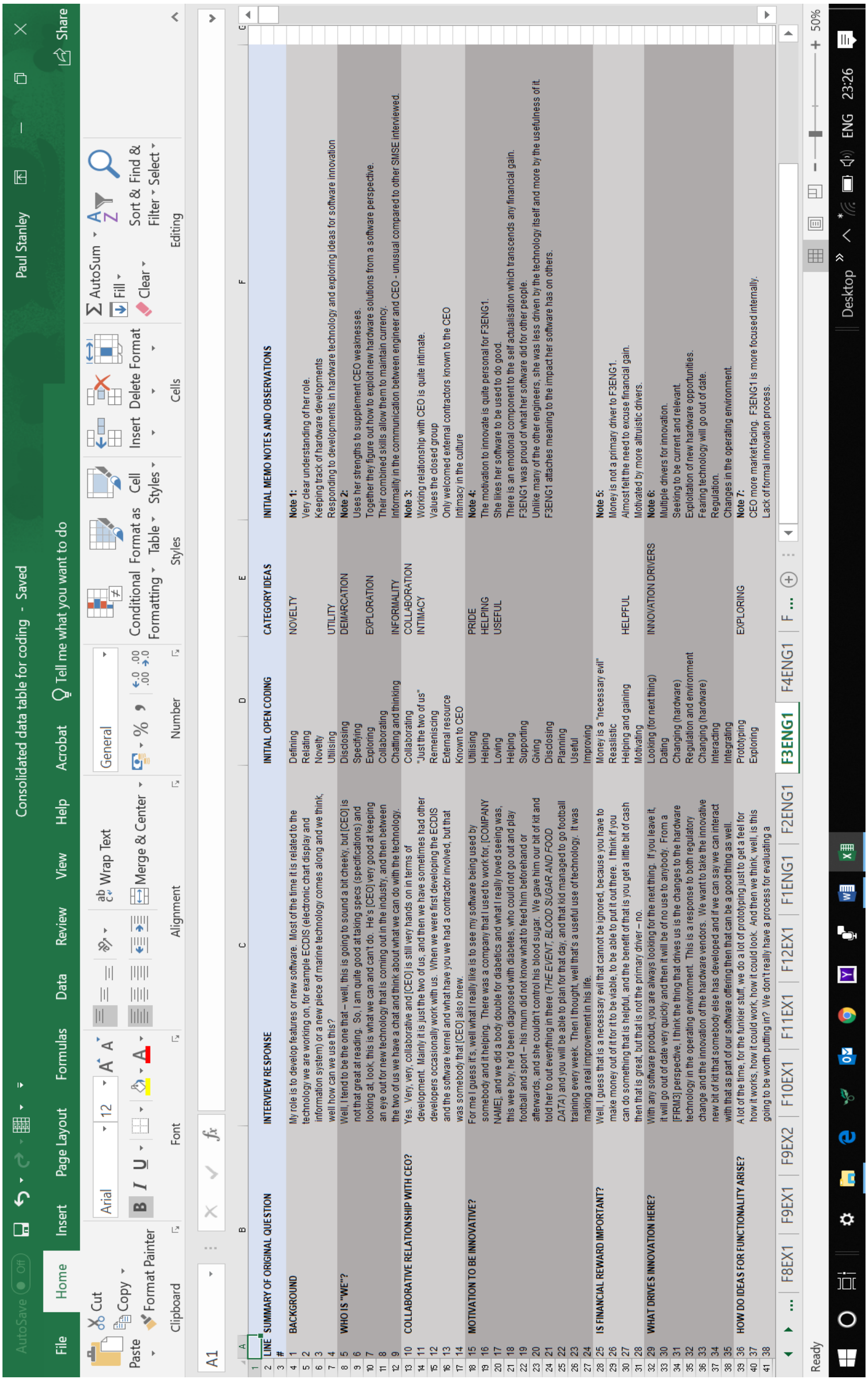


Figure 5.6 Screenshot of transcribed and coded data from the interview with F3ENG1 in the Excel worksheet used to store and code interview data

The number of codes, categories and themes for each cohort are summarised in table 5.2 below.

Table 5.2 Numbers of codes, categories and themes identified through coding process

Cohort	**Number of relevant focused codes**	**Number of categories**	**Number of major themes**
Executives	130	48	7
Engineers	84	10	9
Investors	98	16	7

Focused coding (Charmaz 2006) identified thematic words and phrases, establishing relationships, themes, families and paradigms to start to explore explanations of phenomena. In Glaser's view of GTM, the use of constant comparative analysis between data sets means that coding is an active interpretation of observations and indicates the validity of categories (Glaser 1978). Within CGTM, Charmaz suggests that the researcher scrutinizes categories for "*power, purpose and pattern*" ("3Ps") (Charmaz 2014, p.296). Memos were written at each stage of the research and maintained a record of my own perceptions and emerging ideas, scrutinizing categories against Charmaz's "3Ps" for relevance and validity.

I grouped the focused codes into categories and assessed the level to which interview respondents were clearly identified with each code:

- ● Positively identified with the code
- ● Neutral or somewhat identified with the code
- ● Negatively identified with the code

Although stopping short of a critical realist position of counting the incidence of each code (Urquhart 2013, p.159), the consistency of identification with each code helped identify saturation and provide evidence for the relevance and importance of each code. However, even if only one person identified positively with the code, this was viewed as interesting and worthy of further consideration, recognising that, "*real life is composed of different perspectives that do not always coalesce, discussing contrary data adds to the credibility of an account*." (Creswell and Creswell 2018, p.201).

I used Excel to tabulate these results with a worksheet for each interview cohort. This method also allowed me to use the Excel comments feature to embed quotes and notes behind specific markers. An example from one of the worksheets relating to the engineer cohort is shown as figure 5.7 below.

Finally, I started to consider causality using Urquhart's (2013) "6Cs" framework of causes, contexts, contingencies, consequences, covariances and conditions. This allowed me to compare data between cohorts and establish theoretical perspectives on possible cause and effect. I also created some integrative diagrams (Strauss 1987) to show how relevant categories inter-related within their own cohorts. Some of these diagrams are used in the analysis in chapters 6 and 7.

5.13 Chapter conclusions

This chapter has outlined the link between axiology, ontology, epistemology and method that led to the selection of constructivist grounded theory methodology for this research. It also offers a detailed description of the execution of the research and the subsequent data analysis. The possibility that other perspectives and methods would have been legitimate ways to explore the research question is acknowledged, but I feel that given the nascent nature of this topic, the selected method offered an appropriate balance between a representative sample size, analytical depth and legitimate epistemology. The interviews provided a substantial amount of narrative data which ran to more than 270,000 words or 600 pages of transcribed text. The text is rich in content and generally stays close to the topic. The importance of this became apparent during the coding process, where it became clear when categories were saturated and there was sufficient triangulation between narratives to feel a degree of confidence in the relevance of emerging themes.

The next chapter provides a detailed analysis of the findings.

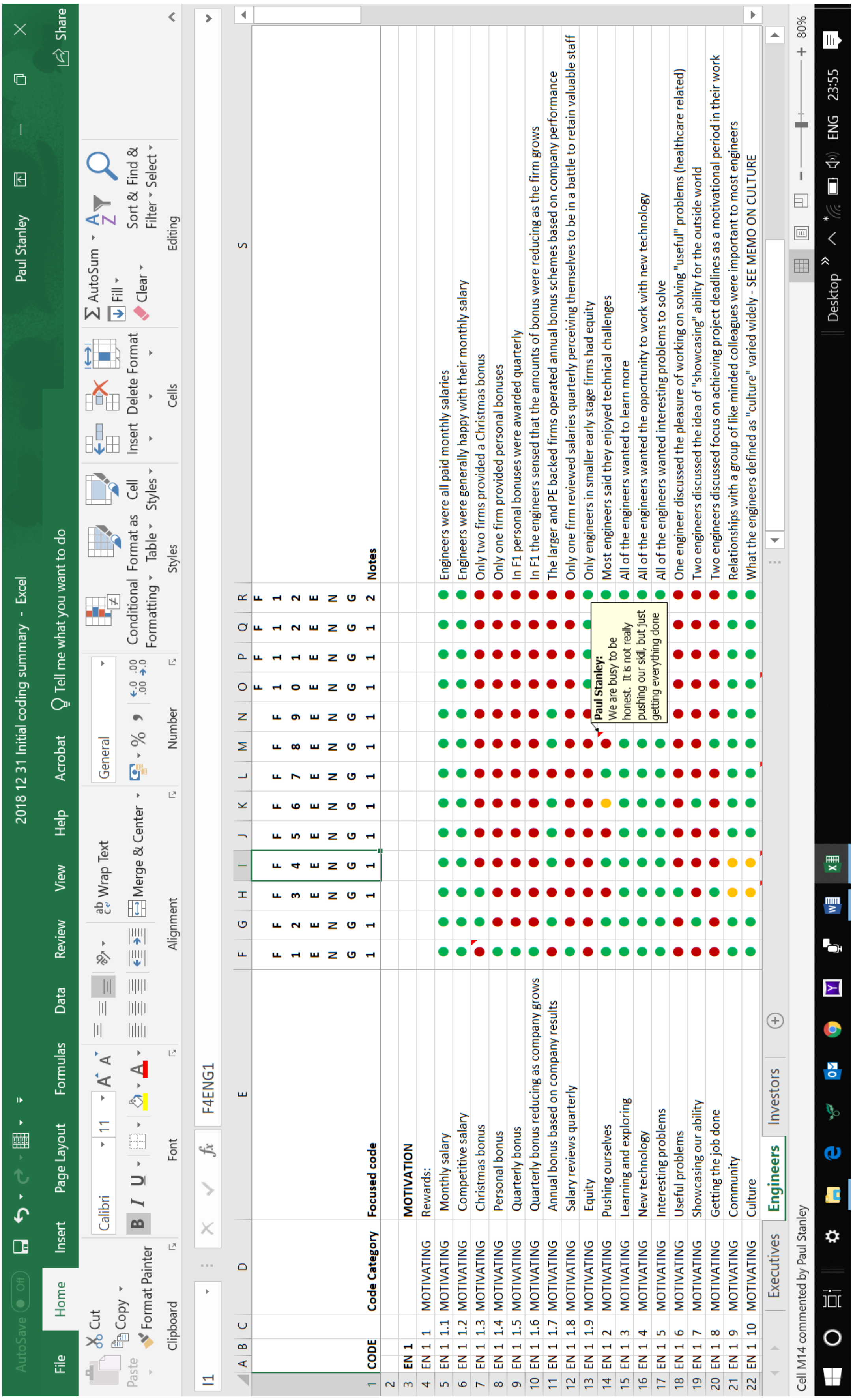


Figure 5.7 Sample worksheet from initial coding summary

6 FINDINGS

This chapter provides an analysis of the findings from the 34 interviews conducted in the research. The research question is specific to perceptions of executive leader influence on the innovative work behaviour of engineers and so although all the narrative data went through a full cycle of coding, only the coded data that relate specifically to aspects of and perceptions of innovation leadership are presented in the findings. Consistent with CGTM, memos were prepared after interviews and throughout the coding and analysis process. These memos helped with theory building and to inform the literature reviews. Some of these memos are shown in Appendix 10 and referred to in the text below.

The main findings of the research are summarised and presented from the perspectives of each of the three interview cohorts:

- Executives (leaders).
- Software engineers (followers).
- Private equity (PE) investors (observers and influencers).

Following this summary, the data is compared between cohorts to expose areas of commonality and divergence. Relationships between the data are explored and interpreted, developing a chain of evidence for observations and new theoretical findings. Each of the themes is supported by a diagram that summarises the progression from selected codes to categories and themes.

In the interviews, I directed interviewees to discuss innovation and innovation leadership. In these dialogues, innovation leadership behaviours were self-identified by the leaders and experienced by the engineers. The PE executives provided a different perspective on innovation leadership, being more distant observers of the performance and output of the SMSE that they invested in. In coding and analysing the discussions about these phenomena, consideration was given to the extent that behaviour conformed with or represented an established theory within the extant literature discussed in chapters 2 to 4, or if the behaviour represented something new or contradictory to the existing literature. However, the detailed analysis of how the findings relate to the literature is reserved for chapter 7.

Although there was no positivistic effort to test for the existence of specific models of leadership within the interviews, within each cohort it was generally apparent when the type of innovation under discussion related to exploitation of existing intellectual property or exploration seeking the creation of new intellectual property or developing new markets (Tushman and O'Reilly 1996). Similarly, certain leader behaviours that were discussed appeared to be consistent with aspects of the full-range model (Avolio and Bass 1991) or of instrumental leadership (Antonakis and House 2002, 2004 and 2014). On some occasions, the behaviours discussed did not fit neatly into full-range or instrumental constructs, but instead reflected a more collaborative or distributed leadership (Gronn 2002; Spillane 2006) approach. The perceptions of the use of such styles of leadership are noted for each cohort. Of course, given the inductive and interpretive nature of the research, not all perceived leader behaviours observed or discussed related to established theory and there was no attempt to force the data through any existing paradigm.

As shown in chapter 5, the frame from which the sample cohorts were drawn displayed a relatively high degree of socio-demographic homogeneity, which is considered consistent within the software (British Computer Society 2017) and private equity (Payton 2020) industries. Even where there was a degree of ethnic or national cultural diversity in the research sample, the similar age range, educational and social backgrounds of interviewees meant that many of them had similar life experience, at least in their professional lives. In addition, the research question is narrow in focus being only about executive leader influence on the innovative work behaviour of software engineers, and the industrial context is also narrowly defined, being on British SMSE providing B2B software. Within this narrow and homogenous sample and within each cohort, interviewees displayed relatively similar views on many aspects of their experience of innovation leadership. However, there were areas where differences did arise. Some of these differences were identified between cohorts, and these differences are discussed in chapter 7. A lesser number of differences existed within (rather than between) each of the leader cohort and the engineer cohort, but on occasions a single or small number of individuals expressed counter-thematic views to others. Where this occurs, these counter-thematic views are discussed, and their existence probably makes the evidence "*more realistic and more valid*" (Creswell and Creswell 2018, p201). Although explicitly recognising the counter-thematic data, in the analysis I took a conscious decision to remain true to a relativist position and not to drift into critical realism by expressing the levels of agreement or dissonance in precise statistical or numerical terms.

The inductive and interpretative nature of this research means that grounded theory methodology is not being used to test observations directly against established theory. However, to express the observations requires use of familiar language in relation to the acts of innovation leadership under discussion. It is therefore important to be specific about what certain terms that relate to acts of leadership mean when used in the findings section. Therefore, I created the following definitions to ensure analytical consistency when discussing innovation leadership in this thesis:

- Behaviour: something that a leader says or does that is observed and noted by the leader themselves or by an engineer or by an investor.
- Trait: a distinguishing quality or characteristic that a leader perceives themselves to have or that an engineer or investor believes the leader to have.
- Style: the particular way a leader perceives themselves to act or in which engineers or investors perceive a leader to act in respect of the task of leading innovation.

These definitions allow the findings to be expressed and discussed in a way that may allow theory to be constructed free of the constraints of existing theoretical models.

6.1 Findings: the executive leaders

Summary of findings for the executive leader cohort

Most of the executive leaders interviewed showed evidence of using instrumental leadership and transactional leadership styles. However, they occasionally showed evidence of other leadership styles when circumstances dictated. Executives in larger SMSE and PE backed firms tended to discuss situations in which they were required to exhibit a broader array of leadership styles than the executives in the smaller firms. It was not possible to determine definite causality from the data. Perhaps the larger firms presented broader challenges that required a richer palette of possible responses. Alternatively, the executives leading larger firms may have learned or developed a broader range of leadership styles and were to some extent either self-selecting or externally selected for roles that required this increased level of leadership competence. It may be that neither or both explanations are correct and that other factors not captured by the research are influencing leadership style. However, the research data showed a relatively low level of conscious awareness of switching between styles, and rather than actively selecting an approach, it appeared that executives were intuitive and reactive in their choice of innovation leadership style.

PE backed CEOs generally discussed behaviours that evidenced that they could combine supportive and collaborative approaches to innovation leadership based on providing resources and positive encouragement and they appeared to be capable of moving quickly between strategic and tactical issues. Owner-managers were more inclined to discuss tactical interventions, often in the context of project management or crisis management, particularly in relation to cashflow related problems. In all the SMSE analysed, there was substantially more discussion of incremental exploitation innovation based on enhancing existing intellectual property rather than exploration or research and development (R&D).

Subjects that came up in all the interviews were survival and cashflow concerns. The narrative data revealed that one of the possible factors that limits appetite for exploratory innovation in SMSE may be dealing with real or perceived resource constraints and having a short-term survival focus. All the executive leaders interviewed discussed cashflow and feared running out of cash, irrespective of the relative maturity, strength or size of their firm. The consequence of this was that the executive leaders where explicit about displaying a predominantly external focus on securing cash for their businesses, either by driving revenue through sales or through managing relationships with investors and debt providers. This external focus required the executives to spend most of their time away from the office during normal business hours. This time away from the office limited their personal engagement with engineers and impacted their chosen communication styles and methods, resulting in a reliance on email as a primary means of communication.

Although the word culture was used in many of the interviews, the executive leaders showed a lack of explicit awareness of the theoretical importance of culture and creative climate in supporting innovation. However, the executive leaders of larger SMSE and PE backed firms showed some evidence of understanding the importance of their practical support for encouraging creativity and innovation by providing resource and encouragement to support engineers.

The executive leaders interviewed believed themselves to be the primary source of innovation within their firms. However, none of the interviews suggested that the leaders self-identified as being visionary in their approach, although the leaders of PE backed firms did sometimes display evidence of charisma and communicated what I considered to be a compelling strategic vision within the interviews.

In this cohort there was no evidence that PE backed leaders used their personal impact to pursue exploratory innovation beyond the agreed business plan. Any charismatic traits in the PE backed executives were most evident when discussing turnaround situations or describing occasions when they needed to inspire their colleagues to fix a serious operational problem or deficiency.

The main themes relevant to innovation leadership identified within this cohort of executive leaders are summarised in table 6.1 below:

Table 6.1 Major themes: executive leaders

#	Theme
1	The individual SMSE executive leaders interviewed primarily used instrumental and transactional leadership styles and rarely undertook exploratory innovation.
2	The SMSE executive leaders interviewed were primarily focused on cashflow and survival which seemed to influence the innovation leadership behaviour of these SMSE leaders.
3	The external focus of the executive leaders of SMSE interviewed seemed to have consequences for communication with engineers.
4	The SMSE executive leaders interviewed appeared to be more focused on exploitation than exploration.
5	Awareness of the impact of structure, culture and climate varied between the SMSE leaders interviewed.
6	The SMSE executive leaders interviewed believed that project success was related to clarity of vision, communication, and leaving the engineers to do their job; they felt that project failure was related to poor communication.
7	Of the executives interviewed, the owner-managers and PE backed executives appeared to have different attitudes towards recruitment and retention of engineers.

The evidence for themes 1 to 7 relating to the executive cohort is presented below.

Theme 1. The individual SMSE executive leaders interviewed primarily used instrumental and transactional leadership styles and rarely undertook exploratory innovation.

Most of the executive leaders suggested that they perceived themselves to demonstrate a flexible approach to managing and leading their firms, switching between styles of innovation leadership as circumstances and day-to-day tasks required. However, when discussed in detail, the main styles of leadership employed were instrumental and transactional. In the smallest of firms, the executive leaders were often also busy with basic and administrative management tasks.

> *HR falls under my remit and accounts is handled by a bookkeeper, but where needed, [business partner] gets involved in that. But if we grow five-fold it has to look substantially different to be honest with you.* (F2EX1)

> *Now I'd employed a few people. I guess I hadn't fully appreciated – I don't think anyone does – what that entails on a day-to-day basis. Making sure there's enough bog roll and tea and whatever else you have to do. As well as the day job. So that's probably been the hardest thing… making sure that pensions are sorted out and wage rolls run and all the administration – where did that all come from? Why's it all take so long and costs so much?* (F3EX1)

There was evidence of an awareness of the effectiveness of different styles and behaviours in some of the smaller firms:

> *Well, there are times when we need to be explicit about requirements or deadlines for example. In that kind of management, everyone generally finds their own way. And I think if you try to work in one way with the entire team, that's not going to work. I think you have to have different strokes for different folks. But you learn that… you learn that by observing the success or failure of different approaches with people. I think saying, "this has to be done by this time" might work once or twice, but it won't work a third time.* (F3EX1)

Behaviours for all leaders were more closely aligned with exploitation rather than exploration. PE backed leaders occasionally showed some evidence of exploratory innovation.

> *Moving to a new vertical market was a big challenge. Our technology was fine, but we didn't have the SMEs [Subject Matter Experts] or know our way around.* (F1EX2)

> *So, the business was a product business; it sold software. The strategy was to become a services business, so to take that capability and move it into a service-oriented business model. So far, all of these solutions have been successful, and they are all being used which I am delighted about. Adoption of some of them has obviously been slower than others, but essentially, we are seeing adoption of all of them now.* (F5EX1)

> *I said that in 5 years' time the lion's share of our revenue will not come from what we are doing now, but it will come from an adjacent space that takes advantage of those core capabilities that we have got. And that is now exactly what is happening. So, we are looking at our core building blocks in the platform and figuring out how we re-apply them.* (F6EX1)

> *We have found something we are good at and we are now trying to grow the business by repeating that around the world. However, we also need to figure out what to do next, so I do sometimes push the dev [software development] team to try something new.* (F8EX1)

All the PE backed leaders were experienced general managers and demonstrated a readiness to provide practical support and encouragement for innovation. When they discussed innovation leadership behaviours, they often associated these with management tasks relating to controlling projects, managing people and providing resources.

> *I always try to understand why the engineers are asking for resource. We have grown quickly, and this puts strain on the organisation. Of course, we want to create a degree of operational gearing through automation and we expect to become more efficient over time. However, sometimes we just need to throw more people at the problem, and if this is the case then I always try to provide the resource. The Board understands that we are a growth business and they are tolerant of losses at this stage, providing they represent real investment in capability and product.* (F1EX2)

> *Our people are great, but sometimes they get stuck in the detail. Projects sometimes slow down because of this. I try to stay close enough to spot this and hold a project review to drag them out of the weeds. There may be good reasons for the project struggling – it might need more resource. It is important that we understand this and also try to figure out if our estimates were wrong or if we have strayed from our own plan.* (F6EX1)

> *The best thing I can do is make sure they have the tools to do the job.* (F8EX1)

The two larger owner-managed firms had considered undertaking explorative innovation but were more usually focused on exploitation. In one case, the owner-manager sounded almost complacent in tone:

> *Innovation in this industry has not been amazing. I haven't seen anything in the last 25 years that worried me, but of course you never know. So far when they compete against us it is a price thing.* (F4EX1)

The owner-managers of smaller firms spent most time on delivering projects or dealing with the implications of operating under cashflow pressure.

> *The problems always looked a bit more difficult if I am honest because a lot of what we were doing was building enough resources while keeping cashflow right in order to build products and keep all that going.* (F2EX1)

> *Most of the time we are just focused on meeting customer requirements, so we can get paid.* (F7EX1)

> *That's why we always drift back to [existing product]. It is tried and tested. We know we can make money. We would love to do other things – we have ideas all the time. But we have to keep everyone paid. We have bootstrapped this business without any external funding, so the revenue has to flow.* (F10EX1)

The general business news media offers up examples of well-funded large firms led by high profile charismatic and visionary leaders who challenge their firms with transformational projects and become known for "moon shots". For example, well-known entrepreneurs like Steve Jobs, Richard Branson or Elon Musk. This type of behaviour was not evident in the cohort of executive leaders interviewed in this research. It may be that SMSE that are cash constrained or perceive themselves to be cash constrained are less likely to embark upon ambitious R&D projects.

The PE backed CEOs were each clear that their approach was based on execution of a strategy that had been agreed with their investors or boards. They tended to run the business to detailed agreed plans, monitoring progress and implementing corrective actions when indicated. They were therefore primarily focused on short term delivery of agreed goals and had in mind an exit event to realise the investment for their shareholders within a specified time period.

> *When we bought [F5] we already had a plan in mind. We have pretty much stuck to it.* (F5EX1)

> *We agreed a plan with the Board and that is what we are busy doing. PE firms have a time horizon and the plan is built around getting them their exit.* (F6EX1)

Although usually incentivised by both bonuses and equity interest in the businesses, the goal focus of the PE backed CEOs seemed to be more of a trait or habit than a response to the incentives.

> *What we do is fascinating and useful. I enjoy the challenge and I want us to be successful.* (F1EX2)

> *Of course, I can see the endgame. There is an opportunity to make some money. But I don't think about it day-to-day.* (F5EX1)

> *I think you get to a point in your career where you have to like what you do and do it with people that you like. I have had a couple of good exits and made a bit of money. There are things I could do that would make me richer – I could go back to [low tax Asian country] or [Middle East] and run a business there. But we [F6EX1 and wife] want to be here now and doing this [role] really works for me.* (F6EX1)

> *It's never been about the money for me. I came from the [sector name] and I always felt that analytics would be the key to unlocking industry value. When I got this opportunity, I was really excited. I could see the potential to finally do what I had been talking about for years. It felt like a chance to really use my experience to do something worthwhile.* (F8EX1)

By contrast, the owner-managers did not generally seem to be executing against a stated plan and seemed focused on proving the product market fit for their business ideas. It is tempting to conclude that this might be due to scale or maturity, but the executives in the larger and more mature owner-managed businesses did not behave differently to the leaders of smaller owner-managed firms in this regard. The owner-managers were generally more reactive than the PE backed CEOs. Possible explanations for this could relate to a combination of the disciplines imposed by a PE board and the active selection of CEOs to run those firms who have prior PE experience and display behaviours consistent with PE preferences. Or it could just be individual preference and personality, as suggested by F3EX1:

> *I didn't take a business plan to the city and get the suits to invest as that would be a whole pile of other pressures to kow-tow to. And although I generally have a collaborative nature, in that scenario I probably would not be so collaborative. And it is not that I would have a problem working for someone if I thought they had a better understanding of things than me. It is what I call the "arseholeness" of some people that I struggle with. But when I did work for other people, I was fairly sure that I did have far better ideas. Of course, I recognise now that there are multiple skills required. It is all very well to have the idea, but you also have to have other talents and people who can support those ideas from different angles. I've got a better appreciation of that now.* (F3EX1)

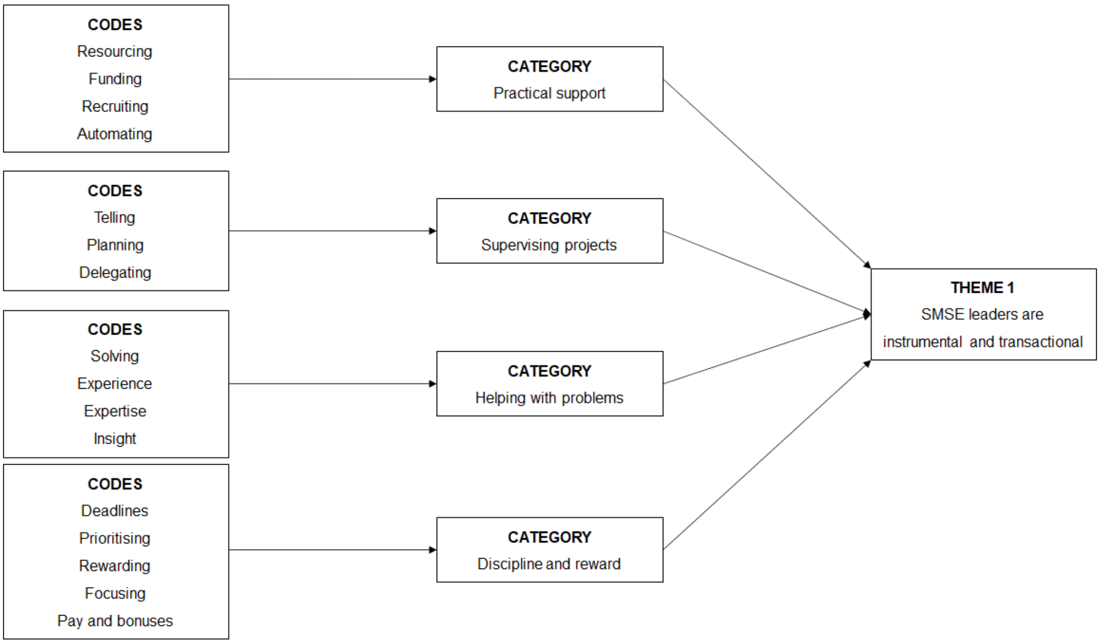


Figure 6.1 Chain of evidence: theme 1

Theme 2. The SMSE executive leaders interviewed were primarily focused on cashflow and survival which seemed to influence the innovation leadership behaviour of these SMSE leaders.

The SMSE leaders interviewed found themselves engaged in a variety of leadership, management and technical tasks every day. Whether owner-managers or PE backed CEOs, their roles required a broad base of skills, experience and competence and represented a constant battle for survival. Even executives at the larger and PE backed firms were conscious of the survival imperative:

> *So if you were to ask me what is one of the big motivators for innovation in a small business? Well nothing quite motivates as much as survival. Just the threat of your very survival being at risk. So if you have to find product market fit before your money runs out, you have to try a lot of things.* (F1EX1)

> *Even in this type of business, money can sometimes be tight. I rely on my CFO a lot to make sure we don't run aground.* (F8EX1)

Fear of running out of cash seems to be a primary motivator for leaders. Each leader discussed the external market and the battle to find what F1EX1 calls "*product market fit*":

> *The business had been through a very long period of trying to find product market fit. The original intent was to take the behavioural analytics and*

> *apply them to web* advertising*. [We then said] let's try to do something that is more focused on a use case around fraud. Our first customer was [on-line bookmaker]. We didn't have the software platform at that point, so it was really just about applying the data sciences concepts and behavioural analytics.* (F1EX1)

> *The technology was great and we would create products and solutions for other companies on a contract basis, but the thing I thought that we [meaning the wider industry] were doing wrong was that they [meaning competitors] always sold the IP, which worked for them and probably worked great for their customers, but what I always felt was, you know, that you create good IP there and I was part of projects that I thought were very innovative and wonderful. But, the IP was sold to the customer and the problem with that was that when you went back to a new customer you kind of started from square one. You had to demonstrate all of your credentials again even though here is a company with lots of history and successful projects, in this new project that you are at you start from zero. A blank sheet of paper.* (F4EX1)

The perceived pressure on cash seemed to focus leaders on sales activity and on managing relationships with shareholders and lenders. The leaders interviewed all said that their focus on generating revenue meant that they spent a lot of their time dealing with external customer issues and prospective sales opportunities. F4EX1 is founder and CEO of F4 and a PhD qualified engineer who also takes a lead on software design. Despite his critical role in engineering design, this executive told me that he spends significant time away from the office and in direct communication with customers. His focus on revenue generation reduced the capacity of the business to undertake R&D.

> *The plan was that as soon as we had our own little bit of bandwidth we'd start doing our own R&D and so on. But you know what happens Paul, that as soon as the contract ends you are so scared that you know you don't know how to pay salaries that you spend all of your time trying to sell rather than… and then when you've got jobs for the guys that are working for you then there's no space to do any R&D, right?* (F4EX1).

Each year, F4EX1 budgets for exploratory innovation and every year he sacrifices that resource to meet short-term customer requirements.

> *As we grew, we budgeted to have 15% of our recruited technical resources available for R&D. However, the reality is that when revenue generating customer opportunities come along we always compromise R&D to generate short term revenues and satisfy immediate customer demand.* (F4EX1)

F4EX1's reluctance to commit investment to R&D seemed consistent with his view on the potential longevity horizon for his business. The business had already survived and prospered beyond his original expectations and had afforded him a good lifestyle over many years. He took the view that this business was more of a long-term project that would inevitably come to an end and he did not have the desire to diversify or repurpose the business to apply the core competencies and assets to new problems or markets. This theme is further developed in a memo written following the interview with F4EX1 (memo 10.2 in Appendix 10).

Only the smallest two firms did not have dedicated salespeople. However, even in the firms that employed salespeople, the executive leaders spent a lot of time away from the office trying to make sales and manage customer relationships.

Most of the executives also discussed the time spent ensuring that they maintained good relationships with investors and lenders. The small owner-managers all had some elements of external finances invested in the business. This was usually provided by family, friends, and members of their wider business network.

> *Lots of people have been generous in helping us get up and running. You want to look after these folks and keep them informed and involved. It is important to make sure their loans are repaid or their investments become valuable. Also, they want to know what is going on. My wife's father helped us. I spend quite a bit of time keeping this group up to date.* (F11EX1)

> *No-one is asking for their money back, or even when they might. They all know that they have taken a risk. Ultimately, they have backed me though. I can't let them down.* (F12EX1)

The PE backed executives were supported by funds that required compliance with specific governance, reporting and oversight. Regular board meetings were required in the PE backed businesses and the executives interviewed each spent at least two days a month on activities related to the board meeting and investor discussions.

> *The Board meetings impose a discipline on us. I want to be ready for the meetings and anticipate their [meaning the non-executive directors]*

> *questions – I don't want to look like an idiot. But also, it is just about being professional.* (F8EX1)

> *Whether it is going badly or going well, the non-execs will always have difficult questions. They understand that things often don't go to plan. That's why they need a good exec [executive] team. However, when things go well, they want to know how they could be even better and when things go wrong, they want to know what I am doing about it. You have to be prepared and that takes time, effort and information.* (F1EX2)

All of the businesses had relationships with external lenders, which were usually traditional banks. Most of the firms had a mixture of term loans, overdraft and corporate credit cards. The PE backed businesses also had more sophisticated lending instruments to manage. Although the larger firms and PE backed firms employed qualified finance professionals as finance director or Chief Financial Officer (CFO), the executive leaders of all of the firms interviewed spent considerable time on finances.

> *Our funding is complicated. We have done several private equity rounds, and each time requires discussion and negotiation with our lenders. I am glad to have such a great CFO, but he spends lot of time on this stuff and so I have to lean on other people in the finance team for day-to-day support on deals.* (F1EX2)

> *Well, I suppose I do worry about cash and we have just strengthened the balance sheet again. But the business is growing strongly, so we are beginning to see the impact of that. The shareholders have always made it clear that if we needed further investment, they would do that.* (F5EX1)

> *This business has permanent cashflow problems. I have sunk a lot of my own money into it and so have the other shareholders [who are all private individuals]. I spend a lot of time dealing with this stuff – a lot of time worrying about it.* (F7EX1)

> *I am not a finance guy and we can't really afford to employ one yet, so all of this stuff falls to me. Just making sure there is enough cash to go round… It can be stressful. (F12EX1)*

Cash constraints are a reality in many businesses, but in SMSE such constraints can be severe and cause a diversion from strategy. Concerns about cashflow and survival have forced some of the firms to engage in activities not related to their original vision. For example, F3EX1 had to halt strategic development to generate cash from projects to ensure survival:

> *There were one or two side-tracks that were commercially forced upon us. Just practically, we needed to make the money to carry on.* (F3EX1)

Similarly, F11EX1 was often called upon to undertake paid consulting exercises in F11's industry to support the cash needs of the business:

> *It has been a constant battle between strategic platform development and undertaking bespoke consulting and development work on a T&M [time and materials] basis. It is frustrating because we don't make the progress we want on our platform, and I worry that we are wasting time, but the offers of investment we have received are too dilutive at this stage, so we have to survive through generating cash from consulting projects.* (F11EX1)

For all of the leaders, this focus on survival seemed to dominate their thinking and represented a foundation concept for many observed behaviours, habits and attitudes. Two important aspects of this emerged across all firms. The first is that the leaders primarily focused externally with the objective of securing cashflow from customers and sources of finance. Secondly, the leaders were anxious to establish product market fit for the core software product of the firm to secure repeat business and ongoing subscriptions for software licences and services. This often involved investing in enhanced feature functionality in response to customer demand in an effort to secure longer term customer commitment and make repeat sales. This resulted in a bias towards path dependent exploitation over exploration or R&D. For example:

> *I think most of innovation, I would say, is incremental. Whilst obviously the smaller step ones are easier ones to do, because the cost is manageable and you do a little bit, and you see how customers react. Is it the direction you want to go in?* (F4EX1)

As customer requirements are reflected in feature functionality improvements designed to enhance product market fit, the leaders can return to their external focus in the next cycle phase because growth in these smaller firms usually requires working capital that can come either from increased revenues and profits or from external funding sources. This is illustrated in the diagram below (figure 6.2).

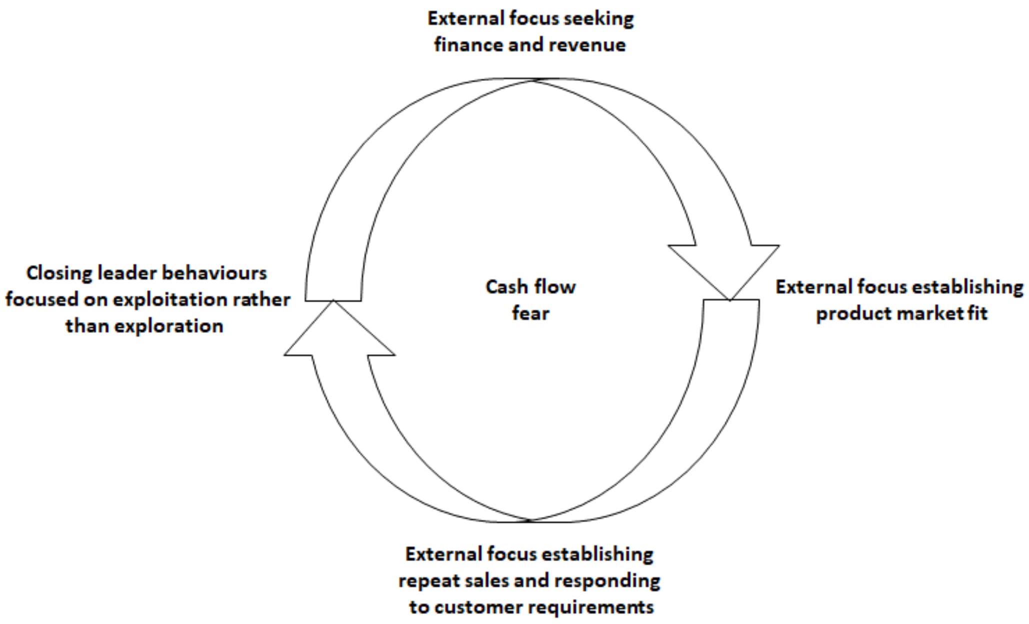


Figure 6.2 Cashflow fear favours exploitative innovation

These factors are important because they may underpin the innovation appetite and innovative capacity of SMSEs. As we will discuss below, these factors also seem to influence the way in which leaders engage with the software engineers in their firms.

Only one of the firms (F1) seemed to be relatively unconcerned with cashflow. This firm had recently completed a major fund-raising process and works in an area of software that is currently highly attractive to PE investors. Although the executives interviewed (F1EX1 and F1EX2) were conscious of the survival imperative, they expressed confidence in raising more money should it be needed. Despite this, they were focused on establishing replicable product market fit in a single market using a single software platform, and so most of their innovation related to product feature functionality and improved processes. Executives from the other firms expressed much stronger views on the day-to-day realities of managing tight cashflow:

> *Building a small team comes with many challenges, cashflow probably being one of the top. You are chasing yourself all the time. So because of the cash you don't have the time to do certain things.* (F2EX1)

> *So, we are the ones – you know – that at certain points, have dropped our salaries or have reduced our salaries to nothing for periods just to get by and make sure that the business survives.* (F2EX1)

> *Every time we rescued the finances so that we could afford to carry on was always a high point. I mean, there was once or twice where it was down to*

> *the line and I thought, well can we keep on going? But we always found a way.* (F3EX1)

> *The hardest thing is when it gets close to the wire and I think, well who am I going to go and have this conversation with, and say, look sorry I [messed] up? So, it's keeping away from that I guess. Is it fear? Maybe it is. Fear of losing what you have achieved.* (F3EX1)

> *It's my money. I have had to keep putting cash in. The employees don't really understand the personal sacrifice that is sometimes required to make sure they get paid.* (F7EX1)

> *I read about Elon Musk living on hot dog sausages and oranges when he started his business. I lived on rice and lentils. Stock cubes and curry powder are still luxuries.* (F10EX1)

Even F9EX1 and F9EX2 who run a firm with an inherently cash positive business model were still conscious of the importance of cashflow:

> *Cash has never been a real issue for us, but there is something about starting your own business from scratch that makes you aware of the importance of looking after cash.* (F9EX2)

> *We have been fortunate in this business, and it may be approaching time to sell and move on. I have lots of other ideas, but I don't want to risk my capital in the existing business. First of all, I like to have clarity on where my cash is and what it is doing. Also, what if my latest great idea fails it could dilute value and consume cash in an otherwise great business. It also worries me that my latest idea could be more valuable than the existing business – what then? (F9EX1)*

The importance of cash and cashflow was a recurrent theme for the leaders interviewed. After the first four interviews, the role of cashflow focus on influencing leader behaviour was captured in a memo (memo 10.3 in Appendix 10). Further analysis and interview data resulted in a memo and integrative diagram of codes and categories documenting the possible implications of cashflow focus (memo 10.4 in Appendix 10).

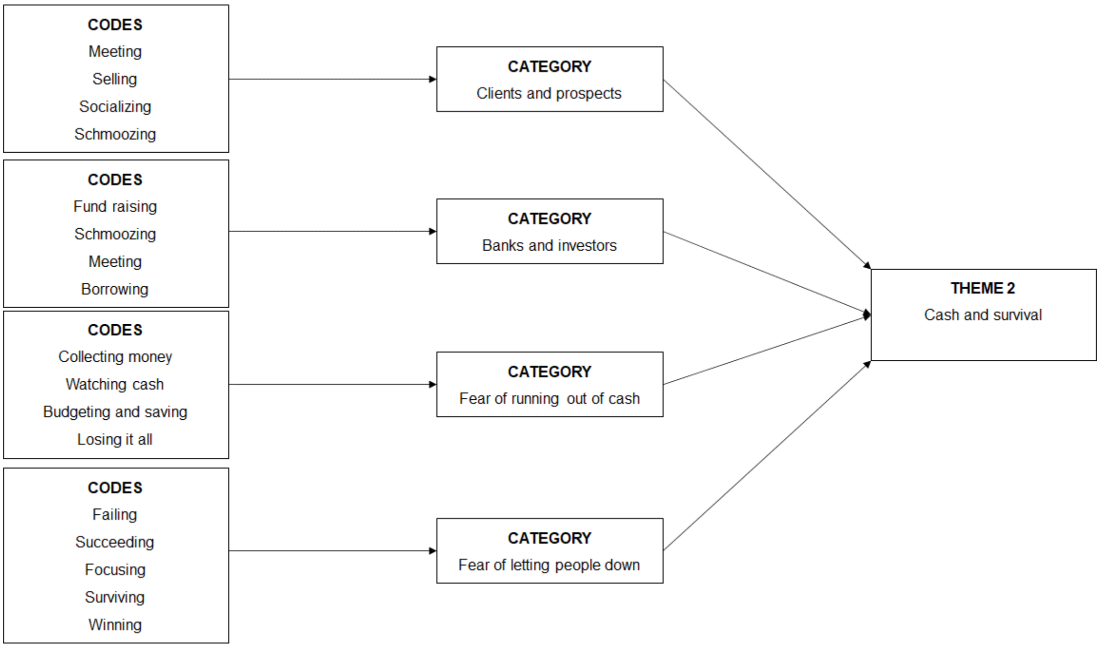


Figure 6.3 Chain of evidence: theme 2

Theme 3. The external focus of the executive leaders of SMSE interviewed seemed to have consequences for communication with engineers.

The focus on cashflow and survival resulted in the executives spending a significant majority of their time with providers of funding (such as lending banks, existing investors or prospective investors), or with customers and prospects who could provide a source of revenue. This focus on cash availability is not surprising. After all, selling goods or services and collecting cash to ensure survival has long been regarded as the primary management objective in any commercial organisation (Drucker 1954). However, this dominant external focus seemed to have a number of direct consequences in terms of the interaction with engineers because the executives spent a majority of their time away from the office and were busy in external meetings during what are generally regarded as normal business hours.

> *It is easy to become disconnected. We are already very international. I am constantly on the road. It is important that we have [F1EX1] as COO as he keeps me in touch and has day-to-day control.* (F1EX2)

> *The difference really comes from my side – the bit that allows us to grow. I become more strategic and less operational to the organisation. So I am still the foot soldier at the moment, going out and seeing clients and doing meetings and getting work. I don't want that to be removed because I still think there is importance to that – having client engagement at director level.* (F2EX1)

> *I still spend a lot of time out selling and building relationships. Our larger customers expect to see me.* (F9EX1)
>
> *We have tried to split responsibilities, and I am supposed to be more customer facing. We don't make a big deal about being married, which is why I use my old surname at work, but many of our larger customers know and they want to see us both.* (F9EX2)
>
> *We are still pretty small and you would think we would talk a lot, but the days and weeks just slip by and I am on the road so much.* (F10EX1)
>
> *There are some weeks I just don't make it to the office.* (F11EX1)

The external focus of executives in all of the businesses resulted in email becoming a preferred communication method between the leaders and the software engineers. This generally took the form of requests to provide customer specific modifications or fixes to existing software applications, and feedback on new feature functionality in development. The email communications were generally sent out of business hours, overnight or early morning, and were not usually interactive, being largely one way from the executive to the engineer.

The executives acknowledged that there was limited direct personal one to one interaction between the leaders and the engineers. Where direct interaction did occur, this was usually at a supervisor level rather than directly with those developing the software apart from in the two smallest firms (F3, F10).

Personal communication between executives and engineers was generally limited to group meetings or project meetings. Group meetings were often referred to as "town hall" meetings by the interviewees. In these sessions, the communication was generally one way from the executive to the engineers, and covered business updates and recognition of individual contributions to project success.

In project meetings the executives were generally trying to assess feasibility, timescales and budgets. They spent little time on personal interaction with the engineers in these formal meetings. Social interaction outside of business hours was also limited between executives and engineers. F5EX1 suggested that this was primarily due to physical location being out of town and most engineers having to drive to work or having young families. Although the firm had provided financial support for bingo nights and five-a-side football events, he had never personally attended. F4EX1 suggested that the lack of social engagement was related to age and national culture. Some degree of social interaction was slightly more common in three of the four very smallest firms (F3, F11, F12) and was generally based on a trip to the pub.

In all of the businesses, external focus on the market and on providers of funding was greater than internal focus on climate, culture and communication.

The diagram below (Figure 6.4) illustrates how cashflow focus appears to be a foundation concept in explaining leader interaction with engineers in the SMSEs analysed.

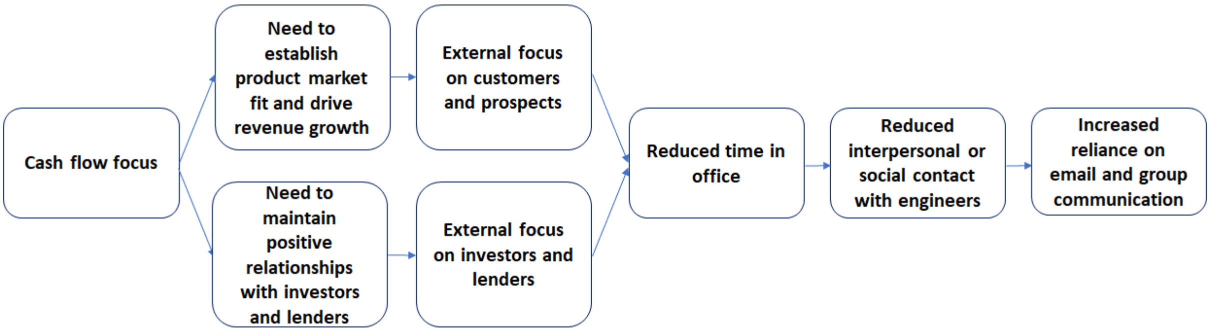


Figure 6.4 Implications of cashflow focus on executive leader behaviour

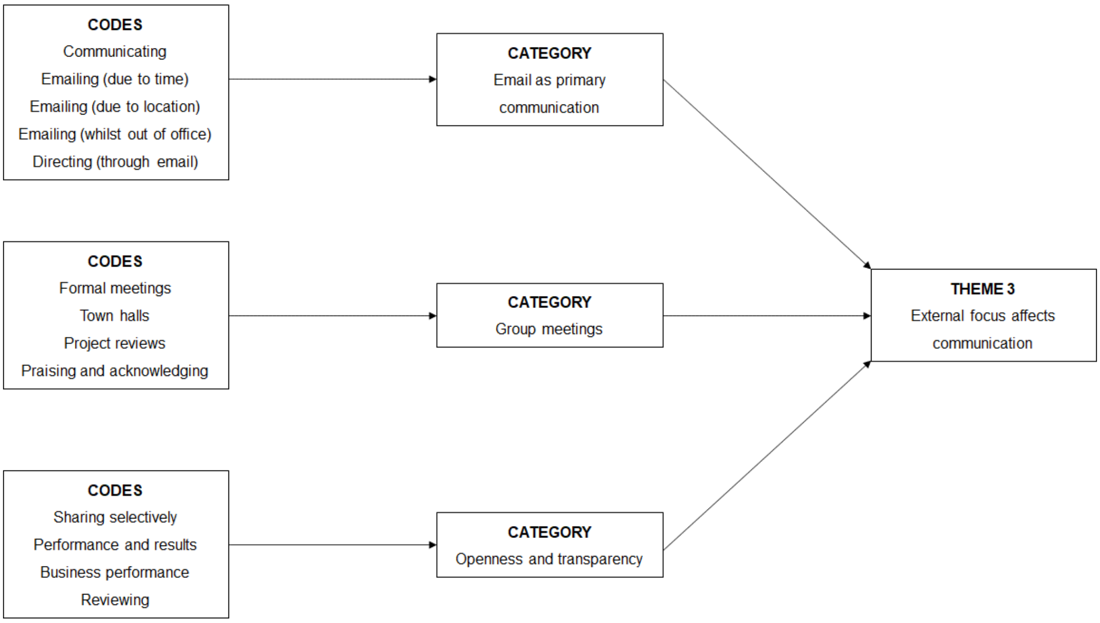


Figure 6.5 Chain of evidence: theme 3

Theme 4. The SMSE executive leaders interviewed appeared to be more focused on exploitation than exploration.

All of the executives discussed innovation in the context of enhancing feature functionality of existing products or improving existing processes. They occasionally discussed accessing new adjacent markets with existing products. There was little consideration of exploratory innovation or R&D in any of the firms interviewed. Most of the innovation was incremental and exploitative in nature. The main reason for this seemed to be linked directly to executive concerns about the availability of cash. Although the six larger and PE backed firms (F1, F4, F5, F6, F8, F9) had materially better access to funding and stronger cashflow than the executives in other firms, there was little difference between these executives and those in smaller firms in terms of their attitudes to cashflow and survival. Attitudes to innovation in these firms influenced the literature review on innovation studies which started with an exploration of Schumpeter and evolutionary economics in memo 10.16 (Appendix 10).

The executives were each able to discuss innovation in the context of similar definitions. For example:

> *Innovation, well, new products, new processes, new markets. (F1EX2)*

> *For me, innovation is not necessarily a new way of doing something. It's looking at a cleaner, potentially more efficient – bringing an advancement in some area. Whether it is in time, quality or experience. That's it basically for me. So, we have seen a lot of innovation within industries where it is not a completely new idea. They are actually just bringing an advancement to an existing potential product by considering what is becoming more and more normal for other users.* (F2EX1)

> *What it means to me is… it is a bit about creating value by doing new things or doing things differently. (F6EX1)*

The executives were conscious that funding constraints had implications for the types of innovation that SMSE typically pursue.

> *I mean – as a business I would say we are innovative for a number of reasons. One, you are actually forced to innovate sometimes because you've got… you've got pressures on you around being efficient. Because of cashflow, because of time constraints and the like so when you are looking at innovation we are looking at actually having the time to innovate. If you don't have the time to innovate, why don't you have the time to innovate?* (F2EX1)

Much of what the executives perceived to be innovation fell into two categories. The first and most discussed were feature functionality improvements to their software, usually based on customer requests or feedback. The second, and less commonly discussed, were minor improvements to business processes.

> *So, one of the things that I do, and I think it is something that [prior industry] are very good at, is operationalising and creating procedures and making sure they are refined on an ongoing basis. So innovation for me isn't just about new products. It is about doing things in a new way. Much more efficient and better.* (F5EX1)

The Organisation for Economic Cooperation and Development (OECD) offers definitions of innovation that attempt to apply a somewhat subjective test of significance:

> *A product innovation is a new or improved good or service that differs significantly from the firm's previous goods or services and that has been introduced on the market.*
>
> *A business process innovation is a new or improved business process for one or more business functions that differs significantly from the firm's previous business processes and that has been brought into use by the firm.*
>
> (OECD/Eurostat 2018, p.21)

Against this test of significance, it could be argued that many of the SMSE interviewed were not engaged in innovation at all because the work they were undertaking was of a more incremental nature. However, what is important for this research is their perception that what they are doing constitutes innovative work behaviour that involves creativity and problem solving. So, if we accept that the activities discussed do constitute innovation, then it is likely that this innovation is exploitation rather than exploration (or R&D).

> *We haven't really invented new products but what we have done is re-used existing competence to address those markets: re-applied the building blocks to wider transactional opportunities. This is still innovation because it is creating value from new things that leverage our core building blocks which is no bad thing.* (F6EX1).
>
> *Of course, one of the things about innovation is that people often think you have got to do something like going to the moon, right? But, you know that innovation is in small steps. And one of them is… I always think of that VW Golf thing where they said there was 230 changes from one version to the*

> *next and you think, wow, how can there be really 230 changes and of course the thing is each one is really quite small and makes a difference to that next Golf version.* (F4EX1)

The PE backed businesses discussed having formal processes for developing innovation from ideation to delivery. The process described by F6EX1 below was like others in terms of providing a gating process to prioritise and approve innovation ideas.

> *We have these strategic solution reviews, or SSRs. They feed into what we call the solutions steering board; the SSB. All pretty standard practice. Ideas can be generated through… we have a ticketing system which anyone in the company can access so they can generate their ideas. Those ideas are given merit; they are all reviewed by the SSR. If they are deemed to be a good idea worthy of further development then they are pushed through to the SSB and if they are approved they are pushed forward to next steps. So, we tend to follow a life cycle of getting these products and new ideas onto the table. Where we are now is that the customer demand has kind of over taken us needing new ideas, but if I went back 4 or 5 years we were generating those new ideas and coming up with them. But now, that's changed and of course the customer demands, well, it is an easier path to follow.* (F6EX1)

One of the CEOs brought in an external agency to help them establish what he referred to as a "growth mindset", referencing Dweck (2008):

> *We've worked with [named consultancy firm] to help us build processes where we kind of build a growth mind set organisation. And we have psychological tests in terms of looking for those types of people. So, because you know at the end of the day, a company of our size, you want to remain agile, to remain as entrepreneurial as you can. But at the same time as you grow, as you know, you've got to start putting structures in place because otherwise it becomes chaotic. That's an inevitable outcome of that growth phase is putting those structures in place.* (F5EX1)

In the owner-managed firms there was little evidence of formal processes to promote and develop innovation. In the smaller firms, the owner-managers were driving the innovation agenda based on customer feedback or competitive necessity. Occasionally, software improvements were originated by engineers, but often there was no formal process to agree these, and enhancements were included in the next release cycle without formal sign-off.

The executives saw themselves as the primary architects of innovation. The preference for exploitation over exploration is further discussed in memo 10.14 (Appendix 10).

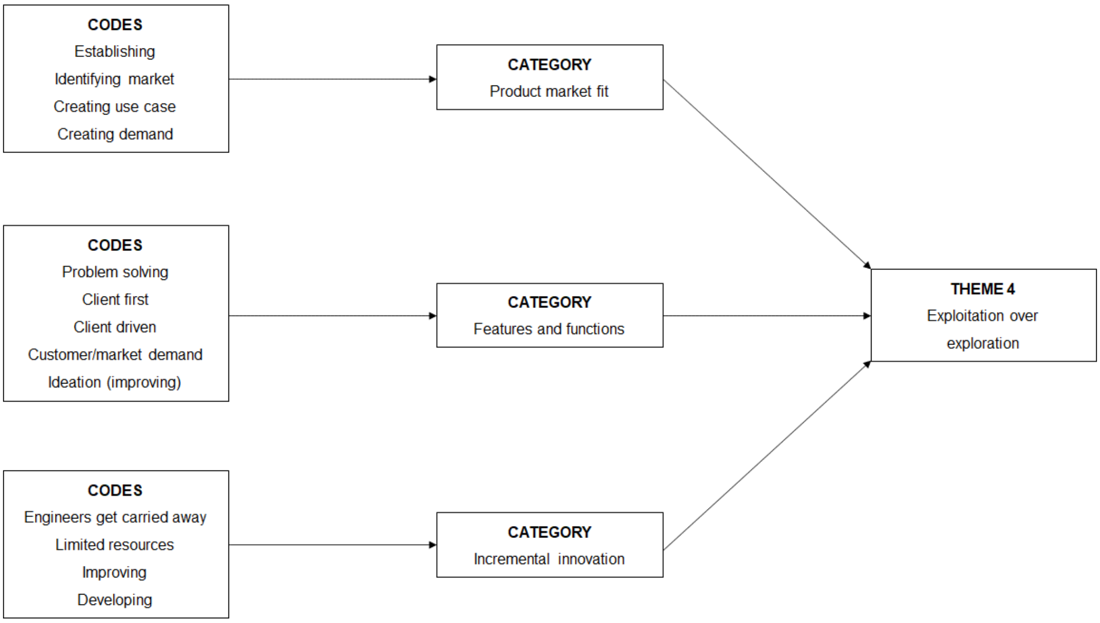


Figure 6.6 Chain of evidence: theme 4

Theme 5. Awareness of the importance of structure, culture and climate varied between the SMSE leaders interviewed.

The executives all discussed culture in very loose terms showing little evidence of an academic or theoretical understanding of culture. However, all of the executives did acknowledge that the engineers shared a specific macro-culture and one executive did use the explicit term "*engineering culture*" (F1EX2). The recognition of a specific engineer culture was generally expressed in somewhat stereotypical terms. Even the executive leaders who had technical backgrounds themselves recognised that the engineers had a distinct culture within their organisations. This culture was often characterised as "geeky" and the cultural behaviours and espoused values that were mentioned included:

- A focus on technology for its own sake.
- A lack of interest in the commercial aspects of the business they worked for.
- Excitement about exposure to new software tools and environments.
- A tendency to spend more time than is necessary developing specific applications.

- Pride in their programming achievements.
- A degree of competition between engineers in terms of technical skills and elegance of software solutions developed.

Although there were elements of the engineering culture that the executives found frustrating in relation to commerciality, the leaders were generally positive and supportive of the engineering culture.

One executive claimed to have a sales-driven culture, but really this just referred back to being focused on revenue:

> *I would describe it as a sales-driven culture. A lot of our decisions are about revenue, increasing and protecting revenue. Which is not unusual as a PE invested business. You know, we are not there as a lifestyle. We are not there to create social good, but if we can do that along the way then fantastic. We are there really to create value for our investors, so everything we do needs to be focused around that objective. How do we move down that path of increasing sustainable recurring revenue? Hard edged and clear.* (F6EX1)

Another executive recognised culture as a factor in retention. For example:

> *When we started to get a turnover of staff we realised that the culture wasn't there. They were going elsewhere for a reason and we needed to understand why that was… they are interested in money and they've got bills to pay as well. But they are as much about their working life. The environment that they are working in. The types of problem that they are being able to solve for people.* (F2EX1)

Despite acknowledging the importance of culture, in most of the firms the leaders did not display great insight into their own role and impact in terms of organisational culture. The exception to this was F1EX2, a mature and experienced executive with many years working for larger consumer focused organisations. She was very clear in her explanation of the importance of culture in F1:

> *Just because you can't see it doesn't mean that it doesn't exist. I think it is almost tangible in organisations. Certainly, there are elements of the culture here which are unique. Listen to the background noise in the office – there is a gentle hum of almost constant conversation, but it is still quiet and studious out there. There is a pace at which people move around – they are busy and energetic. We don't clock people in or out in this kind of business,*

> *but it doesn't matter what time of day or night I arrive, there will always be someone in the office developing code or handling data for our customers. Of course, we have a close link to [university name] and many of our staff have done post-graduate research. They are intellectually curious, and they seem to want to retain some of the feel of a research environment. I support that in any way I can, even in simple ways by making sure there are always snacks and drinks available in the kitchen.* (F1EX2)

Often, the leaders found it easier to be clearer on what their culture did not represent. For example, F4EX1:

> *We don't do any of the California stuff. So, something unusual that we do is we pick up all of our guys time [meaning that the firm pays for all overtime]. It means that people feel they are properly remunerated for all the stuff they do; even overtime out of hours. When they work really hard, we pay them to do that. If they have to work a Saturday morning and so on, that gets picked up. But it also means people don't hang around in the tea-room or coffee room because I think they see the value of their own time. When they are working, we pay them and when they are not working they go and do whatever they do in their spare time. So, we do not have the culture at all of pizzas and people hanging around the office doing nothing very much. If you look at what happens with the Japanese; I have a lot of Japanese customers and spend a lot of time there; they are quite proud about how they come in at 6am and leave at 10pm. But, it's all bullshit because what happens in the middle?* (F4EX1)

There was little evidence of an understanding of how a creative climate can lead to improved innovative work behaviour. Given the business school education and obvious intellectual curiosity of some of the executive leaders, then it was possible that some of them would have a more theoretical understanding of culture and climate, but this proved not to be the case. This prompted me to write the longest memo of the research (see memo 10.10 in appendix 10).

The executives in the PE backed firms generally showed evidence of trying to facilitate engineer delivery by providing resources and expertise where possible and were particularly engaged when projects or client deliverables came under threat.

When projects came under pressure in the owner-managed businesses, in those firms where the executive leader had professional software development skills (F2, F3, F4) then the response was personal involvement in the software development tasks.

In the owner-managed businesses where the executives did not have engineering skills (F7, F9, F10, F11, F12) then the executive leaders attempted to resolve delivery problems by managing client side expectations, whilst leaving the engineers to do the best they could to recover the project.

As the firms have grown, they have struggled with determining the right level of structure and process:

> *As an organisation grows, you need more structure. It's like saying you have no skeleton – you are an amoeba - just a single founder. I can get everything done and I don't have to talk to anybody about it. When you migrate to a larger organisation, it's more of an exoskeleton where I need to have something that holds the organisation together. But an exoskeleton is going to limit the size of an animal. The reason we don't see giant spiders and flies is because an exoskeleton can't support an animal beyond a certain size. Then you get into endo-skeletons like giant mammals, because it's got structure inside of it. So there are functions within organisations that enable the bits to do their jobs.* (F1EX1)

There are perceived cultural implications to introducing too much structure:

> *My job is making sure that there is just enough structure. If I suddenly took best practice and implemented it in this environment, it would kill the organisation's ability to flex and be nimble. There would be an exodus because a lot of the people are here because it is a small business in Cambridge that they can cycle to, wear jeans and a t-shirt. (F1EX1)*

One of the leaders recognised that as the business started to grow, the culture needed more attention:

> *I think building a small team comes with many challenges – cashflow probably being one of the top. Because of that, you are chasing yourself all the time. So because of the cash you don't have the time to do certain things. You're learning your processes. Although you have processes in place, you always learn that your processes are not quite good enough. Often you need to evolve them, you need to change. I think it probably was when we started to get a turnover of staff that you realise that the culture actually probably wasn't there.* (F2EX1)

Another leader acknowledged that as the business grows then the structure would also need to change:

> *It's currently a flat structure divided into products. I think as the business grows that will have to change. I don't think that it is necessarily sustainable in that fashion.* (F5EX1)

In the smallest of the firms interviewed, the executives could already envisage a time when more structure would be necessary and were aware of the possible impact on culture:

> *We are still very small and so I have to do almost everything apart from the coding [meaning software development]. But we have some customers now, some revenue and we will need more people. That's when things will change.* (F10EX1)

> *It's already started to be honest. At first, everything came back to me, but now we have more defined roles and responsibilities. It's good because I have a bit more time for myself. I live in [country name] and can sometimes head back on a Thursday or travel to London on a Tuesday. But that puts a bit of distance between me and the team and so people make their own decisions.* (F11EX1)

> *I come from quite a structured environment [he was a British Army officer in the first part of his career serving almost seven years in an infantry regiment and leaving with rank of captain] and I still get comfort from having structure and process, discipline I suppose, but in the early days it is all a bit more chaotic. We have had fun, but it has been stressful at times. Personally, I am looking forward to having some structure and a management team to share the burden rather than doing everything myself. But I suspect that the "techies" love it just the way it is.* (F12EX1)

The relationship between structure, success, growth and culture change is a complicated one, and from the data it is hard to determine if there is a discernible pattern of cause and effect evident. Do businesses become more successful and grow because they put in place appropriate structures or do businesses put in more structure because of their success and growth (as suggested by F1EX1)? Does the culture change because of the growth and structure or is it something in the culture that allows the growth and change in structure to occur? One thing that can be seen within this relatively small homogenous sample is that the smaller firms have less structure and the larger firms have more structure. However, it is not possible to determine primacy of structure or agency from the data within these interview narratives.

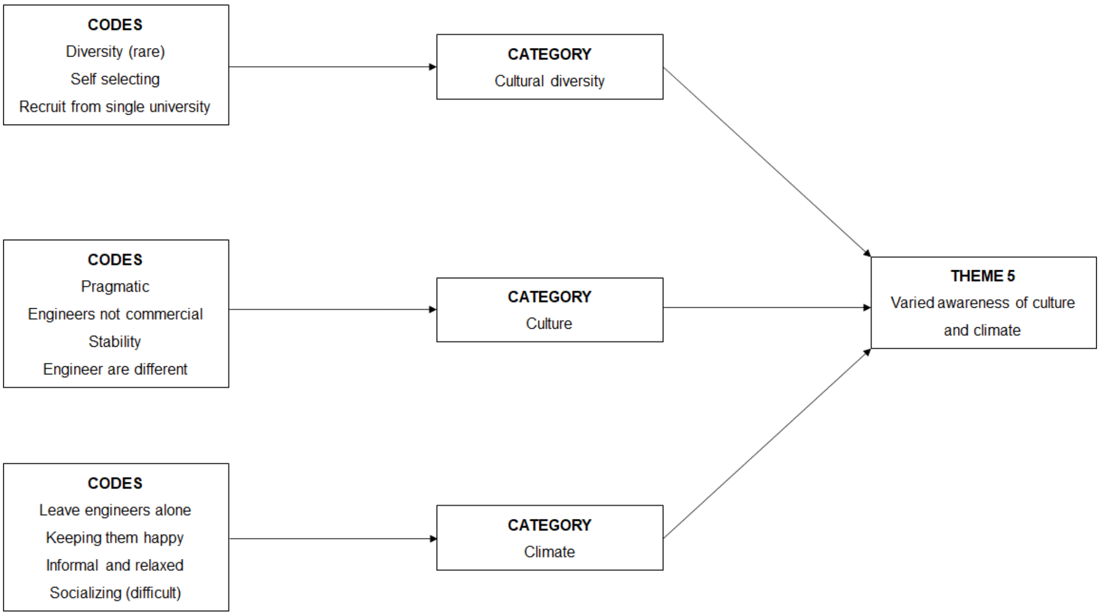


Figure 6.7 Chain of evidence: theme 5

Theme 6. The SMSE executive leaders interviewed believed that project success was related to clarity of vision, communication, and leaving the engineers to do their job; they felt that project failure was related to poor communication.

When asked to consider an innovation project that went well, the leaders focused on how they created a clear vision and a sense of urgency or "*burning platform"* (F1EX1) to focus attention on the end goal. They also provided structure and guidelines, but then stepped back to allow the engineers to do their work. The leaders played a primary role in customer communication. In general, there was not much agreement between leaders and engineers interviewed on success factors, but one notable area where they did agree was that the engineers should be left alone to do their job. This was nicely summarised by F1EX1:

> *I have to communicate with this group to solve this problem using these very, very bright people who are committed to our survival and therefore to the solving of this particular problem. And then getting out – of – the – way.* (F1EX1)

Others also observed the importance of leaving the specialist engineers to do their jobs:

> *You have to have the right people on the bus and have them sitting in the right seats. People need to have the right skills and experience and being the right job.* (F6EX1)

> *There is not much point in trying to get involved in the detailed delivery. I don't have the skills or experience.* (F7EX1)

> *It is so important to know where you are heading and make sure everyone else knows too. I am not at all technical, so once we have agreed what we are going to do I have to trust them. I have to leave them to it.* (F8EX1)

> *I want to trust them, but sometimes it is hard to believe what they tell me – especially about timescales and resources. But I have no choice unless I want to become a programmer – which I don't. Generally, I just get in the way, so I am better off going to see a customer or just going home. F9EX2 [is wife and business partner] is much better at this stuff than me. She seems to know how to get the best from them.* (F9EX1)

> *Well, I don't know about that, but they are the experts and that's why we pay them. No different to a lawyer.* (F9EX2)

One executive noted the benefit of having the engineers speaking directly with the client:

> *I think that project went well for a number of reasons. One, we built a very good rapport with the customer in that respect. I talked to the customer. But the software engineers did talk to the customer too. You see, initially, I build up the rapport, talk to the customer to build their confidence in our company. And then, at the right technical points I would get the technical team involved. (F2EX1)*

When discussing innovation projects that went badly, the same leader acknowledged his own role in not handing over technical management to the engineers soon enough:

> *The main reason for this is I didn't hand over technical management of that project early enough. So that by the time we were hitting designs and requirements a lot of the information was third party. In which case it wasn't coming straight from the customer and it was coming through the wrong person within the organisation and as such it had not been documented properly. If you start off a project at that level, you are never going to reach*

the customer's requirements if you haven't documented them correctly in the first place. (F2EX1)

Other leaders also focused on customer communication problems along with structures and processes.

> *Locking down the spec [specification] early is important. Scope drift can wipe out our profit.* (F7EX1)

> *Where it goes wrong is where the expectations are wrong. Customers, sales people, myself, and the engineers can easily end up with a different perspective.* (F8EX1)

> *Sometimes I don't see F10ENG1 for days and he is busy writing code. By the time I see him he has already developed something that is really cool, but doesn't do what the customer asked for. I have to be really careful to make sure we keep checking we are building the right thing.* (F10EX1)

None of the leaders discussed informal interaction with the software engineers during development projects, but did have occasional formal reviews, usually when something went wrong. It appeared that once a project had been established, the interactions between leaders and engineers became focused on hitting project deadlines to enable an invoice to be raised.

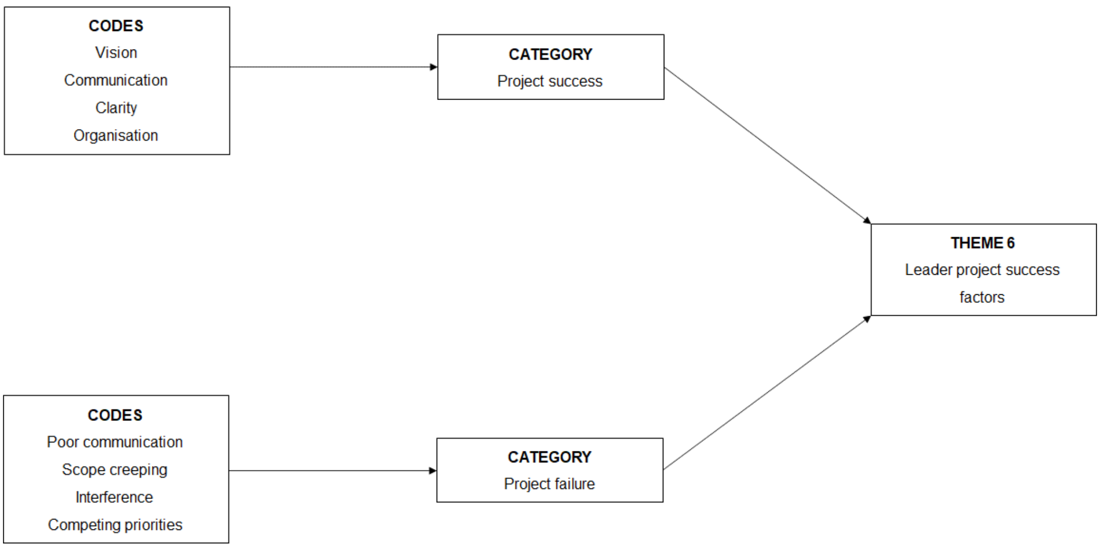


Figure 6.8 Chain of evidence: theme 6

Theme 7. Of the executives interviewed, the owner-managers and PE backed executives appeared to have different attitudes towards recruitment and retention of engineers.

Attitudes to recruitment and retention of engineers differed markedly between the PE backed executives and the owner-managers. PE backed executives identified value in working with human resource partners within their firms and external professional recruiters to recruit a more diverse group of engineers. These executives articulated an understanding of the value of retaining skills and knowledge within the firm. With one exception (F4EX1), owner-managers did not seem to explicitly value diversity in their software teams. In addition, owner-managers seemed less concerned about retention and viewed engineering skills as a replaceable commodity.

> *It is better that they move on. Older engineers often demand salaries inconsistent with their value added and they have fixed ways of doing things. They can be difficult to manage. I prefer to hire the young guys and get them doing it the [F4] way.* (F4EX1)

> *We know we are not offering a job for life. We can't. We can't compete. They want to go on and develop new skills. We are part of their journey and all I say to them is that I hope they leave [F9] a better engineer than when they joined us.* (F9EX2)

> *Diverse? Not really. It is all a bit male, pale and stale here I am afraid.* (F6EX1)

This last comment resulted in a memo written on the way back from the interview (memo 10.5 in Appendix 10) and developed using coding from other interviews. HR and industry literature confirmed the lack of diversity in software firms and the PE community and this is discussed further in chapter 7.

Only the smaller firms that were just beyond the start-up phase (F10, F11, F12) offered equity incentives to their engineers. Often the core intellectual property of their business idea was embedded in the skills and knowledge of the founding engineers in these firms.

> *We couldn't do it without [F12ENG1 and F12ENG2]. We are still at the stage where a lot of what we do is informal and in their heads. If they left it would be a disaster.* (F12EX1)

Each leader recognised the need to hire new skills as they scaled. F1 was founded by two data scientists who realised that they needed to bring in software engineers to support them. F2EX1 ran out of capacity and identified people in his network that could help:

I was working alone, but I realised that there were two or three people locally that had the skill sets that I could call on so I could build a small team very quickly. (F2EX1)

With the exception of F9, owner-managed businesses did not generally acknowledge the contribution that professional HRD could make to their businesses, considering HR to be concerned with payroll and administration. Consequently, the smaller owner-managed businesses tended to hire locally in an egocentric manner:

I started in 2010 going to F3ENG1, saying look I am on my own at the moment. The work's getting too much. I know it is a big risk, but do you fancy coming to help me? I've known her for years. It was a simple conversation. (F3EX1)

In the smaller owner-managed businesses, the *alma mater* university of the founders provided a majority of the software engineers. The result is a visible lack of diversity. F3ENG1 is the only female software engineer that I met in any of the businesses. She is aware of the current gender balance of the industry and asked how many other female engineers I was planning to interview. Her guess was that I would struggle to find any. Unfortunately, she was correct.

The smaller owner-managed firms were more likely to re-enforce culture by perpetuating a lack of diversity:

I would take two of the guys and invite some of the young guys to see the processes as well. They interview the people to see how good a fit they would be. Again, first interview – just a simple Q&A session. Pass that and then the guys will get them in and will usually do a couple of hours working on something with the team. (F1EX2)

Although the larger and PE backed firms were generally more open to professional HR practice and encouraging diversity, they were still sensitive to the importance of new engineers fitting in with the existing culture:

It is similar to taking a rock star engineer or a rock star data scientist and bringing them into a business. You need to make sure that the person you are bringing in is also is capable of integrating with the rest of the organisation, so you don't break the culture. (F1EX1)

So, diversity is not just about women, right? And it is a challenge to recruit female engineers, but we have more in sales and more in admin and so on. I don't really know the diversity percentages accurately, but women engineers are probably 20%, or something like that. But diversity, well we probably have about 30 nationalities. The constraint we have is we want them [engineers] to be flexible from account to account and we want them to be low cost. Cost and flexibility trump age. Older software engineers can be tricky. They can be a little difficult to turn around. It's not worth the extra money and the challenge of managing them. Going right back to the beginning of time we said two years' experience and a good degree. Now we even take straight from university. (F4EX1)

It's still a very small team. People have to get along with each other. (F8EX1)

The reward systems for software engineers in some firms appear to be under-developed. Some of the leaders were acutely conscious of this but concerned at the potential increase in costs associated with financial incentives:

The problem with incentivising anything is it is more cash going out of the business. (F2EX1)

Apart from the CTO, the engineers don't have equity or bonuses. They tend to be paid a flat salary. Some of them work on call, so they can make more money that way. But the incentive scheme…. I've wanted us to look at that, but we've never been able to successfully employ something that we think is an appropriate type of model to do that. (F5EX1)

We'd love to do more for them – for everyone, but we just don't have the money. (F7EX1)

Some of the executives noted that as the businesses scale, the reward structures that worked at start-up struggle to keep pace. With no formal policy, the basis for rewards broke down or became capricious. F1EX1 believed F1 to be *"good at rewards"*, but this was brought into question by F1ENG1 who perceived that the reward systems had been diluted by recruitment and not aligned to the cashflow of projects, and so were becoming unaffordable.

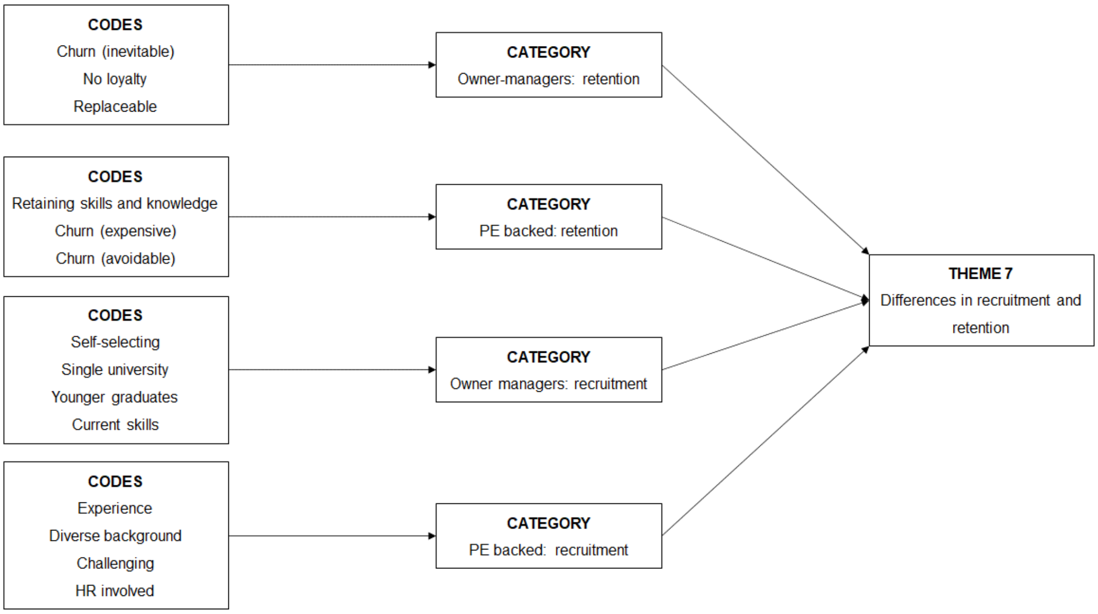


Figure 6.9 Chain of evidence: theme 7

6.2 Findings: the software engineers

Summary of the findings for the software engineer cohort

The engineers interviewed were primarily motived by having the time and autonomy to work on interesting problems that were useful to society and allowed them to showcase their abilities. Money was regarded as a hygiene factor or secondary motivator. The engineers displayed little interest in the business performance of their firms, other than having a desire to know that the firm's financial performance was sufficient for them to be secure in their jobs and confident of their longer term employment prospects.

Culture and climate appeared to be very important to the engineers, and they seemed to value stability over change. In the larger and PE backed firms, the engineers were conscious of the existence of a distinctive engineering culture. Many engineers were concerned that if their firms were highly successful, significant growth may result in an unwelcome change in organisational culture.

Although they did not necessarily use specific theoretical references, many of the engineers interviewed recognised when their executive leaders displayed specific leadership traits, behaviours and styles and were most appreciative when that manifested itself in the practical support for projects by providing incremental resources.

The engineers recognised that much of their innovative work related to exploitation as they added feature functionality to existing software applications in response to customer feedback. However, in two of the PE backed firms, the engineers acknowledged that there were some elements of process relating to executive approval for developing innovation from initial ideation through to delivery.

The engineers identified the external focus of their executive leaders and generally accepted this. However, some of them expressed frustration at the lack of personal contact with leaders and the reliance of leaders on email. There was little social contact between leaders and engineers and most personal encounters took place in groups where the leader was sharing information with a wider community.

The engineers interviewed believed that they were the primary source of innovation within their firms.

The main relevant themes identified within the cohort of engineers are summarised in table 6.2 below.

Table 6.2 Major themes: software engineers

#	Theme
8	The software engineers interviewed recognised innovation leadership behaviour but did not generally discuss their leaders shifting between different styles.
9	The software engineers interviewed were not primarily motivated by financial gain.
10	The software engineers interviewed valued having time to explore, learn and play.
11	Most of the software engineers interviewed wanted to maintain existing company culture.
12	The software engineers interviewed believed that they were the main source of innovation in their firms.
13	The software engineers interviewed accepted the external orientation of their leaders.
14	The software engineers interviewed had mixed views about leader praise and recognition.
15	The software engineers interviewed had a low interest in commercial issues.
16	The software engineers interviewed associated project success with control and independence and project failure with poor communication, compromised technical objectives and time pressure.

The evidence for themes 8 to 16 relating to the engineer cohort is presented below.

Theme 8. The software engineers interviewed recognised innovation leadership behaviour but did not generally discuss their leaders shifting between different styles.

Although some of the executive leaders described moving between different styles of leadership, most of the engineers discussed behaviours and examples that suggested that they perceived their leaders to prefer a single dominant leadership style. The exception to this was F1ENG1's perception of the leaders of F1 who he acknowledged as displaying a variety of styles. He discussed how F1's leaders enable intrinsic motivation through challenge and freedom and also enabling what he called, "*an engineering technology led culture*":

> *The challenge, I think, of working in an interesting environment on interesting problems with pretty cool technology. The facility to – we are very – we trust people, we can give people positions of responsibility and give them a lot of power and autonomy to find their own way. Ask for help where required, but we don't micromanage. We don't say I want you to go and work on this and this and this. The idea is that we give people a fairly broad open-ended problem and they have to go figure out how to solve it.* (F1ENG1)

> *Well, certainly F1EX2 has always been totally supportive of the fact that we have a great culture. She has always completely understood the idea of having an engineering technology led culture... She's always been very keen that we foster the best engineering practices that we can. She's been very keen on supporting me whenever I have been to her and said things like "we need to focus more on quality because there is a risk that if we start shipping these things then quality will suffer".* (F1ENG1)

However, he also discussed times when leaders had to be more directive and intervene:

> *Well, there are many examples where we have been forced to focus on fire fighting. And we may be thinking that this is not the best long-term strategy, but you just have to suck it up and get on with it.* (F1ENG1)

On some occasions, there was a notable difference in perception between the leaders and the engineers. For example, F4ENG1 observed closing leader behaviours, whereas F4EX1 discussed behaviours and examples that self-identified more strategically.

> *I had to sell the idea into F4EX1. If he likes an idea it is great but if he doesn't get an idea it is hard to make him understand and it is probably not*

> *worth it. If it is major and he is not involved you have to sell to him. If it is project based, then that project will just get on and do it.* (F4ENG1)
>
> Compared to:
>
> *So, for example we have an ideas@ email that you can send your ideas to. We brainstorm those ideas. Then they turn into product and so on. And then when it is anything more than a kind of a concept then I fund it and make it happen.* (F4EX1)

Other engineers described dominant styles:

> *F2EX1 is always keen to get things done as soon as possible. And I think that is where the scheduling will maybe benefit us. Where we know we can then say how long this is going to take so that we are not getting to the end of a project and feeling like we are cutting this one short to start the next one.* (F2ENG1)
>
> *He [referring to F3EX1] is very, collaborative and is still very hands on in terms of development.* (F3ENG1)
>
> *The culture is process driven and quite formal. You know, if you have got clients on site, as much as we would love to be Google and sit around on beanbag chairs, it is not going to happen. You know, people are expected to be presentable and to represent the company in a corporate mentality.* (F5ENG1)
>
> *He [F8EX1] is really good at managing the clients and giving us the air cover we need to get the job done. He understands that good work can take a bit of time.* (F8ENG1)
>
> *Sometimes he [F11EX1] becomes the "platoon commander" [like F12EX1, F11EX1 was also a British Army infantry officer] again and he just tells us what to do.* (F11ENG1)

The nuanced difference in perception between engineers who tended to discuss a single dominant style and leaders who discussed a greater breadth of styles is interesting and may be explained by a variety of factors. First, the frequent absence of the leaders from the office during core business hours means that the engineers do not often get to witness the behaviour of their executive leaders close up, and instead mainly experience their relationship with the leaders through the relatively impersonal and formal medium of emails, or at larger team gatherings. Secondly, whilst leaders may be making decisions and facilitating progress by using many different styles of innovation leadership, the impact of this on day-to-day work activity may be channelled through managers and supervisors rather than being experienced by the engineers through direct interaction with executive leaders, and so the engineers may be unaware of the leader's direct involvement. Thirdly, as long as the engineers have a general sense of security and job satisfaction, the interviews suggested that the engineers had relatively little interest in wider business issues, and so some may simply not take much interest in what their leaders are doing.

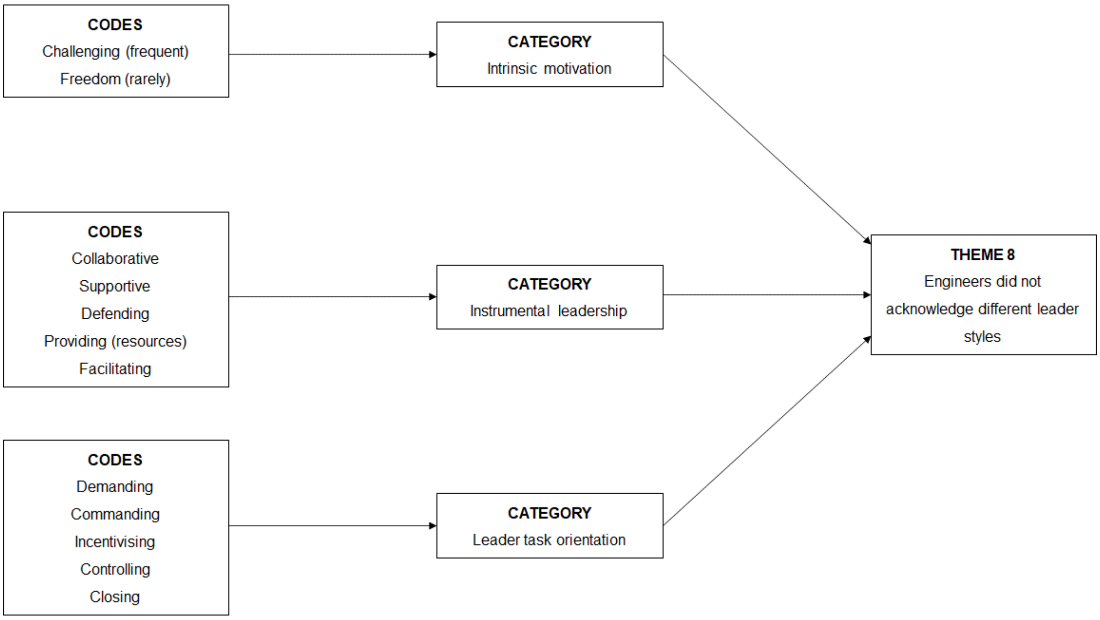


Figure 6.10 Chain of evidence: theme 8

Theme 9. The software engineers interviewed were not primarily motivated by financial gain.

The market for software engineers is competitive. However, none of the engineers interviewed seemed primarily motivated by money. Other than being paid a level of salary that meets hygiene factor requirements and is regarded as competitive within the sector and geographic region, additional financial incentives such as bonuses were relatively unimportant to most of the engineers interviewed. Soft factors such as working environment, challenge and pride were discussed much more often and with much greater passion and conviction. Issues of self-actualisation associated with having the time and space to do good quality work came higher up the engineers' stated needs. Some of the quotes below summarise their feelings about motivation:

There is no reward scheme. I think it is just in our nature to be creative. Nothing really above our monthly salary, although we do get a Christmas bonus. What we enjoy is building something to the best of our ability. Even if that means pushing ourselves and learning. (F2ENG1)

It doesn't have to be a cash incentive to be innovative during our projects. It is just giving us the time, to give the projects that flair, that polish. (F2ENG1)

If you can do something that is helpful, and the benefit of that is you get a little bit of cash then that is great, but that is not the primary driver. (F3ENG1)

It is not really about the money. This works for me – for my family situation. I am a single dad and there are not too many opportunities like this in [REGION] where you can work from home and do stuff that interests you. (F7ENG1)

Look, I could earn more with one of the big names for sure. I have the right credentials for sure. But this feels right – it is worthwhile, and I am working with people I like. I have a bit of the equity, so who knows. We are not going to be the next Google I know, but maybe we will be bought out at some point, but that is not my dream. I just enjoy the work. (F11ENG1)

I gave up a great job and a steady income to do this. But it is important to give it a go, before I have any obligations – wife, kids, mortgage, grown up stuff. (F12ENG2)

Some of the SMSE have tried to establish bonus and performance based reward programmes. However, as the businesses have grown, reward structures have failed to keep pace with the growth and all of the firms (early stage, owner-managed, PE funded, small and medium) struggled equally with taking a strategic approach to financial compensation:

We have a quarterly bonus scheme and that is discretionary. There is a lag between work being done and money coming in. It means the money coming into the bonus scheme does not reflect the degree to which you have just exploded around your people. Doing the same job today as I was two years ago, I don't see the same level of bonuses. (F1ENG1)

> *Who knows how the annual bonuses are calculated. If we have a good year, then (F4EX1) shares some of the joy. I don't think there is any structure to it.* (F4ENG1)

The attitude of engineers to financial reward contrasted with the attempts of some leaders to offer transactional incentives and this theme was explored in a memo (memo 10.15 in Appendix 10) and related back to seminal motivation literature which is discussed in Chapter 7. The motivation of the engineers seems to be intrinsic to the task of solving problems and developing useful software, rather than dependent on reward. Each of the engineers displayed a sense of social conscience around the value of the work that they did. This was most clearly expressed by F3ENG1 and F10ENG1:

> *There was a company that I used to work for, and we did a software body double for diabetics. I really loved seeing this wee boy - he'd been diagnosed with diabetes - who could not go out and play football and sport. His mum did not know what to feed him and she couldn't control his blood sugar. We gave him our kit and that kid managed to go to football training every week. It was making a real improvement in his life.* (F3ENG1)

> *Getting something working or solving a customer's problem. Fixing an issue. I'm quite often involved in deployment and remote installations. Starting a pilot. Finishing a pilot. It's rewarding. When I look at our [market] share of it is pretty impressive and something I am proud of.* (F4ENG1)

> *Our software connects people and makes communication affordable. It is really important because these people are away from their families for weeks or months at a time. I know what it is like to be away from home for months.* (F10ENG1)

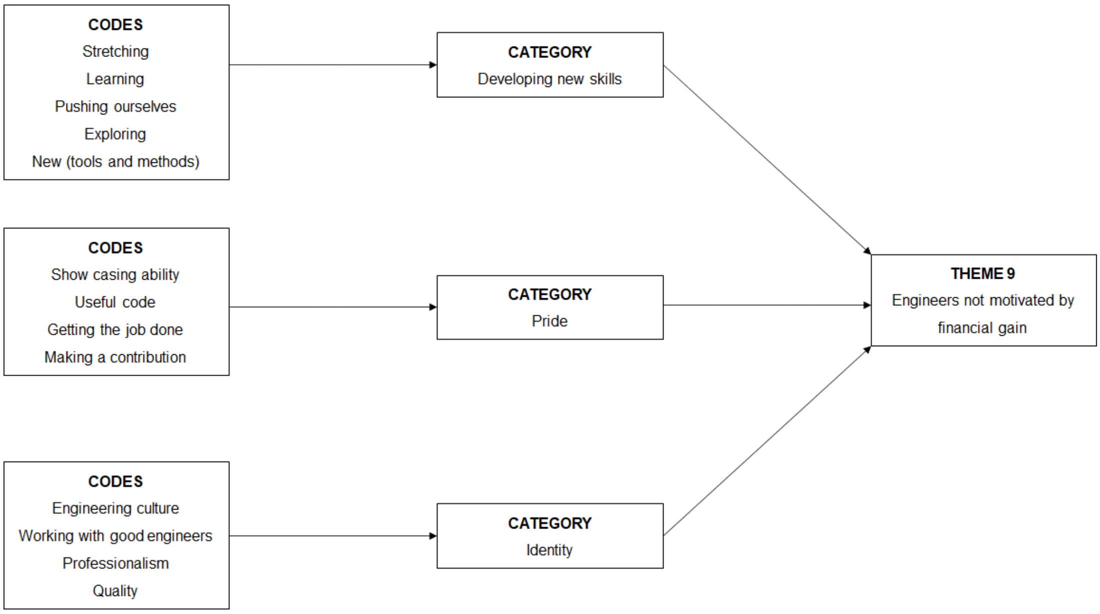


Figure 6.11 Chain of evidence: theme 9

Theme 10. The software engineers interviewed valued having time to explore, learn and play.

The engineers were mainly degree educated and displayed traits of intellectual curiosity in their interviews. They generally developed a passion for their subject and chosen career early in life and for them, being a professional software engineer represented the achievement of ambition. Many expressed a strong sense of wanting to continue learning and developing. They associated one element of job satisfaction with having time to explore and learn:

> *The CEO lets me play - lets me explore new technologies. It is just having time and space. A luxury I might not get if I were at IBM.* (F3ENG1)

> *I wanted to get into the web industry because it is always changing. There's never an opportunity to get bored because there's always new technology and new ways of doing things.* (F2ENG1)

> *The CEO has fostered an engineering culture. She is very happy to let a bunch of geeks work in an office in a very stereotypical "Cambridge Engineering" approach.* (F1ENG1)

> *I have skills from gaming software and I could see an application for them in our training platform. It was great that I got the time to experiment with this and play with a few new ideas.* (F7ENG1)

One of the firms claims contractual rights over any intellectual property that the engineers develop in their own time and another has a policy of not allowing engineers to contribute to open source code. These appear to be significant disincentives for some software engineers, and engineers at F1, F2, and F6 stated that they knew of colleagues who had decided to leave firms in search of more freedom elsewhere. When I asked if this could have been more to do with other incentives available elsewhere, not limited to cash, they each affirmed that it was in relation to the intellectual property and open source policies alone. This then prompted follow up questions on their own attitudes to these issues. It seemed that for these three engineers the balance between doing interesting and useful work in the current environment marginally outweighed the freedom that might be achieved elsewhere, but that seemed to be a factor that was constantly being weighed and re-assessed. For these three engineers at least, loyalty was based on a very complicated combination of hygiene and motivation factors and they are always questioning when the right time to move on might be.

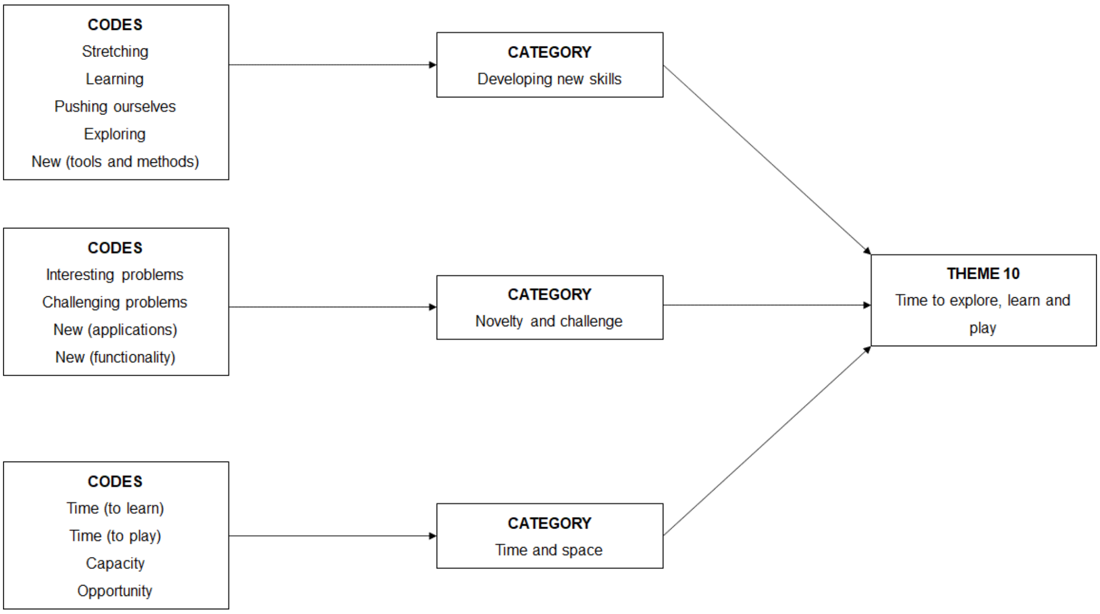


Figure 6.12 Chain of evidence: theme 10

Theme 11. Most of the software engineers interviewed wanted to maintain existing company culture.

The erosion of SMSE culture as the firms grow seems to worry engineers. This was articulated most clearly at F1, which has grown to more than a hundred employees and is wrestling with formalisation. F1ENG1 had a lot to share on this topic, and belied a sense of increasing frustration with how the culture of the business had changed due to growth:

> *Places like Google started out as a small and fun place to work and now it has become a behemoth and is not an enjoyable place to be a software engineer anymore*. (F1ENG1)

> *We are going through a phase of professionalisation which is good and bad. You get to focus on the things you want to do. But as you grow there are cultural challenges around communications, making sure everyone is aware of what's going on, and you have an increasing number of relationships. As you grow you generate conflict.* (F1ENG1)

> *What is the cultural cost of saying we are an organisation that is signed up to ISO? You are looking around saying, "Why am I working here? I could be working for IBM if I wanted that level of bureaucracy".* (F1ENG1)

Other engineers were also conscious of how the culture of their firms was changing with success and growth, with one engineer suggesting that perhaps there would be benefit to the culture changing to reflect scale and maturity:

> *F4EX1 is a start-up [entrepreneur] engineer who has been here 30 years and has never had the pressure from others to put structure in place. To some extent he has resisted that. He doesn't want F4 to turn into [names a big technology company] where you have this process that you work through and you have to fill out these forms. You are not allowed to do anything unless you have done that and then you can't get anything done. There is in many ways a start-up culture, but with the good and bad. You know, that start-up culture of you can get things done. Just go and do them. And put in the overtime to get it done. Balanced again, maybe, is there a better way of doing this? Is there a more advanced way of doing this? Maybe learning from past experience and not making the same mistakes again.* (F4ENG1)

In F1, the engineer interviewed acknowledged the cultural awareness of the CEO, and was specific in identifying the existing of an engineering culture within the firm.

> *Well, certainly [CEO] has always been totally supportive of the fact that we have a great culture. She has always completely understood the idea of having an engineering technology led culture.* (F1ENG1)

Engineers in the smaller firms recognised that success would bring growth, which could change the culture.

Right now, it is fun. It doesn't even feel like work most days. It can be hard, but I am doing stuff I enjoy with people I like, and there is pressure, but it is not like I have felt in bigger companies. If we succeed and grow it will change. Don't get me wrong – I want us to be successful, but I know it will feel different and that might be a bit sad. (F11ENG1)

We put in some long days, but we have a good time. It feels a bit like a family at the moment. When we grow, it will be different. Not so intimate. (F12ENG1)

Memo 10.6 (Appendix 10) was written to record initial thoughts on engineer resistance to culture change and to consider how the internal perspective of the engineers contrasted to the external focus of executive leaders.

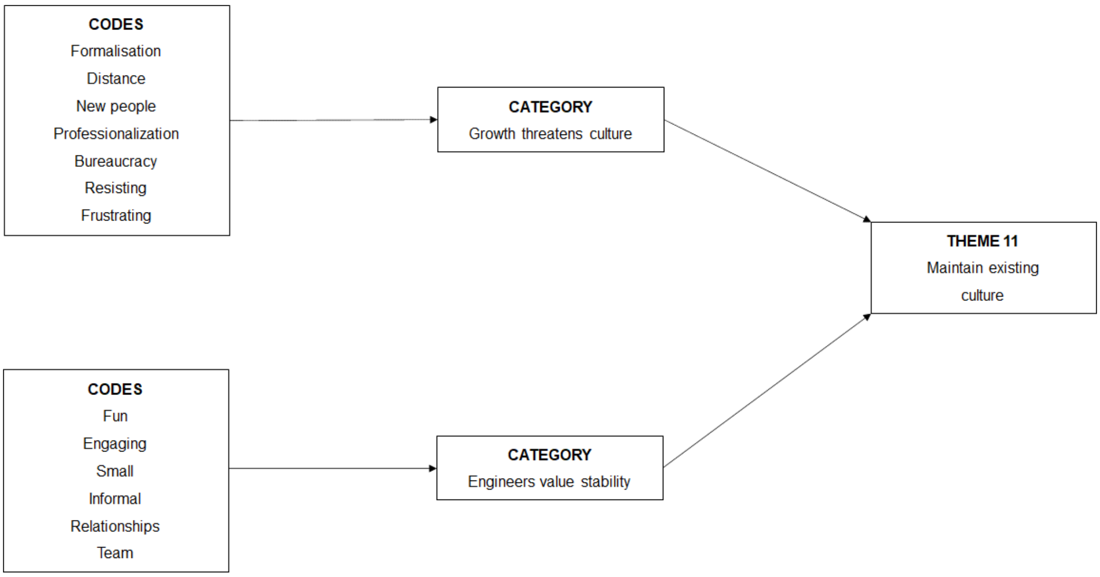


Figure 6.13 Chain of evidence: theme 11

Theme 12. The software engineers interviewed believed that they were the main source of innovation in their firms.

Many of the leaders interviewed had claimed to be the main source of innovation within their themes as they would often be primarily responsible for identifying market and user requirements. However, the software engineers also believed themselves to be the main source of innovation and provided evidence in the coding of interviews for their primacy in providing the creative cognition that led to them believing that they drive product and process innovation in their firms. This is explored further in memo 10.13 (Appendix 10) and reflected in some of the excerpts from transcripts below:

Innovation is more about lessons learned and procedure based. (F2ENG1)

It is the software engineers who drive innovation. Our directors, well I wouldn't say they are very old hat, but they come from a software background whereas we are primarily web. (F2ENG1)

If someone's got an idea, we will chat about it and it usually ends up in them just doing something in their spare time. If you are any sort of developer you play around with things in your spare time. (F2ENG1)

We don't really have a process for evaluating a business case in a company of this size. A lot of our view is based on feedback from folk that are using our software. (F3ENG1)

A majority of the innovation is emergent here. There is not a formal innovation strategy. We [the engineers] just ask what does the customer need? Looking back over the last 20 years we have done lots of stuff, but we don't think of it as innovation – just as problem solving, but it does create new things. (F4ENG1)

The only really innovative thing we have done whilst I have been here was the gamification of our applications. Gaming software is my background, so obviously that was my idea. (F7ENG1)

They are both bright and creative [referring to F9EX1 and F9EX2], but they are not technical. Some of their ideas are crazy, but they are so enthusiastic. It is my job to make sure we can deliver what they are talking about. A lot of what we do in innovation, it is quite small. Not their big ideas. Those improvements: they come from me and the guys [referring to the other software engineers]. The big bosses don't really see what goes on. (F9ENG1)

The CEO does get involved and he is a good engineer, but he is busy doing other things. Selling. The ideas mainly have to come from me. (F10ENG1)

We are both involved [referring to F12ENG1 and F12ENG2] really. F12EX1 knows the industry, but he is not as technical as us. We are often solving esoteric software and data science problems. Creativity is important, but you have to really know your stuff as well. (F12ENG1)

The exception to this was F4ENG1 who drew a distinction between incremental innovation that was largely driven by the engineers and the "*big new ideas*" that F4EX1 was involved with:

> *F4EX1 is usually involved in the big new ideas, but most of the other innovation comes from the software engineers. Of course, there is a huge range of what we could describe as innovation. The light bulb moments through to the day-to-day decisions. A lot of it is driven by customer requirements. Discovering those bigger issues, I guess F4EX1 is out talking to customers asking what problems do you have and what can we fix? That is where our biggest ideas come from. From the smallest idea from the smallest client just wanting us to figure out how to stop this machine from falling over.* (F4ENG1)

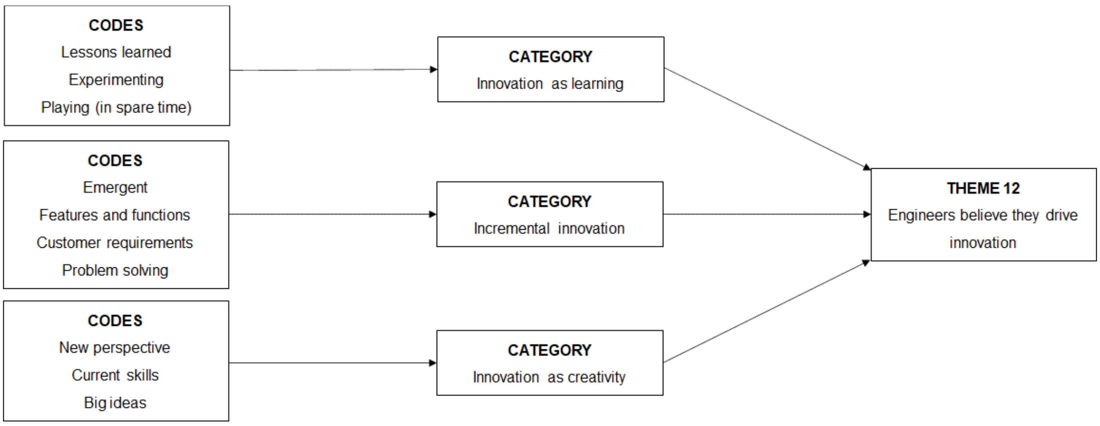


Figure 6.14 Chain of evidence: theme 12

Theme 13. The software engineers interviewed accepted the external orientation of their leaders but consequently perceived their relationships with executive leaders to be formal and hierarchical

Interaction between executive leaders and engineers interviewed for this research were influenced by the executive leaders' external focus. This resulted in a significant use of email and when personal interaction did occur, it was either in a formal team environment or in a project review meeting. Most engineers reported that there was little feedback in the group or "town hall" meetings:

> *It probably should be interactive, but I think again, a lot of people probably still sit there and observe.* (F5ENG1)

The leaders rarely engaged socially with the engineers. Consequently, the engineers' lived experience of executive leadership in all the firms except F3 was relatively formal and hierarchical. In F3, the close working relationship had been formed over many years and F3ENG1 was very protective of F3EX1. An important aspect of this relationship was that she was conscious of him being dyslexic and was pleased that she could be his reader:

> *This is going to sound a bit cheeky, but [F3EX1] is not that great at reading. So, I am quite good at taking specs [specifications] and looking at what we can and can't do. He's very good at keeping an eye out for new technology that is coming out in the industry, and then between the two of us we have a chat and think about what we can do with the technology* (F3ENG1)

The engineers understand and accept that their leaders are primarily externally focused:

> *The CEO is out in the market, interacting with our customers. I tend to be stuck in the office most of the time. But he's speaking to people and finding out what's going on.* (F3ENG1)

However, it is frustrating when leaders come back into the business and intervene in projects in a transactional manner. For example:

> *One of the real frustrations is when someone comes in in the morning and they've got 20 plus emails from the CEO going through a current project and taking screen shots and commenting on things we know about. Not even in one email - 20 separate emails with a screen shot each. (F2ENG1)*

This final quote prompted the drafting of Memo 10.1 (Appendix 10) that contrasted the perspective of the executive leader of F2 with the views of F2ENG1.

The reduced time that executives spend in the office reduces the time available for personal interaction with engineers and results in a reliance on email and group communication. This has implications for how engineers perceive their relationship with executives and results in an acceptance of hierarchy and high power distance relationships. Moving to a one-way flow of information from leaders to engineers discourages engagement and means that the engineers are less likely to share ideas with their leaders.

> *I have raised new ideas. I mean, the hole gamification was my idea. But it is rare and I sometimes go for weeks without seeing [F7EX1], so when would I get to explain my ideas?* (F7ENG1)

I know he is busy and leads from the front, but we never get to speak. I don't think he has time to listen to my ideas and I don't want to fill his inbox with emails. (F6ENG1)

No-one wants to raise things in the town halls. Generally, they drag on as it is, and we all just want to get back to our desks. (F9ENG1)

When we first started, we were really tight. We spent a lot of time together and it was fun – coming up with ideas. But now we are off and running. We just need to stay focused on delivery. If we stopped to discuss every great idea that every software engineer had then we wouldn't get stuff done. But I still feel we are missing opportunities. (F10ENG1)

The sentiments are summarised in the diagram below (figure 6.16).

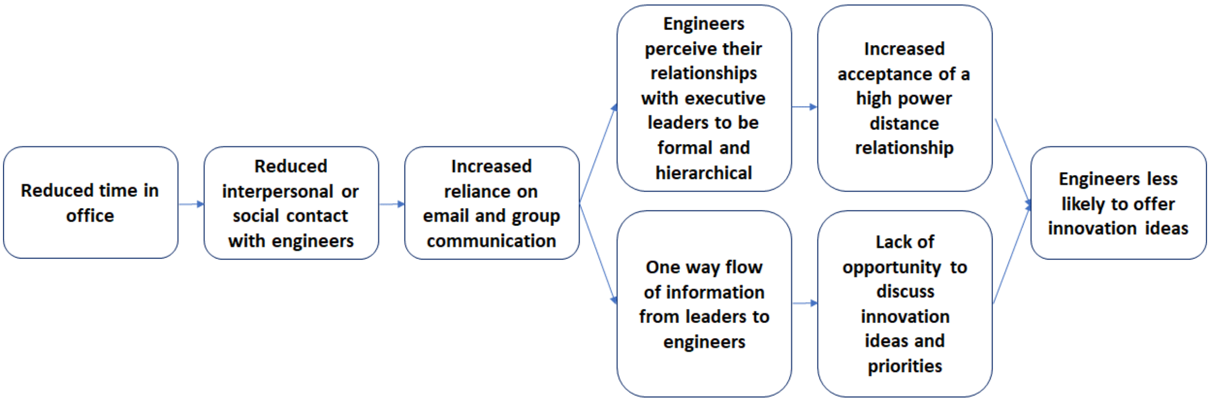


Figure 6.15 Implications of external focus of executives on relationships with engineers

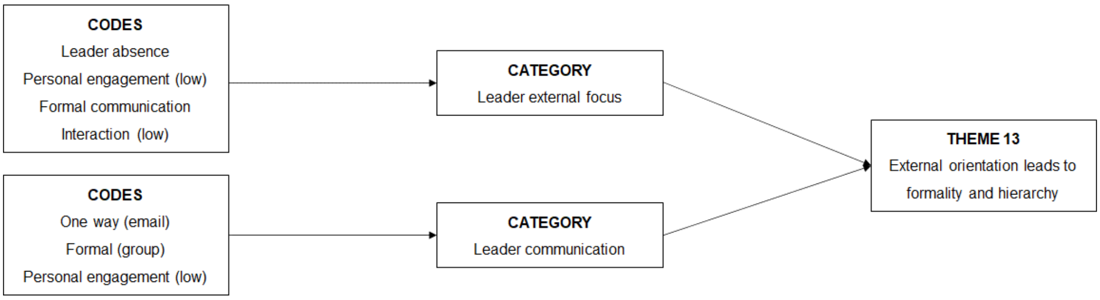


Figure 6.16 Chain of evidence: theme 13

Theme 14. The software engineers interviewed had mixed views about leader praise and recognition.

Each of the leaders attempted to recognise the contribution of software engineers, thanking them and praising them publicly. This seems to have a mixed impact. On the one hand:

It feels good to be the man of the hour and fix things that no-one else could do. (F1ENG1)

Well, I like the sense of achievement. So, if I've got involvement of [discusses a branded product] and it deems to be a successor of previous versions, you know, clients love it, management love it, and the company grows because of it. You sell it to more. You get recognised more. That's a sense of achievement. And you can't really put a price on that. Money helps, don't get me wrong. But it is a sense of satisfaction for me. (F5ENG1)

I work from home miles away from London and although it suits me it can be a bit of a lonely existence. I also sometimes feel a bit vulnerable because what I do is a bit invisible. F1EX7 is pretty good at keeping in touch and sometimes he has just called up to say, "good job on that new (software)" and that feels pretty good. Just to be recognised. (F7ENG1)

However, if overused. it can become meaningless and perhaps even counter-productive:

If you start to say I am going to call out everyone, then it becomes a platitude. It's like going to primary school – everyone gets a medal. (F1ENG1)

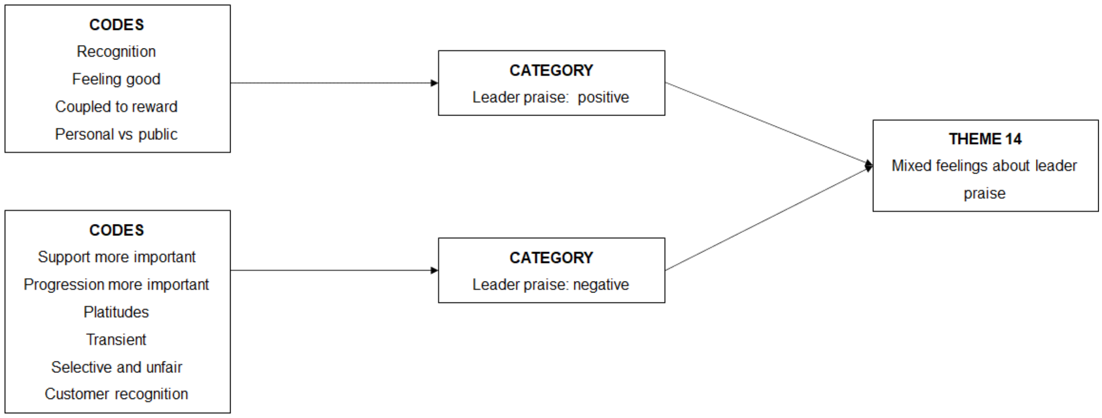


Figure 6.17 Chain of evidence: theme 14

Theme 15. The software engineers interviewed had a low interest in commercial issues.

Leaders have tried to be open about business performance and include the engineers in briefings about business performance. However, this is not universally appreciated:

> *I take an interest in the business, but other developers believe that it shouldn't be something that they need to care about. They are there to do what they are good at. As long as they are getting it done for a deadline, they don't need to be worried about cashflow.* (F2ENG1)

> *Well, I guess that is a necessary evil that cannot be ignored, because you have to make money out of it for it to be viable, to be able to put it out there. I think if you can do something that is helpful, and the benefit of that is you get a little bit of cash then that is great, but that is not the primary driver – no.* (F3ENG1)

> *I don't suppose there is as much interest in this as would be liked. I think a lot of people look at those numbers and go, "Oh, ok". Not perhaps give it much more than a small thought.* (F5ENG1)

> *To be fair, F5EX1 does keep us all informed, but unless there is any obvious financial pressure, then I don't pay it much attention.* (F5ENG1)

> *There doesn't seem to be an issue with money, so I don't worry about it.* (F9ENG1)

Only the engineers in the smaller start-up businesses tended to have equity in the business, and so most of the engineers were not really concerned about financial performance:

> *I guess if you compare it to other tech company start-ups that are externally funded, the company is wholly owned and run by F4EX1, so people don't have share options. So, people are not focused on how the company is doing financially.* (F4ENG1)

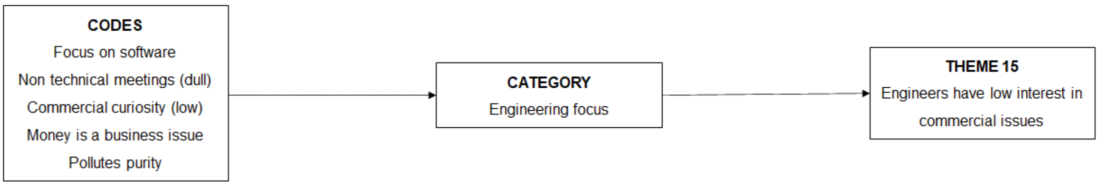


Figure 6.18 Chain of evidence: theme 15

Theme 16. The software engineers interviewed associated project success with control and independence and project failure with poor communication, compromised technical objectives and time pressure.

There was a high degree of agreement between engineers that innovation projects that went badly were perceived had four common themes: 1) poor communication; 2) conflict between the end customer requirements and the leader trying to productise development for re-usability; 3) lack of support; 4) insufficient time allocated to finish the project to a quality standard that satisfied the engineers. Specific examples of each of these are provided below:

- Poor communication:

> *It even happens in a small company like this. Communication is the classic – "send two and sixpence, we are going to a dance". If the engineers don't get to speak to the customers it often goes wrong. We need to understand what they really want.* (F11ENG1)

> *There was a bit of a loss of communication between us and the client. And it didn't help that we had the designer in our team, so there was a bit of communication between our client and our designer, and then our client and us and then the designer and us. So, it was always a bit of "Chinese whispers", and some stuff got lost in translation. The people that did this functional design were not actually involved with the bulk of the projects, and things were lost from that point as well. And it meant that some of the items of the project never got completed to the client's expectations.* (F2ENG1)

- Conflict between end customer requirement and productization:

> *F2EX1 was saying, "Oh can it do this? Can it do this?". At the time I was inclined to just kind of go with it and say, "yeah, let's put it in". And I think that is where the bad experience of the project started. With F2EX1's input, he knew what he wanted for our product, but we should have looked at that after we had finished the client's one. And in hindsight, I should have said that to him. I would say it now, now that I am in a position where I am comfortable and I feel respected here and what I say is kind of taken with some sort of weight to it. In hindsight I would kind of refrain from doing that – I would focus on the client side of it.* (F2ENG1)

- Lack of support:

> *I used to work in a small contracting firm and they put you on one of these jobs to do work and they just kind of left you to it. And when things went wrong there wasn't any back up or support. You were just kind of hung out to dry.* (F3ENG1)

- Insufficient time:

> *Promises are sometimes made without understanding what really needs to be done. I understand he [F8EX1] wants to get the deal in and we need the money, but sometimes we end up over committed and it gets us into trouble. Unrealistic deadlines kill us.* (F8ENG1)

When asked to discuss projects that went well, the engineers believe that they are best left with end to end control:

> *The best project that I've worked on here is the current one. I've gone through from start to finish. It has been the best one, not because of lack of input from the CEO, but we've put in the right processes at the right time.* (F2ENG1)

> *Best thing [leaders] can do is get out of the way and let the technical team do their thing. And that is by and large what is going on.* (F1ENG1).

> *It's head down, bum in the air and just go for it. Generally, the CEO sets the deadline and says we have to have a build date by this date. And we have to make sure it works and is tested.* (F3ENG1).

> *It's great to have the support and all that, but really we just have to crack on and get the code written and tested and there is not much that [F11EX1] can really do to help at that point.* (F11ENG1)

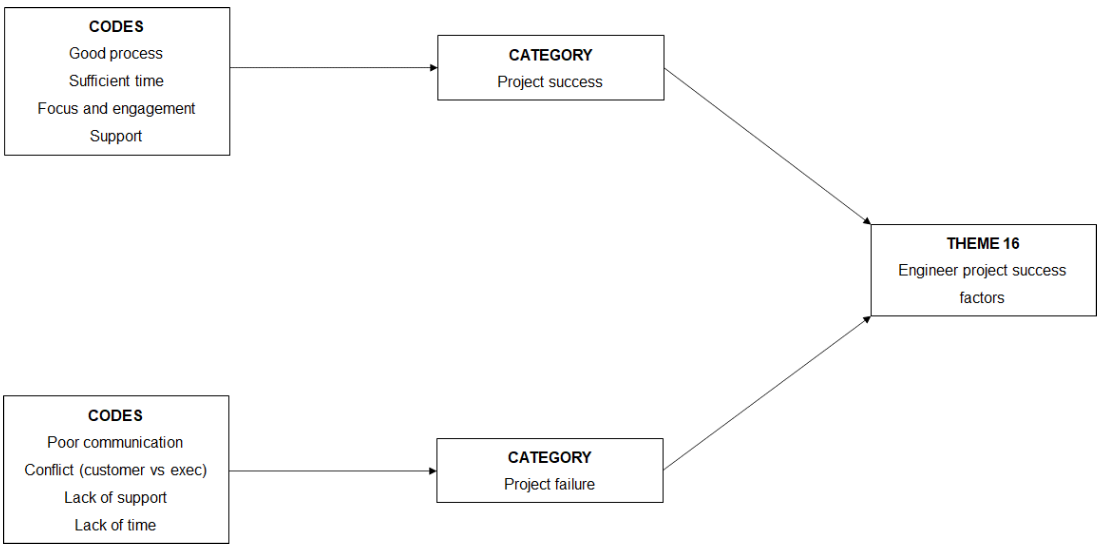


Figure 6.19 Chain of evidence: theme 16

6.3 Findings: the private equity investors

Summary of the findings for the private equity investor cohort

The PE investors were the most homogenous cohort of the three and expressed very similar views on most aspects of the interviews. All the PE investors preferred to back proven businesses based on well-established technology. They expressed support for exploitative innovation, but were rarely supportive of exploratory innovation, making the distinction that exploration is venture capital (VC) or angel investor activity, rather than PE. They discussed a debt leveraged investment approach that constrained cash within the businesses and required reliable cashflow to service the debt. However, they were generally supportive of firms investing any cash surplus that they generated into further exploitative software development, subject to a business case approved through an appropriate governance structure (e.g. investment committee or board of directors).

The PE investors recognised specific limitations of many owner-managers who had not previously worked with PE. They all believed that PE ownership should result in the adoption of high performance working practices, but acknowledged that this theoretical perspective was often hard to achieve for a variety of reasons, including organisational culture and the skills and experience of the executive leader. The PE investors all had experience of replacing owner-managers who had struggled to adapt to PE investment with experienced CEOs who had prior PE experience.

The PE investors said their exposure to engineers in portfolio companies was infrequent and they trusted CEOs to use appropriate policies and strategies to hire, retain and motivate the right talent. The evidence of an effective working relationship between executives and engineers was generally viewed to be delivery of software projects in line with plans presented to the board. However, they all had experience of projects slipping in terms of dates and budgets and did not necessarily infer that there was a problem in the relationship between executives and engineers when this happened. In fact, most of them expressed the view that software projects are generally prone to slippage, which is why they prefer not to embark on anything too new or too ambitious.

The major themes identified in the investor narratives are listed in table 6.3 below:

Table 6.3 Major themes: PE investors

#	Theme
17	The PE investors interviewed valued specific innovation leadership styles most closely related to execution.
18	CEOs established credibility with the PE investors interviewed by demonstrating their execution capability against the initial investment thesis.
19	The PE investors interviewed frequently replaced owner-managers with CEOs who had prior PE experience.
20	The PE investors interviewed preferred to invest in firms that had established product market fit and a proven and scalable business model.
21	The PE investors interviewed leveraged their equity investments with debt and so intentionally restricted cash available to SMSE.
22	Most of the PE investors interviewed claimed to support investment in innovation if funded from the existing cash resources of the business and subject to approval of a business plan.
23	The PE investors interviewed had limited direct exposure to software engineers and trusted their CEOs to manage these relationships effectively.

The evidence for themes 17 to 23 relating to the PE investor cohort is presented below.

Theme 17. The PE investors interviewed valued specific innovation leadership styles most closely related to execution.

The PE investors were consistent in their views of what they expected of SMSE CEOs. They expressed a strong bias towards behaviours associated with tactical delivery against agreed plans. They also valued innovation leadership when it related to execution of major change programmes in a turnaround business. They tended to prefer traits and behaviours consistent with exploitative rather than exploratory innovation.

The PE investors held similar views on the standard private equity investment thesis being generally based on one of three exploitation concepts:

- Funding the continued growth of a successful business model to increase market share, revenue and earnings.
- Improving earnings through transforming the cost base and introducing high performance working practices.
- Increasing scale through a roll-up of similar assets to create a strong market position, benefit cost reduction through synergy, and achieve greater efficiencies through economies of scale.

None of these concepts is dependent on explorative innovation or R&D. The investors were all seeking proven businesses with proven management that they could back to create growth, prior to selling to a secondary buy-out firm or a trade buyer within a defined time period which was widely regarded to be between 5 to 7 years. Consequently, there was limited appetite for exploration or R&D and much more focus on exploitation of existing intellectual property.

> *It is a lot easier to say, "yes" to something that builds on what we already have.* (PE1EX1)

> *It is a time thing. Doing something new from the ground up takes time. There are too many unknowns. Can the team get the software delivered? Will the market buy what we have built? None of us like the "if we build it they will come" model [referencing the movie, "Field Of Dreams"]. We are usually working towards a planned exit and so we just don't have time for distractions.* (PE5EX1)

> *We love to work with creative management teams, but we don't always like their creativity.* (PE6EX1)

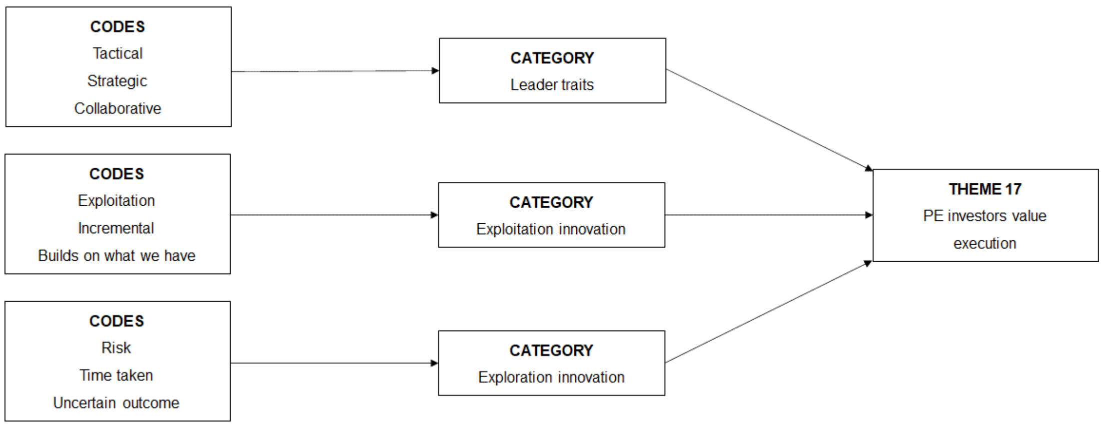


Figure 6.20 Chain of evidence: theme 17

Theme 18. CEOs established credibility with the PE investors interviewed by demonstrating their execution capability against the initial investment thesis.

The competition to find good investments is intense. All the investors discussed the pressure to deploy their funds but were also acutely aware that they are reliant on the execution ability of CEOs. They discussed their experiences of working with owner-managers who are new to PE investment and all the investors had similar experience of this. They stated that owner-managers who lacked prior PE backed CEO experience were sometimes excellent. However, many of them found it hard to adapt to the more disciplined and focused regime that follows professional external investment. The rigours of working with a formal board and developing a relationship with a chairperson can sometimes feel like unnecessary bureaucracy to an owner-manager that has been used to acting autonomously. Sometimes, owner-managers develop a relationship with their firms that can be described as a "lifestyle business". This is inconsistent with the values and obligations that PE investors operate under. Shared decision making with the chair and board is often a challenge and owner-managers are not used to experiencing limits on their power. They may lack the full range of business skills are often weak in areas of compliance, finance and what the PE company expects of CEO in terms of focus, urgency, team building and developing a winning culture. If the business has been long established under private ownership, there is often a deeply ingrained culture and the team around the CEO may contain friends and relatives who are also part of the "lifestyle business" regime. This can mean that management and the investors do not have aligned objectives. It may also mean that the senior team lacks diversity in most respects, and in particular lacks diversity of experience. Ultimately, investment success for the PE investors depends on the CEO's ability to execute against the agreed business plan.

> *It's not easy. Lots of entrepreneurs fail and the tech space can be very competitive. I admire them. We see a lot of businesses run by really passionate people*, *and by the time they get to us, they have often proved themselves. They can execute.* (PE3EX1)

> *There are lots of good ideas, but the question we ask is, "can this guy deliver"?* (PE4EX1).

> *We do everything we can to de-risk our investments. That's why we do DD [due diligence]. But once we put the money in we are in their hands. We want them to be successful and we will do all we can to help, but they have to do it.* (PE6EX1)

The PE investors expressed uniformly strong views on the importance of execution skills in the leaders they select.

> *It doesn't really matter how smart or creative they are – what I am interested in is execution. Getting stuff done.* (PE2EX1)

> *The best ones are like us – they are opportunistic and pragmatic, but they stay focused on the prize.* (PE4EX1)

> *I have sat in lots of Board meetings listening to smart CEOs try to persuade me of reasons to vary from the plan – the original thesis. It is probably no coincidence that this happens when the core business is experiencing problems. We try to be supportive, but we know from bitter experience that sticking to the knitting is almost always the right thing to do with these businesses.* (PE1EX1)

The ability to forge effective relationships with all stakeholders and the ability to align the team behind the objectives of the SMSE were highly prized by all of the PE investors.

> *Good CEOs know how to align their constituencies and manage the diverse interests of stakeholders. They get the best from everyone and the best for everyone. It's difficult to please everyone. It is a balancing act.* (PE5EX1)

Some of the investors were explicit in mentioning "*pragmatism*" (PE4EX1) and the ability to spot when an opportunity presents itself, creating or spotting an inflection point in the business that might allow it to scale profitably.

> *It is almost instinctive. Maybe it comes from experience or maybe it is innate. Some people just know when to strike.* (PE6EX1)

Detailed technical knowledge was felt to be less important in most businesses. Good CEOs were felt to be able to harness the skills and knowledge of those around them and also to work with a wider community beyond the confines of the corporate structure. Evidence that CEOs are always learning and applying new knowledge was mentioned by some of the interviewees.

> *We often come across them because they are great networkers. That's how they get onto the RADAR. That social quality is important to them forging market relationships and internalising knowledge and opportunity.* (PE2EX1)

Whilst higher management degrees and professional qualifications might be desirable, they were viewed as far from essential, and no substitute for experience, which was much more highly prized.

> *A couple of years ago, I read a piece in HBR (Harvard Business Review) about how PE firms hire CEOs. It was US centric - these things often are, but I thought it was BS. I mean, they were saying that we value experience less than ability. We want both. If someone has already executed well and*

> *got a good exit, then maybe they got lucky, but probably not. Especially if they have done it more than once.* (PE1EX1)

A variety of methods were used to identify and select CEOs, including graphology (handwriting analysis) in one firm (PE1). There was a wide range of opinions on effective techniques for assessing candidates. However, external recruiters were often involved and the one thing they all agreed on was the importance of thorough referencing.

The strongest idea to emerge from this part of the interviews was that effective execution builds trust between the investors and executives. Investors showed some tolerance of variance from plan in the early stages of an investment and were willing to work with a CEO to supplement or diversify the management team or provide coaching and support. However, in the event that performance did not start to improve then the PE investors viewed it as a matter of duty to make changes. Not surprising then that a global survey of private equity investors and CEOs showed that 73 percent of CEOs are replaced by PE firms and 58 percent of those within the first 2 years following investment (Bililies, Warren and Roger. 2017). The focus on execution against the original business plan and the risk of owner-managers being replaced by PE investors resulted in the writing of memo 10.11 (appendix 10).

The integrative category diagram below (figure 6.22) shows the inter-relationship between categories that emerged from the grounded theory coding exercise on the PE interviews. The diagram plots a clear route to building trust between the PE investor and the CEO if the business executes well against the original investment thesis. It also shows a feedback loop based on the executive leader not being perceived to have executed well. Interventions may include supplementing the management team, providing additional skills or resources or providing coaching and training in the first instance. However, this step may also often involve replacing the CEO.

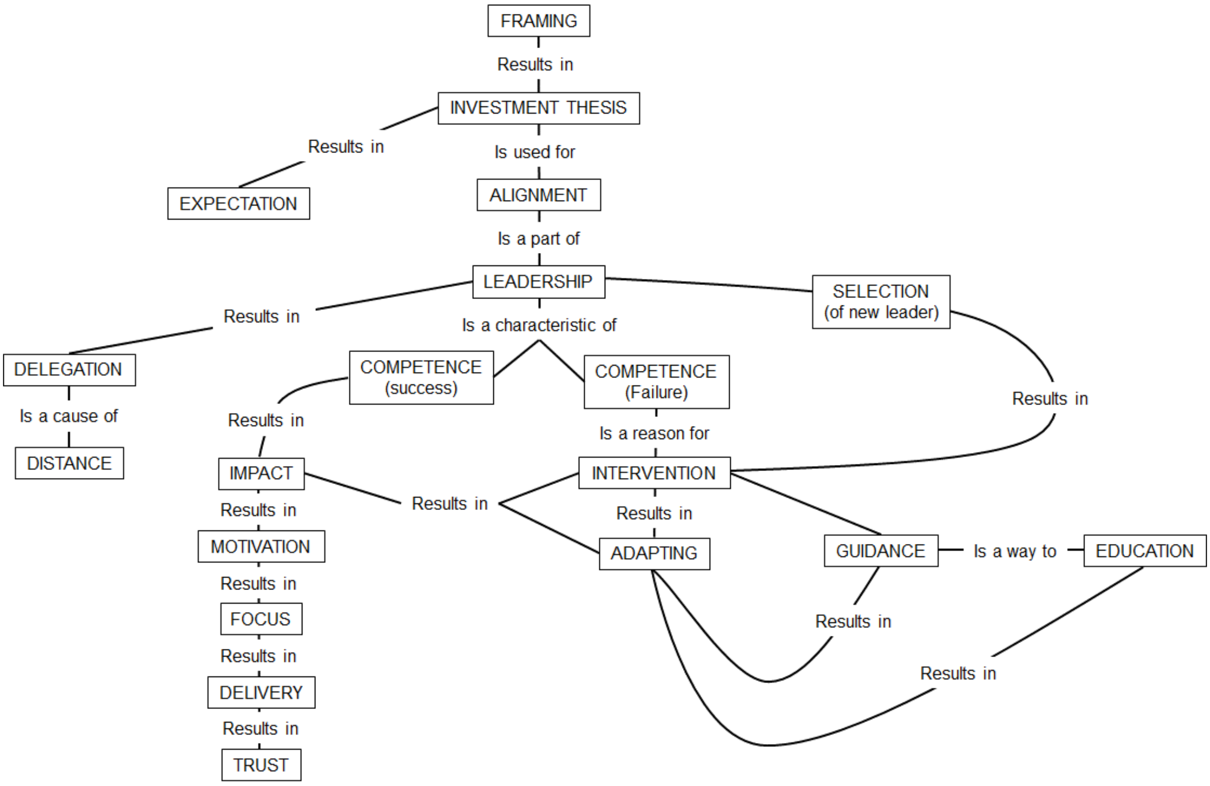


Figure 6.21 Integrative category diagram showing how leaders can establish trust with PE investors

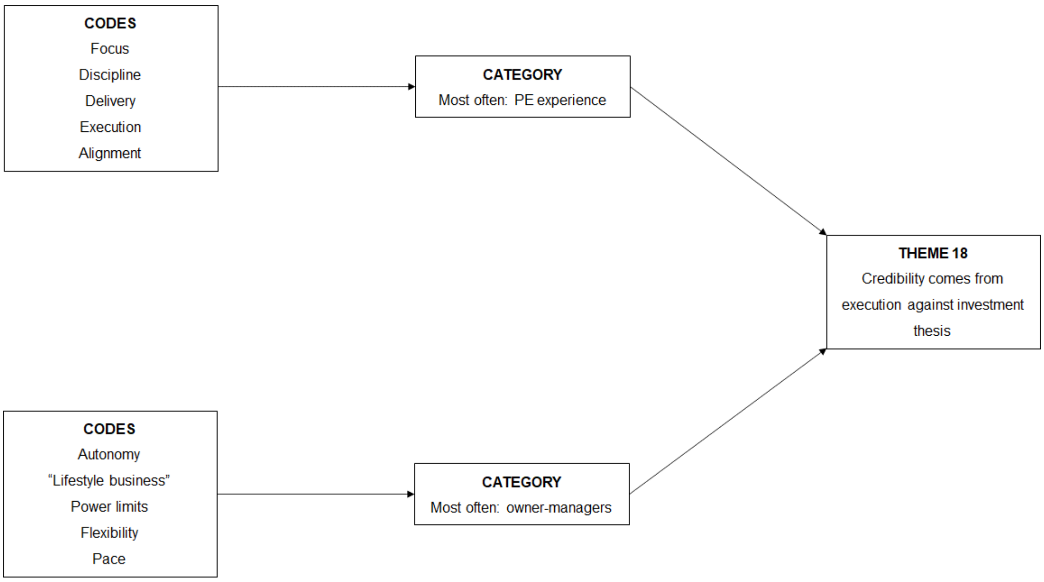


Figure 6.22 Chain of evidence: theme 18

Theme 19. The PE investors interviewed frequently replaced owner-managers with CEOs who had prior PE experience.

As illustrated in figure 6.22 (above), execution failure is one of the reasons that investors may intervene in a business, and possibly replace the leadership. All of the investors had personal experience of having to replace owner-managers with externally recruited CEO.

The fact is that working with PE does not suit everyone. We will work hard on helping them understand how we work – what matters to us. We are tolerant of personalities. But the thing we cannot live with is consistent failure. There are always "buggeration factors" in every business – we know that – we see it all the time. But good executors manage this and still find ways to succeed. (PE1EX1)

It is hard for some of them to adjust. They suddenly have all kinds of oversight and new disciplines. I don't think we are demanding to be honest, but if you have been chief in your own little fiefdom for years and suddenly you have people like us looking over your shoulder it can be difficult. Sometimes it doesn't work out. (PE2EX1)

Look, it's the miserable bit of the job. You find someone who has put their heart and soul into something for years. Often they roll-over some or all of their equity when you invest. You then discover that they are just not up to it. (PE5EX1)

All investors expressed a preference for trying to work with new CEOs and help them be successful. This could take the form of coaching or supplementing the leadership team with people with complementary skills and experience. They also discussed the importance of an effective and experienced chairperson in helping to guide new CEOs through the learning curve of working with private equity and balancing the interests of all parties. Whilst acknowledging the potential cost and impact of replacing an owner-manager on the culture and momentum of a business, they had all experienced it and some noted that on occasions the replacement had resulted in immediate improvements in morale, motivation and culture.

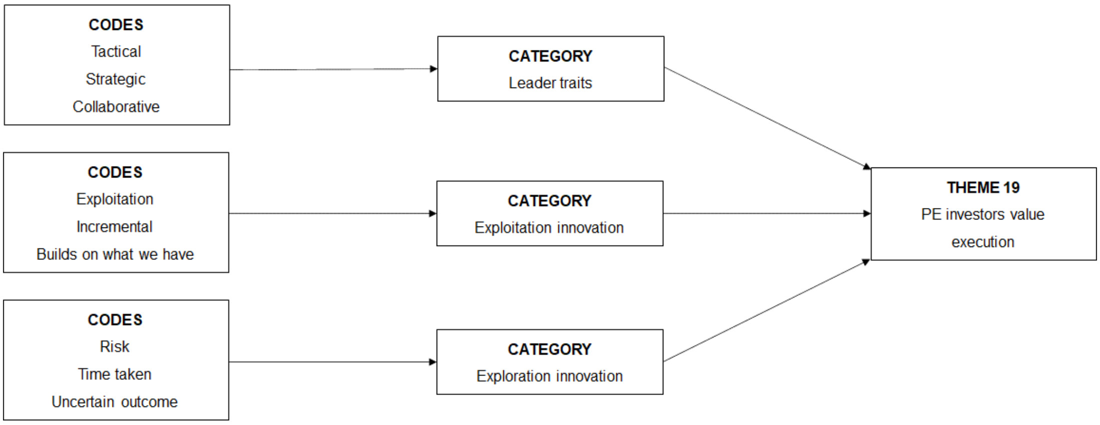


Figure 6.23 Chain of evidence: theme 19

Theme 20. The PE investors interviewed preferred to invest in firms that had established product market fit and a proven and scalable business model.

The PE investors interviewed agreed that many software businesses have attractive financial attributes such as high gross margin, predictable annuity or subscription revenues and good cashflow. They can usually sustain a reasonable amount of debt, allowing the PE to leverage their equity. They were excited by software investments because some firms had experienced exits with high valuation multiples of earnings before interest, tax, depreciation and amortisation (EBITDA) or valuation based on multiples of revenue. These high valuations can be achieved in some segments of the software industry, particularly if the business has established some degree of differentiated competitive advantage or unique intellectual property. However, PE investors also said that they have a limited appetite for start-ups or significant diversification in software firms and believe that other sources of funding are more appropriate for such investment opportunities. They prefer to buy or invest in businesses that have established product market fit and achieved some existing scale. They like to see organic growth potential or the opportunity to lead or benefit from a sector consolidation. They are happy to be on the sell-side of transactions if the firm they have invested in has a degree of rarity value.

The investors noted that not all SMSE are suitable for private equity investment. Issues of scale and scalability in terms of the firm and the market were frequently mentioned. They also tried to avoid undifferentiated or commodity businesses unless they had scale advantage. Businesses that are showing evidence of slowing growth or those that work in an area that may face rapid technical obsolescence were also to be avoided. All agreed that the role of private equity was not to fund start-up or early stage businesses:

> *We don't have a mandate from our investors to do that kind of thing. It is the domain of angels and VCs [venture capitalists]. We know that our investments are never a sure bet, but we cannot take LP money [limited partner money is the money that external funds and high net worth individuals invest in the funds of PE firms] and throw it on the roulette table, even if we get convinced we are looking at the next "unicorn" [a unicorn is a private business valued at more than US$1 billion].* (PE2EX1)

> *I saw one last week. Great idea in the insurance industry, but it was too early. The investment thesis was solid, but it is just not our bag. He needed an angel.* (PE4EX1).

It's not "Dragon's Den" [UK television series where entrepreneurs seek investment from high net worth individuals]. We need to be sure that they have something repeatable and scalable. (PE7EX1)

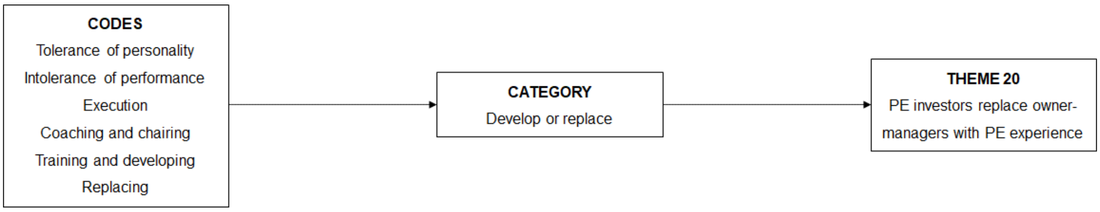


Figure 6.24 Chain of evidence: theme 20

Theme 21. The PE investors interviewed leveraged their equity investments with debt and so intentionally restricted cash available to SMSE.

The PE investors were all clear that they operated a debt leveraged model that required a high degree of financial discipline within their portfolio companies. The consequences of this are that the SMSE needs to be disciplined when it comes to finances and cashflow management. The investors were clear that their investment should not encourage profligacy and that the companies that they invest in need to be able to service debt.

You have to understand our model. It is about leverage. We need to make the money work. (PE2EX1)

I know it is hard for new management teams to understand. Our job is to provide capital and although we all try to differentiate ourselves in the competitive market to find the best investments, capital is a bit of a commodity. When we start working with a new team – an inexperienced team – they often don't really understand how we work and they think we are just sitting on pots of money that we can throw at their business. We have a commitment to our LPs [limited liability partners who invest in the PE fund] and there are regulatory constraints. The business also has to be able to service its debt, which can be considerable in an LBO [leveraged buy-out] structure and quite complicated. We prefer management to stick to the plan, execute well, get the business through cashflow break-even and help us pay down the debt. Bringing new and speculative investments to the table rarely works for us. (PE3EX1)

When we invest it is always against an investment thesis that reflects our views of the market and the firm, and a business plan that is management's best guess as to how the business will develop. We know things don't

> *always go to plan, but we don't like having to put more cash in to cover unexpected losses. We willingly follow our money to take advantage of opportunity. But those opportunities need to be real. The problem that new software ideas represent is we have seen so many projects go wrong, taking longer than expected, failing completely or never delivering the revenue that was promised.* (PE6EX1)

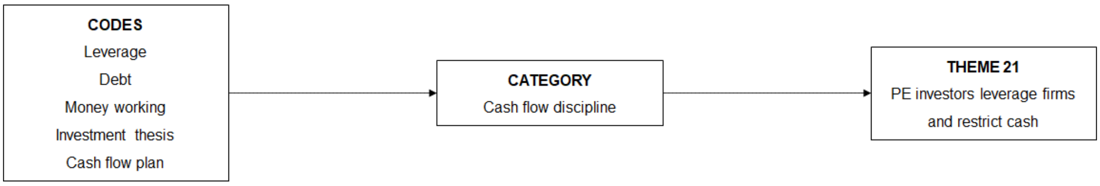


Figure 6.25 Chain of evidence: theme 21

Theme 22. Most of the PE investors interviewed claimed to support investment in innovation if funded from the existing cash resources of the business and subject to approval of a business plan.

PE investors are familiar with investing in software firms and understand that there is a requirement to continue to invest in platforms to meet customer need, improve performance and efficiency, enhance feature functionality for competitive reasons and stay current in terms of hardware, operating systems and other adjacent software or telecommunications technology. This process usually requires a combination of capitalised and expensed ongoing investment and in well-run firms manifests itself through a regular cadence of planned version releases. Occasionally, bug fixes require software patches to be released outside of the normal release schedule. Investors are tolerant of this activity, which largely constitutes exploitation rather than exploration.

The investors are focused on value creation within a defined time period. They PE firms interviewed for this project expressed limited tolerance for innovation in entirely new software applications.

> *We want to create value. If the team comes to us with a well thought out idea and we can see how it creates value within the life of the investment then of course we will be supportive. But with PE, the clock is ticking and every dollar of debt paid down is a dollar of equity earned. It is just the way the model works. It is a model designed to encourage focus.* (PE3EX1)

One investor claimed that he had occasionally supported more exploratory projects, but only on the basis that the project was being funded from free cashflow earned by the business, rather than requiring additional funding:

> *Sure, we will support innovation. If it is in plan, then no problem. If it is a new idea we will even go with it, providing the business is using its own rocket fuel and we are not writing another cheque.* (PE1EX1)

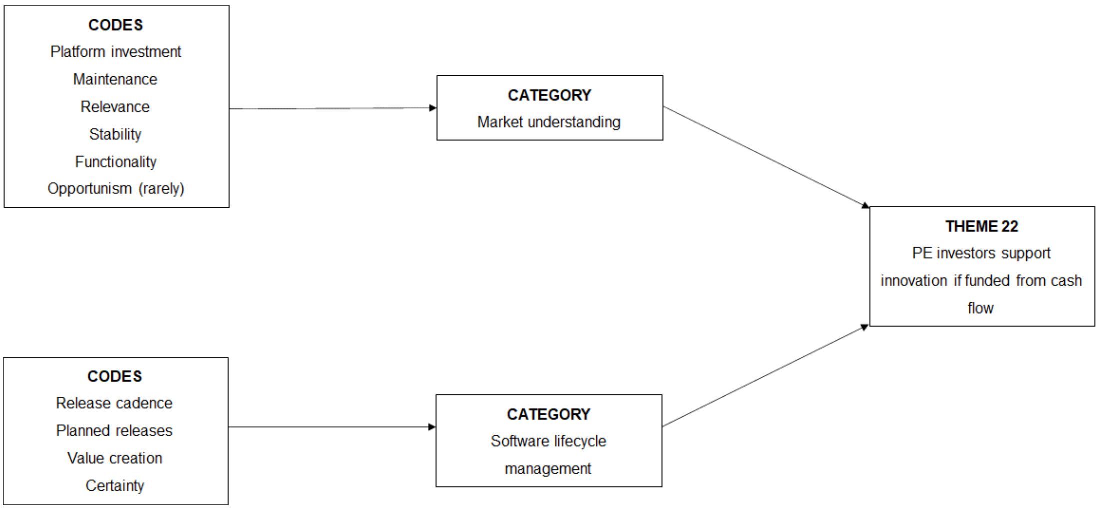


Figure 6.26 Chain of evidence: theme 22

Theme 23. The PE investors interviewed had limited direct exposure to software engineers and trusted their CEOs to manage these relationships effectively.

Most of the PE investors interviewed had relatively little contact with the engineers within their portfolio firms. Although some of the investors had academic backgrounds in natural sciences, none of them were engineers or had any professional experience of developing software or running software businesses themselves. They left the recruitment, management, retention and motivation of the engineers entirely to the executives employed to lead their businesses, and they regarded this as appropriate as they felt it important that the demarcation between the roles of investors, non-executive directors and executive leaders should be clear and respected.

> *They [software engineers] are like mythical creatures – wizards making magic potions - who we are rarely allowed to see.* (PE3EX1)

> *We have to trust our leadership teams to manage. We sometimes see the engineers – demos or company events. I enjoy talking to them, but I don't*

think it makes management comfortable to have the PE investors crawling all over their people. (PE4EX1)

In the event that a non-executive director appointed by the PE firm came from a software engineering background, then one PE investor acknowledged it might be appropriate for them to be more directly involved with the engineers from time to time. However, this was deemed to be something the executives would control and would typically be by invitation:

Sometimes we might have a chair in one of the portfolio companies who comes from a more tech background. Management might ask them to engage or for an opinion. That is probably as close as we get to the engineers to be honest. (PE6EX1)

Only one of the engineers interviewed (F5ENG1) mentioned having met a non-executive director.

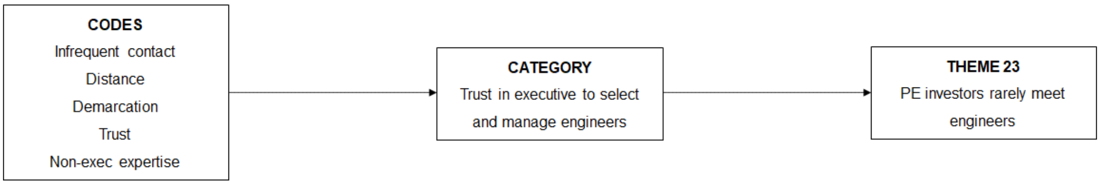


Figure 6.27 Chain of evidence: theme 23

6.4 Chapter conclusions

The chain of evidence from the 34 interviews tells a story of life in British SMSE that is based on the intersubjective experience of executive leaders and software engineers. Some of these firms are owner-managed and some firms are observed, funded and influenced by PE investors. Irrespective of the funding model, the executives all discussed the battle for survival through maintaining positive cashflow and the implications of this in terms of their appetite for investment in innovation and therefore the innovative work behaviour of the SMSEs they ran. This concern with cashflow was no less evident in larger well-established SMSEs that it was in smaller or struggling SMSEs. In fact, those executive leaders running economically successful enterprises seemed to have an ingrained focus on cash and cash generation that they might argue to be one of the reasons for their success.

Analysis and coding of the narrative content of the interviews has identified 23 themes that relate to innovation and innovation leadership in SMSE. These themes are shown in a single table as Appendix 9. In relation to the original research question, the main influence on innovation that executive leaders seemed to exert on the engineers that they led was the practical and instrumental provision of support and resource when required. The biggest threat to the motivation and retention of the engineers related primarily to the culture and climate of the firms. This could be threatened by success that might lead to growth and a more formal corporate structure and style. Equally, it could be threatened by failure, that might increase pressure on short term results and reduce availability of resources and time. The engineers wanted to develop software that they could be proud of and that showcased their skills. They had an explicitly expressed appetite for novelty. The executives and investors were both more naturally focused on incremental innovation and establishing the product market fit required to ensure profitable growth of their firms based on the existing strategy and product set.

Chapter 7 will now consider these findings in the context of the extant literature on innovation leadership and SMSEs.

7 DISCUSSION

7.1 Chapter introduction

This chapter considers the findings of the research in the context of the extant literature. The research methodology proved effective in the collection of rich and relevant data to allow the research question to be assessed from the perspectives of executive leaders, software engineer followers and PE investors.

The chapter considers the nature, processes and experiences of innovation leadership in the SMSE researched in comparison to the extant literature. A construct of innovation leadership specific to the findings of this research is proposed and contrasted to an idealised model that is suggested by the literature. The extent to which leadership influences culture and creative climate are explored and the possible impact that PE investment has on SMSE is discussed. The implications of this research for theory, practice and policy are discussed. The chapter concludes that whilst there are some general areas where extant theory is supported by the findings of the research, there are some specific areas where the SMSE analysed in this research depart from established theory.

The study of innovation and innovation leadership in SMSE offers an exciting prospect of establishing a new trajectory of academic inquiry that might contribute to knowledge and lead to useful insight for practitioners, investors and policy makers.

7.2 Innovation in SMSE

The genesis of each firm involved in this research resulted from the vision and creativity of a founding entrepreneur who identified an opportunity to solve a problem through the application of computer software. Some of these entrepreneurs and innovators are still leading the firms that they founded. As discussed in chapter 2, the organisations studied fit best into Pavitt's (1990) fifth category of innovative firms which he classifies as "information intensive".

Three different types of innovation were identified in the founding phase of these firms. Some SMSE originated with an entirely new idea and established a business opportunity by providing software to do something novel. Other firms built on prior art, improving on the efforts of established firms to carve out a niche of their own through adaption. The third group of SMSE are disruptors in the sense described by Christensen (1997). They identified a market where large established firms held oligopolistic power and challenged that power through creating an alternative solution that initially competed on price, functionality, or both. These approaches are consistent with the definition of software innovation offered by Lippoldt and Stryszowski (2009).

In common with the Schumpeter Mark II model of innovation in large firms (Nelson and Winter 1982; Kamien and Schwarz 1982), large technology companies pursue systematic and professional R&D to develop new trajectories in computing capability. By contrast, SMSE are atomistic firms plying their craft skill to carve out a niche where they may have competitive advantage, or at least be able to harvest a comfortable living. Therefore, SMSE can be better understood in the context of the Schumpeter Mark I model of entrepreneurial innovation (Nelson and Winter 1982; Kamien and Schwarz 1982). Over time, some of these firms may be blown aside by Schumpeter's (1942) gale, some may be bought by larger industry incumbents, as their potential to disrupt (Christensen 1997) becomes a threat or an opportunity to the behemoths of the industry. A few firms might continue to dominate their niche and then seek expansion into market adjacencies, growing into the next generation of behemoths. At least one of the SMSE interviewed for this research seems to have this vision and potential.

Drucker (1954) tells us that innovation is a basic and important function of business. The rapid economic development of the last two centuries is explained in part by successful technological innovation (Mokyr 2010) that has allowed humanity to harness the power of the natural environment and develop a sophisticated bourgeois consumer society (McClosky 2010). Schumpeter (1942, p.82) described the "*gale of creative destruction*" that sweeps through markets and industries as entrepreneurs launch new products and services born from their own creativity, imagination and insight (Schumpeter 1934). Schmookler (1966) considered the pull of demand as a stimulant to innovation. These perspectives on the stimulants for innovation have been bridged through a model that couples the processes of technology push and demand pull (Rothwell and Zegveld 1985). Consistent with the model proposed by Crossan and Apaydin (2010), the broader narrative content of the interviews suggests a more complex picture of innovation having many triggers and influences. Both executive leaders and engineers noted demand pull (Schmookler 1966) directly from existing customers requesting specific improvements to feature functionality, stability, performance, and usability of software as a stimulus for innovation. The complexity of innovation origination within these small firms embodied need, conception, and capability consistent with the coupling model (Rothwell and Zegveld 1985) and on occasions reflected the reality of cyclical economic factors which either stimulated or supressed demand from existing markets (Freeman 1979). However, beyond establishing initial product-market fit, there was limited evidence of technology-push or radical innovation in the firms interviewed.

Much of the literature assumes innovation to be necessary for the survival and success of firms (Martins and Terblanche 2003; Pikkarainen et al. 2011; Pisano 2019). Rose (2010) suggests that innovation is important for differentiation and margin defence in software firms. For the SMSE interviewed for this thesis, the leaders were primarily focused on cash and cashflow. In this situation, it seems that innovation is undertaken defensively against competition and reactively to satisfy customer requests, and so maintains rather than significantly grows market share (Heirman and Clarysse 2007; Cooper 2011 and 2012). Consequently, the firms interviewed for this research showed no evidence of the ambidextrous leadership of innovation (Tushman and O'Reilly 1996; Zacher and Rosing 2015; Uhl-Bien and Arena 2018). Instead, they focused on the exploitation of existing knowledge and capability through the incremental improvement and adaption in feature functionality of the software, usually in direct response to customer requests. Even in the firms that had tried to establish a process for ideation, resource choices and constraints meant that they did not actively encourage exploratory innovation. One owner-manager with a relatively mature business revealed that he sets aside budget every year to support exploratory innovation but then always sacrifices that budget early in the year to support specific customer projects.

The avoidance of explorative innovation or R&D by SMSE carries short term efficiency benefits that are reflected in profit maximisation (Nelson and Winter 1982). At an industry level, if all firms behave in this way the societal impact of the duplicative costs of R&D are avoided, but longer-term benefits may also be sacrificed. As discussed in chapter 2, Govindarajan (2016) recommends what he terms the "Three Box Solution" to executing an existing business efficiently, avoiding traps of past success, and innovating for the future. Instead, the firms interviewed for this research showed little evidence of developing new business ideas beyond the trajectory determined by product market fit from their inception and demonstrated little conscious consideration of the consequential arc of that trajectory.

The literature suggests that innovation requires firms to embrace risk (Utterback 1994; Song and Montoya-Weiss 1998; Ahmed 1998; Bessant and Tidd 2016; Pisano 2019). Despite the focus on incremental and exploitative innovation, the interviews with SMSE leaders did not indicate a conscious or espoused reluctance to innovate as expressed by Ahmed (1998). None of the leaders explicitly said that risk of failure was the reason that they did not undertake radical or exploratory innovation. Although PE investors did articulate concerns about the risks of innovation, no explicit link between risk adversity and an aversion to explorative innovation was noted in the executive leaders. Rather, the executive leaders had an almost habitual focus on cash generation and survival that seemed all pervasive, and so the organisations rarely considered the possibility of radical (Henderson and Clark 1990; Damanpour 1991) or explorative (Tushman and O'Reilly 2006; Zacher and Rosing 2015) innovation because the focus on cash generation remained all consuming.

Only two of the firms operated a formal innovation process in the way envisaged by Goffin and Mitchell (2017) (figure 2.4 above). Even in these firms, innovation was primarily incremental and path dependent. Neither of these firms displayed the breadth of dimensions indicated in Goffin and Mitchell's (2017) model (figure 2.5 above) and focused their efforts only on the dimensions of new features, functions and services. Generally, the firms interviewed did not show evidence of formal process from ideation, through prioritisation and implementation.

The interviews with executive leaders and software engineers both suggested strong support for many aspects of the integrative model of innovation drivers in SMSE proposed by Rose and Furneaux (2016). Their extensive literature review identified managerial, team and knowledge drivers for innovation which were moderated by path dependency and installed base. In the field research of Rose, Jones, and Furneaux (2016) innovation leadership related primarily to path creation, work environment, evaluation, and financing. In this research some similar themes were identified. In particular, the installed base of software with existing customers of the SMSE seems significant in defining incremental feature functionality innovation following an existing technological trajectory or dependent path. However, once the leaders interviewed for this thesis had established product market fit, they did not engage in path creation and mediation of creativity in the same way as those studied by Rose and colleagues. In fact, detailed conversations or workshops with software engineers were uncommon. Generally, these leaders discussed closing leader behaviours (Zacher and Rosing 2015) or convergent behaviours (Van de Ven et al. 2017) intended to keep engineers focused on path dependent incremental innovation in response to feature and functionality requests from customers.

Hunter and Cushenberry (2011) have constructed a model of indirect and direct leader influences on creativity and innovation (figure 4.4 above and 7.1 below) which provides a useful framework for considering the interview responses of engineers. In figure 7.1 (below), each of the areas of indirect and direct leader influence proposed by Hunter and Cushenberry are colour coded to reflect the degree to which engineer followers acknowledged leader influence.

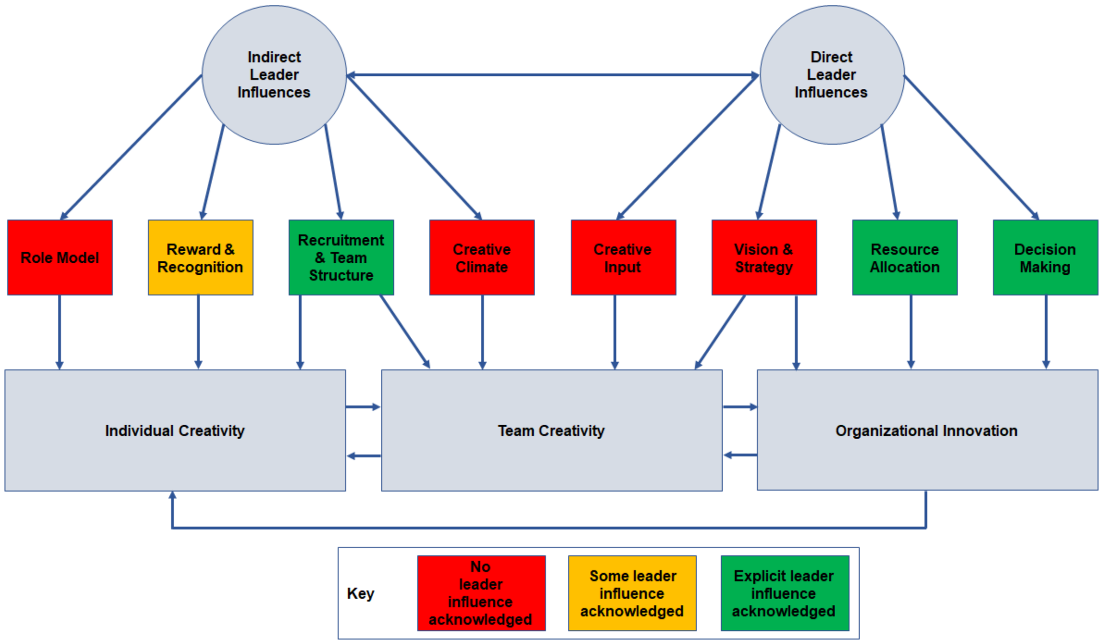


Figure 7.1 engineer acknowledgement of leader influence (Hunter and Cushenberry 2011)

The engineers rarely saw their executive leaders as role models, even when those leaders had an engineering background. Reward and recognition seemed like a controversial topic with the engineers. Most engineers did not have equity incentives in the business, but generally did not express the desire to be shareholders. In most firms, bonuses were either unheard of or awarded in a way that the engineers regarded as capricious, consistent with the findings of Skinner, Pownall and Cross (2003). In the main, engineers regarded their salaries as adequate and were satisfied with pay and conditions. Public recognition was not universally appreciated by the engineers, who in the main preferred a personal expression of gratitude, or simply knowing themselves when they had done a good job: taking pride in this was often enough, without seeking external validation or kudos.

The engineers interviewed for this study generally regarded financial reward as a hygiene factor (Herzberg 1966 and 1968). They were much more focused on self-actualisation (Maslow 1943) and seeking technical challenges that stretched and developed their skills, allowing them to take pride in creating software that showcased their abilities and was socially useful. The engineers generally had a desire to work on interesting projects and wanted challenge and variety. They liked the idea of being associated with exploratory innovation (March 1991; Tushman and O'Reilly 1996) even though their jobs rarely required this type of activity. Recognition was to some extent important, but their self-actualisation was more of an intrinsic phenomenon: they knew when they had done a good job and were proud to showcase their software and skills.

The engineers interviewed were conscious of what Hunter and Cushenberry (2011) identify as direct rather than indirect leader influences on creativity and innovation in the form of resource allocation and decision making. Engineers said that most executive leaders had limited creative input to the development of software. Most engineers did not indicate that their leaders had given them a clear view of vision and strategy. In fact, interactions were primarily focused on short term delivery of user requirements.

Hunter and Cushenberry (2011) identify recruitment as an area of indirect leader influence. Leaders and software engineers in some organisations discussed recruitment. For most organisations, recruitment lacked formality and was often through word of mouth or targeted a local university, typical of egocentric recruitment practices in SME discussed by Skinner, Pownall and Cross (2003). This may have been a contributory factor to the apparent lack of diversity in the organisations. However, the three most mature organisations did recruit more widely and reflected a slightly greater degree of diversity in the engineer population. The engineers interviewed did not seem aware of or concerned by the lack of diversity in their organisations, except for one female engineer in the cohort who correctly pointed out that I would be unlikely to find another woman to interview in an engineering role within an SMSE.

For the firms analysed in this research, technology push may have defined their inception. Beyond the innovative inception of the firm, once product market fit was established, the primary focus of innovation became the development of features and functionality within an existing software code base, representing incremental innovation (Henderson and Clarke 1990; Damanpour 1991; Nagi and Tuff 2012). Executive leaders and engineers both explicitly expressed the conflicting view that they were the primary initiators of innovation, suggesting a Schumpeterian technology push perspective (Schmookler 1966; Rothwell 1975). In practice, incremental innovation was undertaken in response to the pull of customer or market demand and often manifested itself as creative problem solving within the development of existing products or processes. Both leaders and engineers were involved in this process, but the creative cognition seemed to rest primarily with the engineers.

The SMSE in this research seemed to be pursuing common evolutionary paths. The original innovative step that led to the inception of these firms came from novelty, adaption or disruption and often involved risk taking and radical innovation on the part of the founding entrepreneur. In remembering the early stages of the lives of these firms, many of the owner-managers discussed their personal search to establish product market fit whilst dealing with funding pressures. In the early stages of development, the founding entrepreneurs were often working alone or in a very small group and they were often personally responsible for controlling the development of the software whilst simultaneously trying to find customers and investors.

Several of the executives discussed the common experience of cashflow constraints threatening survival, and this seems to be a common and strong influence on their future behaviour and attitudes as leaders of innovation within their future careers. Once product market fit was established, future innovation was usually path dependent and incremental, responding to customer and prospect requests to make changes to the existing code base, primarily based on demand pull, with limited technology push.

For the PE owned firms, the objective was usually to reach a point where the business could be sold, making a profitable return for shareholders. This was also the ambition for some of the owner-managers. At least one of the firms aspired to an independent future, with growth being derived organically and through merger and acquisition, to make the transition to becoming a large firm, possibly publicly listed. Not all firms will be successful, and there were early signs of non-cyclical decline manifested through falling revenue and tightening cashflow in two of the

SMSE interviewed. This evolution was observed in interviews with leaders and investors and is summarised in a development pathway for SMSE shown in figure 7.2 (below).

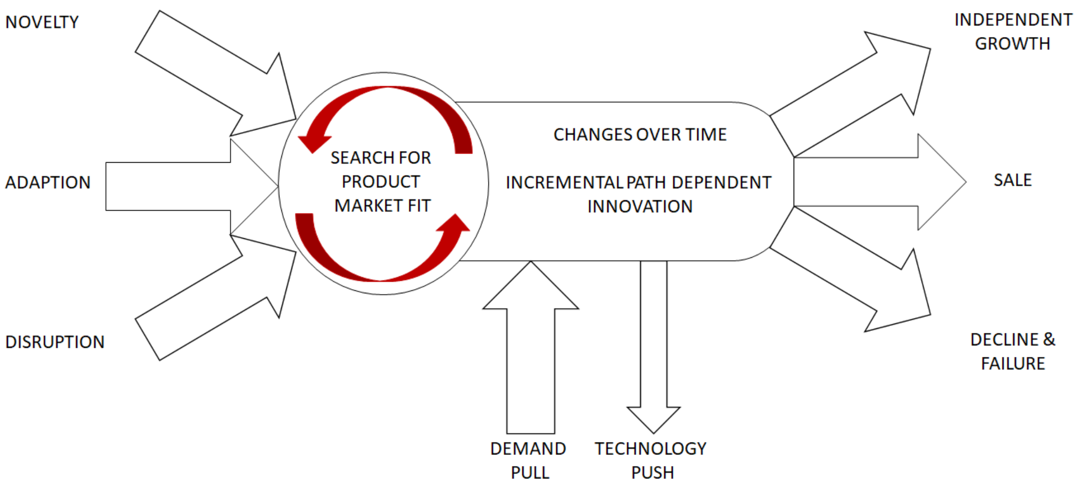


Figure 7.2 SMSE hypothetical evolutionary development pathway

7.3 Leader traits, skills, behaviours and styles

Despite the growth of the leadership industry (Pfeffer 2015), the leaders interviewed for this study did not display a significant awareness of academic leadership theory. Difference in experience and management education between the owner-managers and PE backed leaders was evident in their biographical data. Owner-managers did not display significant reflexivity (Alvesson, Blom, and Sveningsson 2017) with respect to their leadership impact. Leaders of PE backed firms tended to be more reflexive and displayed a common vocabulary for discussing leadership grounded in popular leadership literature rather than academic theory. They appeared to be more explicitly aware of their personal impact. Although all the SMSE executives seemed to be project delivery orientated rather than strategic in outlook and all leaders were very aware of cash and cashflow, the leaders of owner-managed firms tended to be more absorbed by constant financial and operational concerns.

Many of the executive leaders had technical skills in software development and these skills had often been deployed in the early stage of the development of the SMSE. Vincent, Decker and Mumford (2005) note that technical skills and expertise are considered success factors in the leadership of creative projects. However, except for F3EX1 and F4EX1, most of the leaders made little or no technical contribution to projects. Planning skills are also considered important to innovation success (Marta, Leritz and Mumford 2005; Gross 2007; Bujis 2008; Stockstrom and Herstatt 2008) and the interviews with executive leaders frequently mentioned planning, particularly in the context of financial management, budgeting, and project management.

The executives faced daily challenges of various magnitudes in running their businesses, as is normal. However, the PE backed executives were notably more articulate in describing how they solved problems and constructed solutions, perhaps reflecting how experience might complement traits in effective leaders (Mumford et al. 2000a). The fact that this sub-group of PE backed executives had more years of experience, had performed leadership roles in multiple firms, and had been selected based on the evidence of prior success may go some way towards explaining the difference between owner-managers and PE backed executives.

The PE investors interviewed had all experienced the cost and disruption of replacing CEOs after investing in owner-managed businesses. The PE backed CEOs interviewed had generally been hired to replace an outgoing owner-manager who was struggling to adapt to PE ownership. The poor survival statistics for CEOs of firms newly acquired by PE (Bililies, Warren, and Roger 2017) suggest that owner-managers struggle with the transition to PE ownership and may therefore benefit from some formal professional development before engaging with PE investors. However, the literature documents the difficulties that owner-managers have in committing time and resources to formal education outside of the workplace (Garengo, Biazzo and Bititci 2005) and often their skills and knowledge develop through day-to-day interaction with peers, colleagues, customers and suppliers (Gold et al. 2007).

PE investors discussed their preference for hiring CEOs with proven experience of delivering a valuable exit. However, Cohn and Flaum (2016) have noted that recruiting experienced industry insiders who have a traditional business education may not reflect the specific contingent situation that a firm is facing. Instead, they counsel looking for resilience, a sense of urgency, team building skills and candour. The lack of leadership and entrepreneurship skills in UK SME was noted in a 2015 Government research paper (Hayton 2015) which linked these skills to business performance metrics. Entrepreneurial traits and skills have been previously linked to commercial success for SME growth firms (Baum, Locke and Kirkpatrick 1998; Baum and Locke 2004).

On the occasions that executive leaders did become directly involved in influencing innovation, they most commonly displayed closing leading behaviours (Zacher and Rosing 2015) and focused on convergence (Van de Van 2017), exploiting path dependent development trajectories (Boland, Lyttinen and Yoo 2007) enabled through a construct that resembled aspects of instrumental leadership (Antonakis and House 2002, 2004 and 2014). Innovation was primarily exploitative rather than explorative (Zacher and Rosing 2015; Uhl-Bien and Arena 2018) and leader behaviours did not support an agenda of radical or disruptive innovation. Consequently, even when engineers did offer interesting ideas for disruptive or radical innovation, the existing path dependent trajectory of the firm was re-enforced by executive leaders based on a heuristic that seems heavily influenced by cashflow optimisation. The leaders were generally unwilling to invest a defined percentage of immediate resource and cash to develop new trajectories that might be in the longer-term strategic interests of the firm. However, they were willing to invest in resources to deliver more immediate incremental innovation in response to direct customer feedback.

In common with instrumental leadership theory (Antonakis and House 2002; 2004 and 2014), the leaders in this study formulated strategy by analysing external demand for feature functionality but determined action by considering the impact on cash and cashflow. Leader motivation and direction of followers was only occasionally based on contingent reward. More usually, leaders did not explicitly consider their personal impact on the motivation of engineers and provided direct feedback on code quality and functionality by email rather than in person. Engineers were generally pragmatic in their view of this interaction, although some were explicit in expressing dissatisfaction with the low quality of leader member exchange (Denti and Hemlin 2016). Executive leaders and engineer followers discussed the provision of resources (e.g. money, systems, and people) required to facilitate software delivery objectives. The active support for innovation by leaders was felt by both groups to be tangibly demonstrated through the provision of resources (Van de Ven 2017).

Instrumental leadership theory has roots that can be traced to path-goal theory (House 1971) and LMX (Graen and Cashman 1975) but evidence of positive exchanges in the context of LMX were not typically present in the interview data.

Although path-goal and LMX were not originally specific to innovation leadership, some researchers have observed a positive correlation between higher quality exchanges and innovation success (Lee 2008; Sanders et al. 2010; Denti and Hemlin 2016). The external focus of the executive leaders interviewed resulted in them spending little time in the office and therefore little time interacting personally with software engineers, or indeed staff in other functions. Attempting to be efficient and conserve energy (Estel et al. 2019), many of the executive leaders have developed a dependency on non-real-time email interaction to mediate communication with engineers. The reduced social context (Stogdill 1948) also limited the opportunity for personal influence (Dansereau, Graen and Haga 1975). When interaction occurs primarily through email and occasional group meetings, the types of high quality and trusted personal interactions typified by LMX theory (Graen and Cashman 1975) seem less likely to develop through constant role dependent open systems interaction (Katz and Kahn 1978). Pentland (2012) has made a case for the enduring value of face to face communication over email communication.

In the firms studied for this research, much of the flow of information was one way, from executives to engineers. The nature of these exchanges would be regarded as low quality by Denti and Hemlin (2016) and innovation success might then be better explained by intrinsic follower motivation (Denti and Hemlin 2012). Despite this, in many cases, the relationships between leaders and followers did seem to be based on a degree of maturity (Graen and Uhl-Bien 1991). Generally, the engineers expressed respect for their executive leaders, especially if those leaders also had an engineering background. However, even when the leaders had a software engineering background, the engineers did not seem to regard their leaders as experts that they could turn to for technical support or advice. Most of the engineers seemed to accept that the primary communication with their leaders was mediated through email rather than face-to-face, and it may be the case that digital communication is increasingly accepted as normal between leaders and followers in technology firms in the 4IR.

Without significant personal interaction, charismatic leadership (Conger and Kanungo 1987) and other constructs related to transformational leadership (Bass and Avolio 1994) were not generally evident within the cohort of executive leaders interviewed for this research. PE backed CEOs and their engineers did sometimes discuss transformational leadership behaviours in the wider context of a turnaround situation. Consequently, there was also little evidence of emotional intelligence

(Goleman 1996) being displayed in the interactions with engineers and many of the relationships seemed transactional (Bass 1985) in nature. Consistent with the research of García-Morales, Jiménez-Barrionuevo, and Gutiérrez-Gutiérrez (2012), transformational leadership did not seem common in these smaller firms. As also noted by Vaccaro et al. (2012), examples of transactional leadership were more notable in these smaller firms.

The combination of leadership style and lack of regular social interaction between executive leaders and software engineers seems to have consequences for the relationship between the parties, including creating a greater sense of hierarchy. Engineers said that they were sometimes reluctant to share ideas on innovation, and their creative efforts were generally limited to problem solving on immediate priorities such as fixing bugs, delivering systems performance improvements or working on enhanced feature functionality in response to market requirements articulated by customers through executive leaders or the sales function. Whilst this focus may suit the tactical and task orientated reality of software delivery in SMSE, it may result in missed opportunities for creative collaboration that could lead to breakthrough thinking and radical innovation offering new trajectories for growth.

The construct of entrepreneurial leadership (Cunningham and Lischeron 1991; Freeman and Siegfried 2015) exemplified through the creative and innovative integration of talents (Latif et al. 2020) was rarely evident in these firms. For most of the leaders in this study, implementation was the key to revenue and further investment, and therefore served their main objective of cash generation. This focus on cash generation meant that once the SMSE had established product market fit, the role of leadership in promoting creativity appeared less of a priority to the executives than the role of leadership in promoting delivery of finished software (Glass 2006).

In summary, theories of transformational and ambidextrous leadership are suggested to be important for strategy and value creation in firms. The deepening trust and respect implied by high quality exchanges of LMX are considered helpful in supporting creativity and innovation. Establishing a creative climate and nurturing creative people is considered important to innovation outcomes. However, this research found exploratory innovation to be uncommon in the SMSE studied and that leaders were more inclined to display transactional and instrumental leadership, exhibiting convergent (Van de Ven 2017) or closing leader behaviours (Zacher and Rosing 2015). The result was a focus on path dependent incremental and exploitative innovation focused on existing customers and markets. The absence of leaders from the office, who were primarily in pursuit of revenue or funding, reduced the opportunity to directly mediate creativity through in person communication, yet despite this, the software engineers interviewed did not express significant dissatisfaction with their roles or environment.

7.4 Culture, creativity and climate in SMSE

The leaders interviewed for this study did not display an awareness of the impact of culture, climate and organisational structure on creativity and innovation. When culture and creative climate was discussed by interviewees, it was in very general terms and was not underpinned by any explicit understanding of published theory. The development of culture and climate within the organisations studied did not appear to have been done consciously or within the context of a known theoretical framework.

The incremental innovation required to meet enhanced feature and function requirements of customers and prospects appeared to be dependent on the creative cognition and self-motivation of the engineers (Mumford and Licuanan 2004). Beyond initial filtering and communication of customer requests for changes in software feature functionality, the creative cognition of leaders was not specifically focused on innovation. Evidence of leaders undertaking a variety of innovation leadership roles as discussed by Van de Ven et al. (1999) was not found in relation to innovation leadership in this group of SMSE. Executive leaders were generally physically absent from the firms that they ran day-to-day, as they pursued developing relationships with customers, partners, investors and bankers. However, this does not imply a laissez-faire position (Avolio 2011) as the leaders did constantly review internal software development against plan and provide feedback and direction, even if through the medium of email. In fact, as revenue and cashflow was often dependent on completion of software development phases, in most firms there was a heightened awareness of the importance of delivery to specific dates. The executives often seemed to operate as progress chasers, checking on delivery of sprints in agile processes to trigger client invoicing. All the leaders were involved in multiple activities across the wider organisation, and institutional leadership (Van de Ven et al. 1999) best describes the style of innovation leadership discussed in interviews with leaders and engineers. Most of the leaders were not close to day-to-day innovation activity and their involvement either focused on sanctioning the provision of resource or mediating between innovation sponsors and innovation critics.

Whilst the creativity (Winograd 1996) and problem solving skills (Glass 1995) of engineers were recognised by both leaders and engineers, there was little explicit attention given to creative climate (Amabile 1996; Ekvall 1996) and the nature of software development in these SMSE is more consistent with the application of engineering discipline suggested by Glass (2006). The narrative of leaders provided evidence for both positive and negative climatic influences on creativity (Amabile et al. 1996). Leaders were primarily resource focused. Most leaders did not show explicit evidence of work group support or organisational encouragement, primarily because they spent their time on outward facing activities. The relatively flat structures in the SMSE included in this study mitigated against a specific cadre of supervisors driving the innovation agenda. The development teams were given a narrow corridor of freedom within which to develop their software, and most of their working time was committed to delivering specific feature functionality or fixing bugs, resulting in a degree of workload pressure (Amabile et al. 1996) that was felt by some of the engineers to be detrimental to quality and creativity.

For the SMSE interviewed in this research, the type of dynamism and freedom suggested as important in encouraging engagement and collaboration by Ekvall (1996) appeared to be judged an unaffordable luxury by executives and investors. Nonetheless, the lack of direct interaction between executive leaders and software engineers meant that the engineers had control over their own daily work. The engineers generally acknowledged the challenging and stimulating nature of their work and many expressed positive sentiments that they worked without significant supervision, were trusted to deliver, and were usually given the resources that they requested to get the job done. Amabile (1997) notes these as factors that might have a positive impact on creativity.

As Schein predicts (1996) even in these small firms, there was evidence of different cultures being simultaneously present. Each of the firms showed evidence of an executive leader culture which was driven by economics and was primarily concerned with the external environment of the firm. The focus on cashflow and creating product market fit resulted in a primary interest in exploitative innovation (March 1991; Tushman and O’Reilly 1996). By contrast, the engineering culture of the firms was more focused on self-actualisation (Maslow 1943) rather than economics. Although the engineers acknowledged the importance of cashflow for survival, they were otherwise relatively uninterested in the economic performance of the businesses that they worked for and primarily concerned with internal matters such as culture, job satisfaction and the opportunity to work on challenging problems using exciting new technology.

Several engineers discussed the opportunity that larger technology companies give engineers to explore opportunities for innovation for a defined period each week. Some of the engineers acknowledged and some leaders explicitly commented that resource constraints that SMSE face may mitigate against such opportunities being available. Many engineers were not intellectually satisfied by the opportunities within their firms and spent time away from work exploring new software and technologies or developing open-source code or their own applications. Some even developed open-source code surreptitiously whilst at work, releasing their software development products to the open-source community under a pseudonym. The possibility to work on new and exciting projects was articulated by this group as a more significant risk to retention than salary or other hygiene factors.

The style of interaction with the executive leaders was sometimes irritating to the engineers, who on occasions expressed displeasure with the one-way flow of email communication and lack of opportunity for personal engagement. However, this frustration was not significant enough to drive them away from their firms if they had confidence in the ability of the firm to sustain the existing culture, provide them with interesting work and offer job security.

There was strong alignment between all cohorts on survival, which probably at least in part is dependent on developing useful software and delivering customer satisfaction. The executives and investors were aligned on growth, cashflow, product market fit and preferring exploitation to exploration. Other than ensuring the business had enough funding to underpin their continued employment, most of the engineers were uninterested in economic drivers such as cashflow and growth. The engineers were interested in both exploitative and exploratory innovation. Culture, climate, and diversity were considered enablers by executives, whereas engineers saw culture and climate as important for job satisfaction and had little experience of diversity due to industry macro socio-demographic issues.

Figure 7.3 (below) illustrates the cultural similarities and differences of the interview cohorts identified through coding categories. The Executive Culture of the SMSE studied was primarily influenced by attitudes to cashflow and survival reflected in theme 2 of the analysis which relate to a dominant primary focus on survival and cashflow. The Engineer Culture primarily relates to themes 9 and 10 of the analysis, as engineers tended to be relatively unconcerned with personal financial gain and were much more interested in the self-actualization and the opportunity to solve interesting problems and explore, learn and play with new technology. Theme 15 is also reflected within Engineer Culture as they had limited interest in the commercial success of their firms beyond continued viability. The Investor Culture was evident through themes 20 and 21. The investors did not favour innovation that varied significantly from the original business plan and as they leveraged their equity investment with debt and tried to minimize risk and maximise returns.

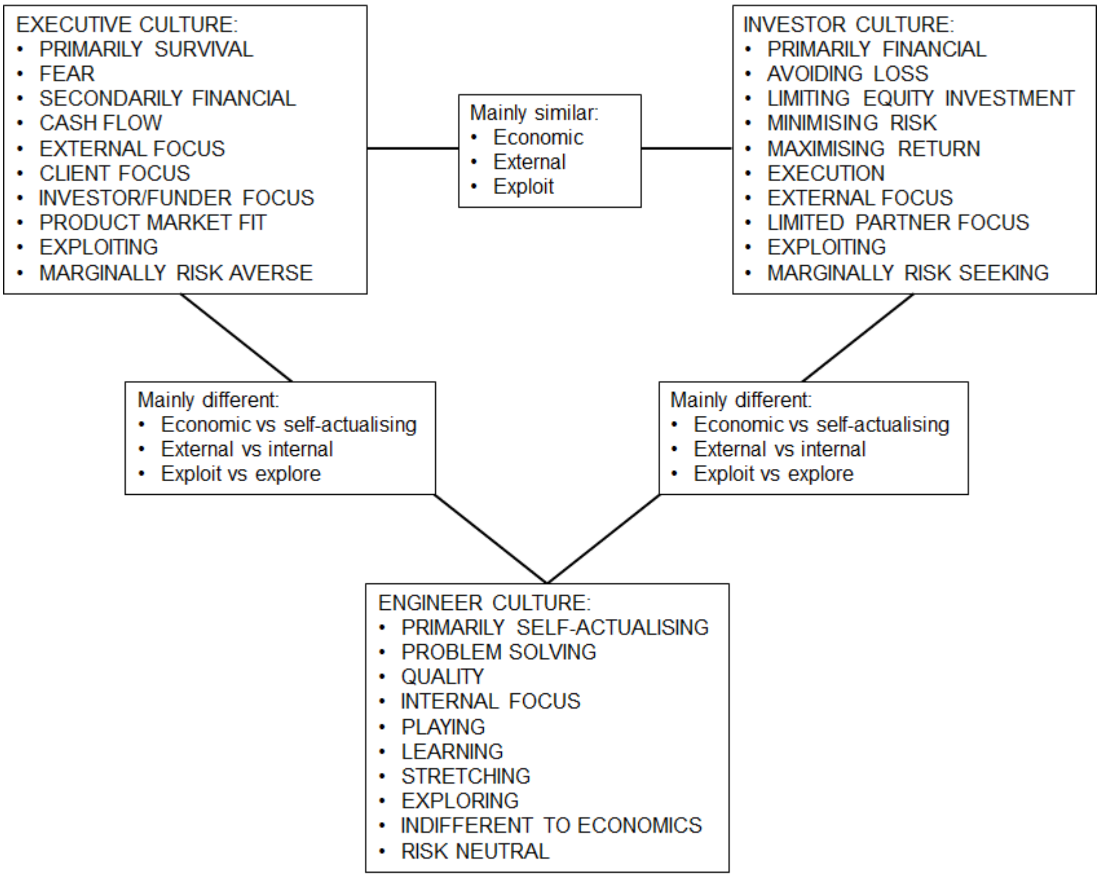


Figure 7.3 Cultural comparison between SMSE interview cohorts

Consistent themes across the firms studied in this research suggest that executive leaders are externally focused and prioritise survival, cash and cashflow. In this group, this focus continues even in the firms with strong balance sheets, well-established business models and good cashflow. Once the SMSE had established product market fit, they did not then engage in exploratory or radical innovation and instead continued to task their software teams with incremental path dependent improvements in product and process. Existing market demand appears to be the primary driver of innovation, but both leaders and engineers claim some responsibility for ideation. Figure 7.4 (below) shows how the categories discovered through grounded theory demonstrate the degree of relative alignment between the interests of the different cohorts.

Although leaders were not typically familiar with innovation leadership theory, many of them displayed aspects of instrumental leadership behaviour (Antonakis and House 2002, 2004 and 2014). This was also noted by the software engineers that work with them. The research identified cultural differences between leaders, engineers, and investors and suggests that the interests of leaders and PE investors were more closely aligned than the interests of leaders and software engineers.

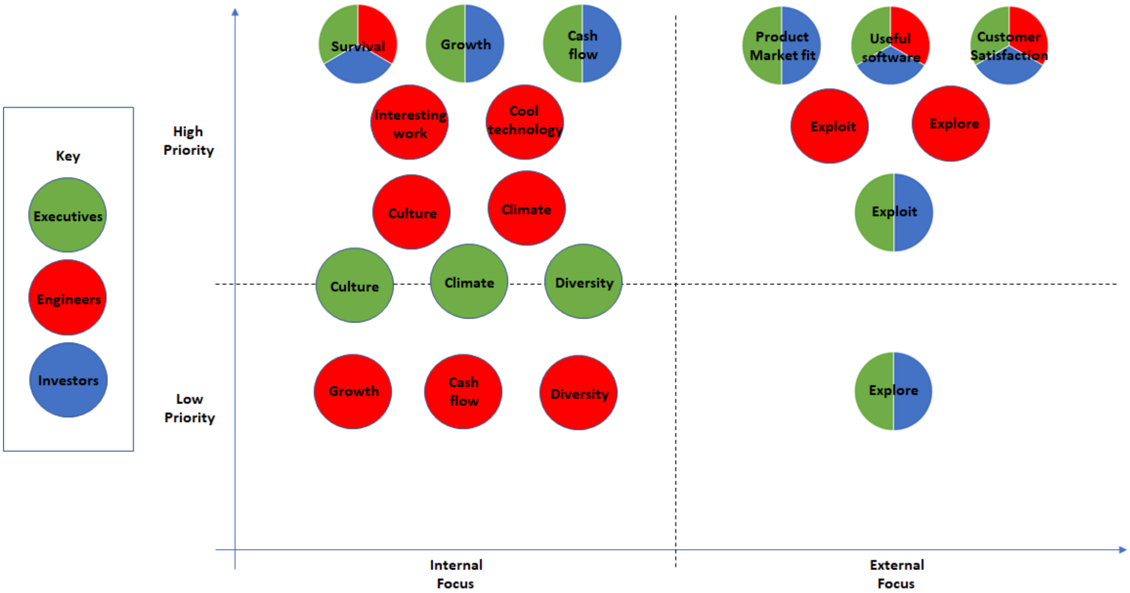


Figure 7.4 Relative importance of categories to different cohorts in the SMSE

7.5 The impact of PE investment on SMSE

PE investors stated that they preferred to maintain strict financial discipline and keep their portfolio firms focused on delivering against the initial investment thesis. The investors and executives therefore maintained a degree of alignment around innovation investment priorities based on the availability of cash. Whether owner-managed or PE backed, the focus on cashflow and survival seemed to have significant implications for innovation leadership and impacted the communication between executives and engineers.

Long and Ravenscroft (1993) reported that PE investment resulted in a short-term focus on cost cutting that reduced R&D expenditure. By contrast, Amess, Stiebale and Wright (2015) found that PE backed leveraged buyouts (LBOs) of SME in the UK resulted in a 6% increase in patent stock and concluded that PE firms promoted longer-term entrepreneurial investment opportunities. However, their study was not specific to SMSE and included product companies that may have been earlier stage investments. Their analysis suggested that the increased debt capacity offered by PE was an enabler for investment in innovation. However, the firms analysed for this study offer qualitative evidence that PE funding may bring discipline to the funding of innovation that reduces expenditure on exploratory innovation and focuses innovation efforts on incremental feature functionality development. Such activity rarely manifests in patents, with most software firms relying on copyright to protect their intellectual property.

Where PE investors were involved in businesses, they tended to be more aligned with the external focus of the executives. Perhaps not surprisingly, their focus was financial, and they valued execution ability in the executives running their portfolio companies. PE investors seemed able to take a detached and external view of the leadership of innovation in their portfolio companies. Whilst they did not often see the interaction between executives and engineers first-hand, they judged effectiveness through results, which manifested through project delivery and commercial execution. PE investors noted that whilst PE investment can help SMSEs scale, it places different demands on executive leaders than they experience as owner-managers and sometimes requires different skills. In common with the Alix Partners research (Bililies, Warren and Roger 2017), all the PE investors said that they had experienced owner-managers who struggled with the transition to such a degree that they had been replaced by executives with prior PE experience. When replacing an owner-manager, PE investors in this interview cohort said that they valued prior experience of success in delivery within a PE backed firm and relied heavily on referencing to establish the credibility of potential CEOs.

The management and leadership skills and traits that were most prized by the PE investors related to practical management, focus and execution. They valued creative problem solvers, but did not encourage significant R&D or explorative innovation, preferring their portfolio CEOs to execute against the agreed plan and conserve cash to ensure that the business could reach cashflow break-even within an agreed term, or achieve certain agreed targets before raising further rounds of funding at higher valuations.

The process of replacing owner-managers is acknowledged by the PE firms interviewed to be disruptive and expensive. This may highlight a requirement to better equip owner-managers with the skills and understanding required to operate effectively with PE investors at the start of the PE investment cycle. Although the PE firms interviewed each claim to be supportive of management and believe their interests to be economically aligned, the reality seems to be that the owner-managers interviewed for this research operate with a different paradigm to the PE backed CEOs. Whilst there may be many complex reasons for this, improving awareness and education about working with PE firms might be worth exploring as a way to improve the success rate of owner-managers retaining their roles after transferring control of their firms to PE investors.

7.6 Innovation leadership construct specific to British SMSE

The purpose of research based on CGTM is to construct theory. The UK SMSE in this research indicate a specific construct of innovation leadership.

Innovation leadership literature suggests an idealised prescriptive model of innovative firms balancing exploitation and exploration (Tushman and O'Reilly 1996), leaders encouraging a creative climate (Amabile et al. 1996) and adopting multiple roles through the innovation journey (Van de Ven et al. 1999), sharing responsibility with pragmatic and exemplary (Kelley 1992) followers to drive progress within growth businesses. As summarised in table 7.1 (below), the experience of firms interviewed for this research was quite different.

Within this group, executive leaders were constantly aware of survival and cashflow. They focused on driving growth through exploiting product market fit for existing software and delivering incremental (Damanpour 1991) innovation usually based on improved features and functionality within an established dependent path (Boland, Lyytinen and Yoo 2007). The engineers existed within their own micro-culture (Schein 2017) and had limited engagement with their leaders with most communication being one-directional and through email and formal group meetings.

Despite not conforming to many theoretical concepts found in the innovation leadership literature, the leaders interviewed for this research had managed to grow their firms beyond start-up and had established a niche in each of their chosen markets. Whilst the leaders were not deeply involved in the innovative work behaviour of their software engineering colleagues, they were constantly engaged

Table 7.1 Comparison of findings to extant theory

Theory	Citation	Finding
Full range model	Avolio and Bass (1991); Bass and Avolio (1993); García-Morales, Jiménez-Barrionuevo, and Gutiérrez-Gutiérrez. (2012); Vaccaro et al. (2012).	SMSE executive leaders were more inclined to display transactional rather than transformational innovation leadership behaviours.
Instrumental leadership	Antonakis and House (2002, 2004 and 2014)	Some aspects of instrumental leadership were evident in the interviews.
Entrepreneurial leadership	Cunningham and Lischeron (1991); Freeman and Siegfried (2015); Latif et al. 2020)	Executive leaders of SMSE did not seem to be focused on the integration of creative and innovative talents. They were focused on short-term code delivery and invoicing to collect cash.
LMX	Graen and Cashman (1975); Denti and Hemlin (2016)	High quality exchanges were not explicitly evident due to non-real-time email mediated communication.
Path-goal	House (1971 and 1976)	Interactions between executive leaders of SMSE and software engineers did not show evidence of path-goal theory.
Ambidexterity	March (1991); Tushman and O'Reilly (1996)	Once SMSE established product market fit they were found to pursue exploitative rather than exploratory innovation.
Leader behaviour	Zacher and Rosing (2015)	Closing leader behaviours were more prevalent than opening leader behaviours.
Path dependency	Nelson and Winter (1982); Boland, Lyytinen and Yoo (2007)	SMSE did not pursue disruptive or radical innovation, and instead developed incrementally within an existing paradigm of software capability.
Creative climate	Amabile (1996); Ekvall (1996)	SMSE leaders showed no evidence of an explicit awareness of creative climate. Work pressure was the biggest detractor to creative climate for software engineers.
Leader technical skills	Vincent, Decker and Mumford (2005)	Most SMSE leaders were not involved in the technical aspects of innovation.
Leader planning skills	Marta, Leritz and Mumford (2005)	SMSE leaders did exhibit a strong focus on planning.
Leader roles	Van de Ven et al. (1999); Mumford et al. (2002)	Innovation leaders in SMSE did not adopt multiple leader roles, and primarily behaved as institutional leaders and occasional critics.

with ensuring the economic success and operational efficiency of their firms. Whilst their relationships with software engineers did not display a deep understanding of creative climate or evidence LMX or transformational leadership, they did display and discuss charisma and transformational leadership in other aspects of their relationships with wider stakeholder groups.

The engineers interviewed did not typically express dissatisfaction with their working conditions or with their relationships with executive leaders. Engineers were most concerned with self-actualisation and maintaining existing culture. Some firms had grown to a level where they were able to attract PE funding, although the consequences of this had often been a change in leadership.

Based on the evidence of this research, a model of innovation leadership in British SMSE can be constructed from the 23 themes (described in Chapter 6 and listed in Appendix 9) identified through the coding process. The relationship between the main themes and the behaviour of each of the research cohorts is summarised in the diagram 7.5 (below).

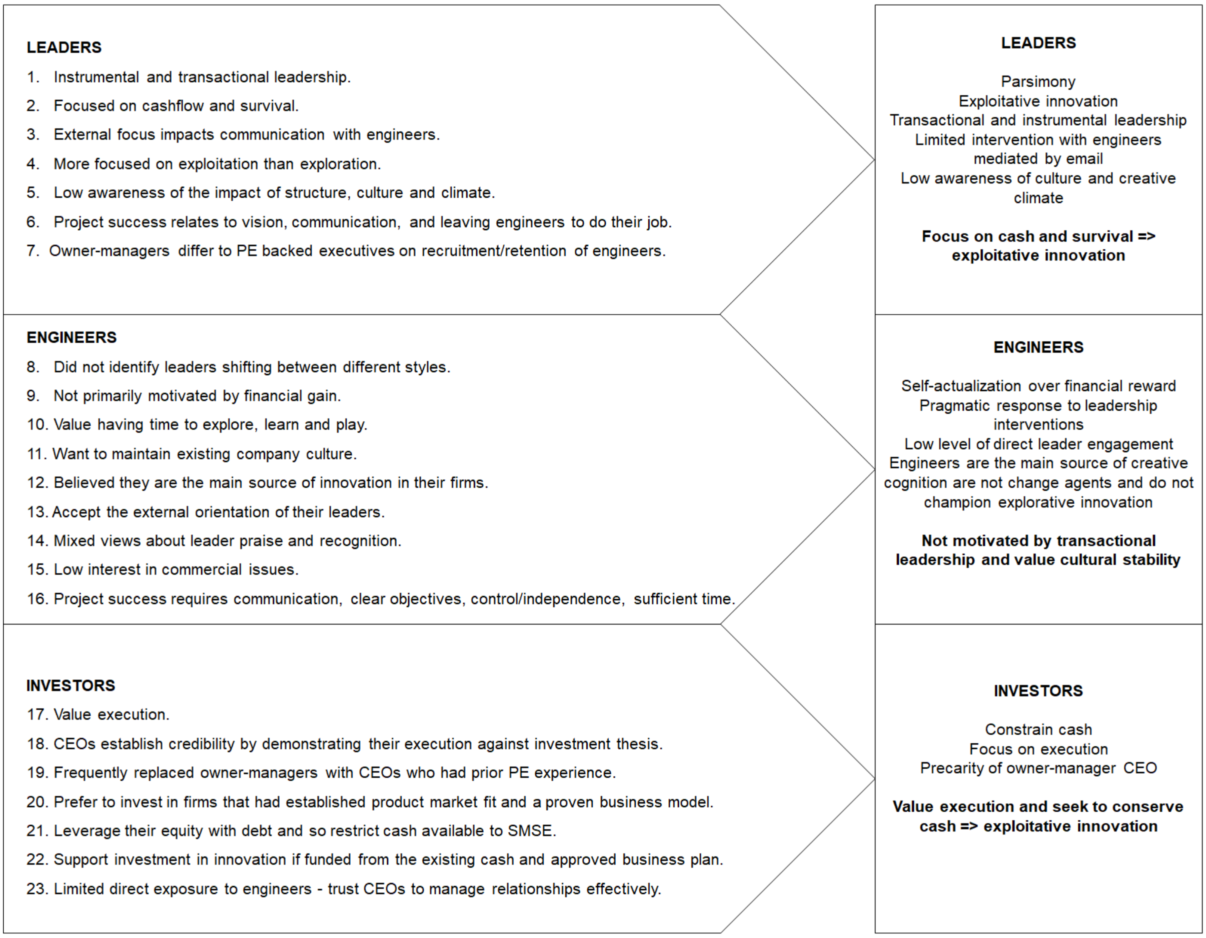


Figure 7.5 Relationship between themes and behaviours of each cohort

British SMSE are typically born from the vision of an individual entrepreneur with a software or technology background. The original innovation that gives rise to the business may be novel, adaptive or disruptive, but often fails to gain traction until the entrepreneur finds product market fit. Once product market fit had been established, executive leaders in this research cohort developed a habit of parsimony as a survival imperative during the early stages of creating their businesses that continued even when the firms had achieved commercial success (theme 2). This influenced several aspects of innovation leadership behaviour. First, the focus on continued cash generation created an external orientation for the leaders resulting in most communication with engineers being mediated through email rather than face to face (theme 3). Secondly, the focus on preserving cash translated to a preference for exploitative innovation in response to perceived customer or market demand rather than explorative innovation (theme 4) resulting in the development of new products, services or markets. Exploitative innovation is more usually associated with transactional and instrumental leadership styles (theme 1) which were more evident in the interviews. The executive leaders believed a successful project was based on clear communication of requirements (theme 6) rather than developing a creative climate and culture (theme 5). The transactional nature of the relationship between executive leaders and engineers was emphasized in the owner-managed firms by the attitude to engineering staff attrition (theme 7), although the PE backed executives did recognise value to continuity and retention.

For the engineers, cultural stability (theme 11) and having time to explore, learn and work with new technology (theme 10) was more important than financial gain (theme 9) or leader recognition (theme 14). Engineers generally declared limited interest in commercial aspects of their firms (theme 15) other than the desire for job security and reliable earnings. Software engineers recognised some aspects of innovation leadership, particularly when they identified instrumental leadership behaviour that supported their engineering effort, but they did not discuss leaders changing styles to respond to contingent situations (theme 8). The engineers accepted the external orientation of their leaders (theme 12) and considered themselves to be the primary architects of innovation within their firms, despite accepting that their leaders were the main external contacts for customers and the wider external stakeholder network (theme 13). Engineers felt that control and independence to execute projects led to successful delivery and that leader pressure to execute to unrealistic deadlines compromised technical objectives and resulted in project failure (theme 16).

PE investors valued execution over creativity (theme 17) and felt that CEOs established credibility by delivering results against the initial investment theses (theme 18). Many owner-managers failed to deliver against PE criteria and all PE executives interviewed had experienced replacing owner-managers with externally recruited CEOs (theme 19). The nature of PE (as distinct to venture investing) is to invest in firms that have established product market fit and developed scalability (theme 20) and the funding structure used is usually debt leveraged and so cash generation is important and cash resources are generally restricted for investee companies (theme 21). As a result, funding for innovation is generally restricted to projects that can be funded from the existing cash flow of the business, subject to approval of a business plan that yields a return within the investment horizon of the PE's holding in the SMSE (theme 22). Generally, the PE investors had limited direct exposure to software engineers and trusted the CEOs to manage the engineer relationships (theme 23).

The integrative influence diagram below (figure 7.6) illustrates how the dominant theme of cash flow fear among executives is re-enforced by external investors and influences engineers, resulting in a bias towards incremental exploitative innovation within a path dependent trajectory.

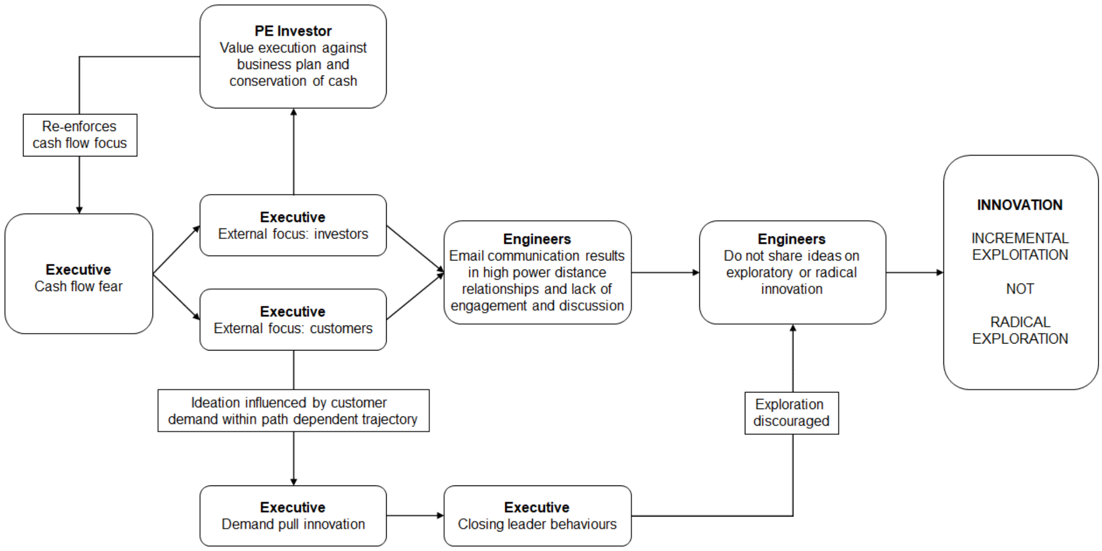


Figure 7.6 Integrative influence diagram of innovation leadership in British SMSE

The causative flow implied by figure 7.6 suggests that a degree of abstraction might offer a hypothetical model where communication between executive leaders and software engineers could result in alternative innovation outcomes. The data from this study were specific to the case of SMSE led by executives that translated cash flow focus into external engagement with sources of revenue (customers and prospects) and sources of funding (lenders and investors) to maintain liquidity whilst trying to grow the business through continued execution of a sales strategy based around existing product market fit. PE investors and lenders both re-enforced the cash flow focus of executive leaders. The result was that leaders were primarily concerned with demand led incremental and exploitative innovation and exhibited closing leader behaviours to discourage engineers from pursuing explorative or radical innovation. A more general model is implied by this causative flow that might moderate the impact of executive cash flow focus through relative investor value sensitivity balancing short-term cash generation against longer term value creation. Executive leaders may then be influenced to consider the value of explorative innovation and display open leader behaviours that encourage engineers to pursue explorative and radical innovation. The abstraction of the causative flow of 7.6 is represented in the hypothetical model below (figure 7.7).

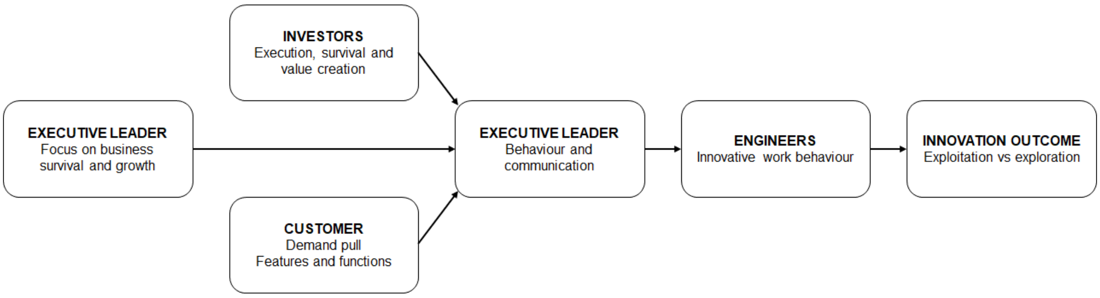


Figure 7.7 Hypothetical model of leader influence on innovative work behaviour of software engineers in British SMSE

Future qualitative, quantitative and mixed methods research could be employed to explore the applicability of this model in different contingent situations. Probing the impact of investor influence on opening and closing leader behaviour may offer further valuable insight to the relationship between ownership, funding, and innovation within SMSE.

7.7 Implications for theory

The theoretical perspective that innovation is necessary and desirable for firms (Drucker 1954; Martins and Terblanche 2003; Pikkarainen et al. 2011; Pisano 2019) is not fundamentally questioned by this research. However, it is interesting to note that none of the firms featured in this research were consistently engaged in significant exploratory (March 1991; Tushman and O'Reilly 1996) or radical innovation (Carlo, Lyytinen and Rose 2011). Instead, they were primarily focused on seemingly modest and incremental improvements to feature functionality and occasionally software development processes. Even the two firms that occasionally claimed to engage in exploratory innovation, such efforts were usually curtailed by the immediate demand for resource from existing customer obligations. The challenge of longevity seems obvious in this situation and prompts two questions. First, how long can these SMSE continue with marginal improvements to product and process before the market moves on and they become irrelevant? Secondly, after years of engaging in incremental innovation, would these SMSE be capable of the vision or have the capacity to engage in more radical innovation to apply their core competencies in a new way and to launch a new trajectory? These are difficult questions to answer and may require extensive historical and longitudinal studies to start to penetrate the underlying complexity.

The focus on survival and cashflow seemed all consuming for the leaders of SMSE interviewed in this research. Whether the immediate pressure of cashflow is an actual or imagined constraint, this factor seems significant in the way in which leaders view innovation within SMSE. The leaders do not generally use different leadership styles as suggested by Oke, Munshi and Walumbwa (2009) and tend to employ the same leadership style irrespective of contingent situation (Fiedler 1967). The executives interviewed for this study displayed a limited repertoire of innovation leadership styles.

The essence of the contribution to knowledge that this thesis represents is the degree to which the findings either confirm or differ to extant theory. The results of this study on a relatively small and homogenous group of firms suggests a specific innovation leadership model that differs to an idealised view of innovation leadership where leaders adopt multiple roles in guiding innovation (Van de Ven et al.1999), encourage some exploratory innovation (Tushman and O'Reilly 1996) with open (Zacher and Rosing 2015) and divergent (Van de Ven 2017) leader behaviours.

The construct suggested by this research is that executive leaders of SMSE are consumed with cash and cashflow concerns. Their leadership style is instrumental (Antonakis and House 2002, 2004 and 2014) and supportive (House 1971) and employs transactional (Bass 1985) and directive (House and Mitchell 1974) leadership. SMSE leaders give little thought to explicitly encouraging a creative climate (Amabile 1996; Ekvall 1996). The firms pursue exploitative innovation (Tushman and O'Reilly 1996) with closed (Zacher and Rosing 2015) and convergent (Van de Ven 2017) leader behaviours. The main leader roles in SMSE are institutional leader and occasional critic (Van de Ven et al.1999). Engineer followers exhibit behaviours that appear pragmatic, conformist and passive (Kelley 1992).

All the SMSE in this study were beyond start-up stage, having found product market fit and started to develop growing revenue and market share and some of the firms could be described as mature. Although some of the firms were occasionally dealing with cashflow strains, none of the firms was facing imminent failure, and all the firms are still trading today. In addition, none of the firms was considering an immediate exit through sale to either trade or PE. These SMSE might then all be considered mid journey and the stage of development may be a factor in considering leader and investor attitudes to innovation. At least, any substantive theoretical construct based on this research should consider relative maturity as a contingent factor.

Extant theory suggests that innovation is essential for the long-term survival and success of a firm (Martins and Terblanche 2003; Pikkarainen et al. 2011; Pisano 2019; Govindarajan and Tangri 2020). However, the SMSE in this study were content with modest path dependent incremental innovation. Although successful firms are thought by some writers to pursue a combination of exploitative and exploratory innovation (Tushman and O'Reilly 1996; Zacher and Rosing 2015; Uhl-Bien and Arena 2018), the firms in this study had achieved a sustainable business model based on modest exploitation of their existing software.

Innovation success is thought to be supported by establishing a creative climate (Amabile 1996; Ekvall 1996), but only a small number of stimulant factors present in the Amabile et al. (1996) KEYS model were noted (see figure 3.1 above). These factors were freedom to develop software, but within a narrow corridor of incremental and path dependent exploitation, the provision of sufficient resources, and challenging work. There was no evidence of active encouragement of creativity beyond the immediate needs of project delivery. Software developers were often working alone or in very small work groups, where the pressure to deliver was high and there was no opportunity for supervisory innovation or workgroup support. The most significant detractor to creative climate was workload pressure, which most of the engineers discussed in their interviews. This pressure concerned the engineers because they felt it limited their opportunity to deliver the highest quality software possible.

As most of the innovation in the SMSE in this study was initiated by customer demand, in all but two of the firms there was little evidence of the existence of a structured innovation process from ideation through to implementation, as suggested by Goffin and Mitchell (2017).

The leadership of innovation in SMSE is not well understood. Literature on innovation in SMSE is limited and literature specific to the study of innovation leadership in SMSE is scant (Rose, Jones and Furneaux 2016). However, there is a richer canon of innovation leadership theory that can be developed and tested within the context of these smaller technology firms. The motivation for developing the syncretic model of innovation leadership which was logically deduced and described in Chapter 4 was to offer a prescriptive toolkit to practitioners that allows ready access to innovation leadership theory through a simple model. It may also provide a testbed of ideas for scholars to investigate further. When considered in the context of the SMSE studied in this thesis, the two constructs that seem most readily applied are Project Innovation Leadership and Tactical Innovation Leadership. Both constructs are characterised by closing leader behaviours that encourage exploitative innovation within an existing technological trajectory. In Project Innovation Leadership, the construct is considered appropriate for short task focused projects where the leader sets specific objectives for software deliverables and the focus is on achieving the short-term plan with a transactional element to success and failure. This construct seems most appropriate to developing specific feature functionality in response to a direct customer request. Tactical Innovation Leadership takes a slightly longer view with the leader setting clear software development objectives and providing some guidance and support. In the case of the SMSE in this study, much of that feedback was delivered by email. When requested by the software engineers, the leaders in this research did generally provide resources to support delivery. This construct seems most appropriate for the development of new versions or releases of application software that contain more significant enhancements than specific feature functionality.

Since the technology boom of the 4IR, we have seen many large international technology firms rise and fall relatively quickly. This offers little hope to smaller software firms clinging to a fragile niche and perhaps dependent on a technology ecosystem of hardware, telecommunications, processes, and value chains – all of which are subject to seemingly constant change. It may be that the transient existence of SMSE occasionally swept aside through a Schumpeterian process of renewal is natural. Perhaps this is no different in the age of software development than it was for the small manufacturing firms of the 1IR and 2IR. However, some small technology firms do become large firms and stand the test of time. If this occurs by more than just chance, then the phenomena that allow this to happen are significant for the economy and for society and surely worth understanding.

7.8 Implications for practice

For the SMSE included in this research, innovation appears to be a significantly lower priority than short term cashflow. This focus on cashflow was explained by leaders to be about survival. The survival and cashflow concerns persisted even in firms that were economically successful and had external investment. Although the leaders and engineers interviewed both expressed the view that they saw themselves as innovative, the innovation discussed was entirely exploitative and incremental and all the firms were dependent on a single product and single market where their software had found product market fit.

The life expectancy of firms has reduced significantly in the 3IR and 4IR. Anthony et al. (2018) noted that even large US firms on the Standard and Poor (S&P) 500 index could expect tenure to reduce to 12 years by 2027 from an average of 33 years in 1964, which they suggest implies that the pace of creative destruction is accelerating. One of the recommendations of their report is that to survive firms should innovate outside of their core. Of course, firms on the S&P 500 have substantially greater resources available than the SMSE interviewed for this research. However, SMSE do have advantages that could be leveraged in terms of agility, proximity to market, comparatively modern infrastructure, and software development processes. Many also have software engineers who expressed a desire to spend some of their time engaged in exploratory innovation. In SMSE, access to patient capital and the confidence of the leaders to invest seem to be the main barriers to pursuing an ambidextrous innovation strategy.

For PE investors, focus on maximising returns from the single product and market of their SMSE investments might be explained by their time horizon. Many UK PE firms invest from funds that require them to realise investment gains within a relatively short time frame and the typical investment period is five to seven years.

To take an entirely new product development from ideation to scale usually takes time and is unlikely to give the returns required by PE within the investment horizon.

PE firms usually exit investments in software firms at a valuation multiple of revenue or earnings before interest, taxes, depreciation and amortisation (EBITDA). Exit multiples for software firms can be significantly higher than in other sectors and so ensuring the firms they invest in are focused on maximising revenue and EBITDA within the life of the investment is important for the PE investor. The PE investors interviewed for this research expressed concern about the risk, distraction, and dilution impact of innovation. They trust that their initial due diligence provides confidence of the portfolio company's sustainability through to exit and then want the CEOs of those business to remain focused on delivering against an agreed plan. That plan generally does not include budget for exploratory innovation.

The innovation challenge for SMSE executive leaders seems significant. Those interviewed for this research displayed instincts and described experiences that have caused them to be averse to anything but incremental innovation. However, at some point they may be faced with the reality of the current product market fit failing due to market or technology changes. At this point, it may be too late to respond, or they may not have the resources, skills and culture required to respond. Investing speculatively and too early is potentially equally damaging. Larger technology firms often engage in what is termed horizon scanning to identify emerging threats and opportunities. For smaller firms, regularly engaging in a similar activity commensurate with their size and resources may be worthwhile.

Specific suggestions for improving practice in SMSE relate to taking a longer-term view than the path dependent trajectory of the existing software application. Having found product market fit in the first place, the owner-manager founders of these businesses have demonstrated the creative cognition required to relate their innovative capacity to market opportunity. The suggestion made by this thesis is that SMSE leaders continue to challenge their organisations to evaluate opportunities to develop new trajectories and that they provide resource and funding to allow some exploratory innovation activity to occur. If SMSE are to embark upon exploratory innovation, then an innovation process that channels and prioritises ideas from ideation to delivery may improve the efficiency of resource allocation and considering explicit support for creative climate may improve engineer engagement and support. Many of the engineers interviewed seemed to yearn for the opportunity to spend some time on exploratory innovation and meeting this need may in turn reduce engineer churn and result in higher morale. At the moment, in many of the firms interviewed, this feels like untapped potential.

7.9 Implications for policy

In our era of the 4IR (Schwab 2015), the creative industries have been identified as important to economic growth and prosperity (UK Government 2020a), and innovation is an explicit area of focus to drive that growth. SMSE are central to building the digital technology that is enabling humanity to develop the machine-readable world that facilitates simultaneous existence in virtual and physical domains (Lee et al. 2018). Many of the firms interviewed for this research are archetypes of the small high technology firms of the 4IR that the UK Government is seeking to nurture and encourage.

The investment climate for start-up or early stage technology firms in the UK has remained buoyant as highlighted by the Tech Nation report (UK Government 2020a). There is support available through incubators and accelerators for early stage start-up firms that show the potential for growth rates more than 20% a year (Roper and Hart 2013). However, the SMSE in this sample are beyond early stage and so no longer qualify to access this support. It seems that the current policy assumption is that beyond the accelerator phase, firms will be capable of independence and will find further funding through the investment community of banks, PE firms and other professional investors.

The UK Government has consistently identified the creative industries and software development as critical for the economic growth and success of the nation. Perhaps now as the world recovers from the impact of a pandemic, the economic impact of a vibrant SMSE sector is even more important. This research identifies four areas where policy interventions might improve outcomes for SMSE. These relate to practical support as the business develops beyond the start-up phase, access to specific Government funding for innovation, incentives for firms to support innovation, and improving awareness of innovation leadership skills through higher and further education.

Incubate, accelerate, and then develop

The free market ideology that has dominated political and economic policy for more than a generation encourages an evolutionary model of firm behaviour (Nelson and Winter 1982). This model applies Darwinian selection to the survival and growth of firms and some economists believe that it ensures efficient resource allocation within the economy. In the 4IR, globalization represents an additional dimension of threat and opportunity, as the digital economy transcends national and cultural borders and enables global competition to even the smallest of enterprises. In this hostile environment, providing facilities and support that protect and encourage the development of SMSE through their early and most vulnerable phases of development plays a part in encouraging innovation and stimulating growth.

The provision of incubators and accelerators in the UK is a relatively recent phenomenon but has quickly become established with more than 200 incubators and a similar number of accelerators now active across the UK (Bone, Allen and Haley 2017) These facilities attract funding from a variety of sources including public funds, university funds, venture capital and philanthropy and are felt to have a generally positive impact on outcomes for the early stage firms that they support (Bone et al. 2019). However, when firms have found their product market fit, begun to generate revenue, and achieved sustainable scale they move beyond the remit of these support resources. In any event, fewer than 7,000 firms are thought to be using UK incubators and accelerators at any time (Bone et al. 2019), which is a small proportion of all SME.

Many of the SMSE interviewed for this research might benefit from some continued practical and economic support, facilitated through regional development hubs that offer advice, support, and assist with access to development funding for later stage firms. Giving entrepreneurial executive leaders a longer period of support beyond the incubator and accelerator phase might allow them to develop skills and confidence. It might also allow owner-managers to consider PE investment alongside alternatives and allow time and training resources to better prepare them for working with PE if that is the path they ultimately take. A Government strategy for UK technology firms that extends beyond incubate and accelerate may help to increase the life of SMSE beyond their initial product market fit and allow them to capitalise on their core competencies by developing new trajectories.

Innovation funding initiatives

If the main concern of leaders of SMSE is survival and therefore cashflow and access to cash, then policy and funding stimuli could be designed to make grant aid available for established SMSE to innovate. The UK Government currently runs competitive processes for innovation funding for firms of all sizes. As of 4 May

2020, there were 14 active competitions registered on the UK Government website (UK Government 2020b). However, none of these competitions related to the business activities of SMSE and many related to aerospace and biomedical science. The case for making the UK a global leader in these areas is undoubtedly strong. However, the UK is already a leader in software and maintaining this national economic advantage could also be a priority for Government funding.

Incentives for firms and investors

The UK Government currently supports a R&D tax credit scheme designed to encourage innovation. Tax credits can be claimed for software innovation where the innovation is deemed novel. The categories of software development that qualify for tax credits are broad. Claiming the tax credits is relatively easy and accounting firms and specialists are available to help. Nonetheless, many SMSE are not aware of the existence of these incentives and do not claim (Ismail 2017). In addition to better publicizing the existence of these incentives, there may also be a case to support firms expensing their entire software R&D costs within the financial year, and allowing them to carry forward P&L losses into future years to mitigate tax as the businesses emerge into profit.

Beyond the benefits that companies receive through R&D tax credits that may improve investment return, other tax incentives currently exist to encourage investment in innovative growth companies. However, these enterprise initiative schemes do not explicitly favour investment in SMSE innovation or support businesses that are beyond a certain stage (UK Government 2017).

It seems that a tax policy initiative could be designed in a way that is specific to encouraging SME technology businesses to continue to invest in innovation beyond the accelerator phase to stimulate further trajectories of growth for SMSE.

Continuing education for innovation leaders of small firms

Many UK undergraduate business degrees now include a course on entrepreneurship and innovation. However, as identified in this thesis, much of the extant theory relates to larger firms. Those who lead and manage smaller firms may by necessity be expected to fulfil many roles. The owner-managers interviewed in this research had developed their businesses with limited capital and resources, and by the time they achieved product market fit and sustainable cashflow they had developed behaviours and instincts that defined their interaction with colleagues, their attitudes to innovation and the culture and climate of their organisations. The experienced PE backed executives interviewed showed similar traits in terms of attitudes towards cashflow and investment in innovation. It may be that these common attitudes are influenced by situational contingency. Nonetheless, providing SMSE leaders with more understanding of innovation leadership theory as it might relate to their own contingent situation could allow them to explore alternative approaches to developing culture and climate within their organisations, setting the innovation agenda and engaging with software engineers in a more collaborative manner than was evidenced in this research.

The scale at which owner-managers are replaced when businesses are invested in by PE is also worthy of comment. First, better business education for owner-managers may give them the financial skills that would allow them to consider alternative funding options to PE. Secondly, educating and preparing owner-managers to expect significant changes for their firms following PE investment might enable them to cope better with the transition. There may also be a case for better educating PE investors to work with new management teams to establish a different approach to collaboration.

7.10 Chapter conclusions

There is limited innovation and leadership literature relating to SMSE. However, the more general literature on both topics presents an idealised picture compared to the experience discussed in the interviews for this research project. The literature suggests that innovation is good for firms, yet the firms in this research cohort all focus more on conserving cash than investing in innovation. The literature suggests a case for exploratory innovation, yet the firms in this sample are mainly concerned with incremental exploitative innovation within a dependent path defined by existing technology and markets. Innovation leaders are suggested to employ a variety of traits, styles, and behaviours in supporting their colleagues and are expected to play a variety of roles. The leaders interviewed for this project primarily employed instrumental and transactional leadership styles, spent most of their time outside of the firms they were leading trying to ensure cash availability and cashflow, and engaged with the software engineers primarily through email or in formal group settings. There was little evidence in most firms of leaders explicitly working to construct a creative climate. However, distinct cultures were identified within these firms. The executive leaders of this group of SMSE were skilled in many areas, seemed to work hard and were respected by their software engineer followers, despite the working relationship not conforming to a prescriptive idealised model based on path-goal theory or LMX. This suggests a new and specific model of innovation leadership in British SMSE.

The value of SMSE to the UK economy is acknowledged by Government and UK SME technology firms receive significant investment. Incubator and accelerator programmes are available to support these firms through their early years. However, when the firms included in this research came of age having established product market fit and achieved sustainable revenue generation, then the impetus to innovate seemed to be lost. Finding an affordable way to stimulate radical or exploratory innovation in these firms is challenging because of the bias towards incremental and path dependent innovation of both executive leaders and PE investors. In this chapter, policy ideas have been suggested that might extend the reach of Government influence into the innovation agenda of SMSE beyond the early stages of their development. These policy ideas relate to practical support beyond incubate and accelerate, funding opportunities for SMSE innovation, improved awareness of and access to tax and investment incentives, and continuing education for SMSE business leaders.

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 Chapter introduction

This final chapter provides an overview of the findings of the research and considers the contribution to knowledge made. It reflects upon the methodology used and recognises some limitations associated with the approach. Finally, it suggests ways in which this nascent area of research could be extended beyond this initial limited inductive study.

8.2 Overview of findings

This thesis asks, "How are executive leaders of British SMSE perceived to influence the innovative work behaviour of software engineers?". By interviewing 34 executive leaders, software engineers and PE investors and using CGTM to assess their responses, the research has identified 23 themes relating to the leadership of innovation within British SMSE. These themes were discussed in Chapter 6 and are summarised in Appendix 9. The research identifies that SMSE are a nascent area of study and that the extant literature on innovation and innovation leadership does not fully explain the themes identified.

Executive leaders interviewed for this research mainly used instrumental (Antonakis and House 2002; 2004; 2014) and transactional (Bass 1985) leadership styles. They were primarily concerned with survival and cashflow and so were externally focused. They rarely promoted explorative (Zacher and Rosing 2015) innovation and focused their teams on exploitative (Zacher and Rising 2015) and incremental innovation (Henderson and Clark 1990; Damanpour 1991), with innovation mainly being a demand pull (Schmookler 1966) response to requests for improved product features and functions from existing or prospective customers. There was relatively little understanding of academic leadership theory as it relates to climate, culture, creativity, and innovation (Amabile 1996; Ekvall 1996). There was no evidence of the leaders actively promoting creative climate (Amabile et al. 1996). The relationship between leaders and engineers was relatively formal and often based on a one-way flow of information communicated through email or in group meetings. Some of the leaders felt it best to leave engineers to get on with their jobs without undue interference. Some differences were noted between owner-managers and PE backed executives, particularly in relation to their attitudes towards recruitment and retention of engineers. Owner-managers generally seemed less concerned and more accepting of churn within the engineer community of their firms than PE backed leaders who generally recognised the value of continuity and experience. Executive leaders felt they were the primary initiators of innovation within their firms. They put project success down to vision, communication and leaving the engineers to do their job.

The software engineers recognised when their executive leaders were being supportive of innovative work through instrumental leadership (Antonakis and House 2002, 2004 and 2014). The engineers were not primarily motivated by financial gain, seeing remuneration as a hygiene factor (Herzberg 1966 and 1968). They had limited interest in the commercial progress of the SMSE that they worked with, other than wanting to be sure that the firm was successful enough to offer them employment security. The engineers were interested in technical challenge, having the time to write what they regarded as good quality software to showcase their skills and having time available to develop new skills and explore new technology. The engineers were accepting of the external focus of their leaders and valued being left alone to get on with their jobs. They had mixed feelings about leader praise and believed that praise did not always go to those who deserved it anyway. Contrary to the executives, the engineers regarded themselves as the main source of creative cognition and innovation in their firms. Engineers and executive leaders both cited clarity of vision and communication as being important factors in project success.

All the PE investors had replaced owner-managers in SMSE that they had invested in. The reasons were cited as lack of alignment with new objectives for the firm, failure to adapt to the needs of external shareholders, continuing to run a lifestyle business, and slow pace of change. The PE investors generally leveraged their investments with significant debt and did not favour allowing portfolio firms to maintain large cash balances. Generally, the PE investors did not favour innovation, identifying explicit execution risks and believing that the payback period would not match their investment return objectives. Some claimed they would support innovation subject to an appropriate business case, but only if it were funded from a firm’s existing cash resources. Most PE investors had limited direct exposure to the software engineers and trusted the executive leaders to manage these relationships effectively.

8.3 Contribution to knowledge

This research makes contributions to knowledge that may be of value to academic research, practitioners who work in or invest in SMSE, and government policy makers seeking to stimulate growth in the creative industries. Smaller British firms have been subject to increasing levels of academic enquiry since the 1970s (Blackburn and Kovalainen 2009) but SMSE still seem to have been relatively under-researched (Rose, Jones and Furneaux 2016). Although both leadership and innovation have a rich body of extant literature, the study of innovation leadership in the context of SMSE is entirely nascent. This research is one in a small number of studies of British SMSE and the few others that can be found do not focus explicitly on innovation leadership and the relationship with software engineers.

Specifically, this research identifies within the cohort of SMSE interviewed:

- Cashflow concerns dominate the thoughts and actions of executive leaders.
- A consequence of cashflow focus is that leaders spend most of their time externally focused on customers, investors and other sources of finance.
- The result of this external focus is that communication between executive leaders and engineers is not real-time and is frequently mediated by email.
- Although leaders identify customer requirements, the creative cognition required to solve software development problems and deliver innovative code sits with the engineers.
- Leaders and PE investors do not favour explorative innovation and focus on incremental innovation within a path dependent trajectory. Even when resources are budgeted for exploratory innovation, they are generally sacrificed to meet or accelerate project timescales because delivery leads to revenue generation.

British SMSE are an important component of Government economic strategy for the creative industries. Understanding the way in which innovation arises in these firms might be of value to practitioners, investors, and policy makers. This research is original in assessing the impact that executive leaders have on British SMSE and how they affect the innovative work behaviour of software engineers within those firms. It may also be interesting to academic researchers to compare the experience of British SMSE to innovation leadership in different contingent situations, sectors, and national cultures.

The innovation leadership literature is fragmented and pays little attention to the specific contingent situation of SMSE. For the firms included in this research, a model has been constructed based on the instrumental and transactional leadership of incremental exploitative innovation within a path dependent trajectory. Pragmatic software engineers use their creative cognition to solve customer problems translated by leaders who then primarily use email to deliver feedback and chase progress. There is little evidence of active consideration of culture or creative climate by the leaders. The strategic horizon seems relatively short term and for many firms is focused on achieving exit through sale to a strategic buyer or a new investor. The transition of ownership from owner-manager to PE firm often results in replacement of the executive leader.

It is not clear from such a small sample whether this picture is repeated across a wider population of firms. It is also not clear whether this is a sub-optimal model of innovation leadership for the various stakeholders of the firms and for society in general. It may be that rather like small firms in 1IR and 2IR, creative destruction inevitably sweeps SMSE aside from time to time and that renewal process ensures an efficient allocation of resources. However, it may also be the case that if some aspects of innovation leadership theory were to be adopted in SMSE, their relevance and longevity could be profitably extended, and they might then grow beyond being single product software firms.

8.4 Limitations

This research considers a small sample of UK SMSE that all provide B2B software. It is therefore both sector and culture specific. Whilst it is hoped that this research may contribute to theory, the application of that theory must come with a warning about the narrow sample and frame size. Any theory emerging from the data requires further research to test validity and applicability to a more general case. In addition, the methodology is based on a cross-section giving a “snap-shot” view of the phenomena. Longitudinal research may reveal different insights over time. In particular, it would be interesting to study innovation leadership at the start-up phase and innovation leadership in firms facing a decline in revenue and market share.

The SMSE used in this research were all B2B software firms. Further segmentation of SMSE into different categories based on a variety of factors might expose important differences between markets, technologies, regions, and firm size.

Comparing the UK experience to that of other countries and cultures would be of interest.

The interviews explored the interaction between different but related groups (executive leaders, engineer followers and PE investors) raising the possibility that data saturation may emerge at different points in relation to the three groups. However, CGTM allowed for a degree of abstraction of categories to reflect data of relevance to each cohort, so meaning and theory should develop with some degree of congruence. Nonetheless, CGTM is not without its critics as discussed in the methodology chapter. Therefore, future research might benefit the application of quantitative techniques and mixed methods to a larger number of SMSE to help establish theoretical validity and uncover new insights. For example, the themes discovered in CGTM would allow the construction of hypotheses that could test mediating and moderating variables using questionnaires.

In CGTM, the researcher is not an entirely neutral observer, but co-creates knowledge with the participants (Charmaz 2017). The qualitative defence of this research rests in methodological self-consciousness (Charmaz 2017), transparency and coherence (Yardley 2000). As an experienced technology entrepreneur, I was acutely aware of the danger of projecting my own biases on research design, the interviewees and on the data. In fact, what emerged from the research was quite different to the perception that I have of my own experience of leading SMSE as both an owner-manager and a PE backed CEO.

8.5 Future direction

As with any research project, time and resource constraints limit the boundaries of discovery. Whilst the sample size interviewed for this research project is large enough to offer interesting insight and draw conclusions about these firms at this time, given the nascent nature of this field of enquiry, significantly more research will be required to move to proposals of general theory. There are several ways in which the enquiry into leadership of SMSE could be progressed.

SMSE are economically significant and form an important segment within the creative industries that the UK Government is trying to promote as a source of national economic growth. However, there has been little research into this type of business. This research makes a case for better understanding the nature of innovation leadership in SMSE. Focusing scholarly effort on a large but relatively unstudied population in such an important area of the economy is likely to make a further contribution to knowledge. The knowledge and insight gained from such research may find application with practitioners, investors, and policy makers.

Beyond this initial CGTM project, further research could involve:

- Broadening the base of SMSEs to obtain more data, considering geography, culture, firm size, sector focus.
- Constructing hypotheses from the key themes that emerged from the project to test using other qualitative, quantitative, and mixed research methods.
- Considering longitudinal approaches to studying the leader follower interaction in SMSE over time and tracking the transition from owner-manager led through PE investment.
- Further development and testing of integrated models of innovation leadership within SMSE.

Software seems ubiquitous in the 4IR. Many aspects of our personal and professional lives depend on the software that controls the devices, machines, and systems that we use. Whilst some of that software is created by large well-known technology firms, a lot of it is created by the type of SMSE studied in this research. The importance of these SMSE to all aspects of our lives and to the health of the economy is significant. Understanding how SMSE innovate and finding ways to help them become more effective and efficient is worthwhile. SMSE are collectively large employers and so improving the working environment for software engineers in those firms by giving executive leaders a greater understanding of how software engineers perceive their leadership efforts is also valuable.

8.6 Personal reflections

My personal experience of SMSE includes being the founding entrepreneur and CEO, leading turnarounds for PE firms, advising PE firms on investment, acquiring SMSE from within large US public and private companies, and mentoring other technology company CEOs as they experience PE investment for the first time. The practical impact of this research is already evident in the way in which I interact with firms as a CEO, non-executive director, investor, and advisor. The research has raised my personal awareness of the potential to improve the shared creative cognition of executive leaders and software engineers. Much can be done to improve the communication quality that might impact innovation. The research has also made me even more aware of the transition difficulties for the owner-managers that I coach and mentor when they are moving to PE investment. Publishing from this research will hopefully raise awareness of these same issues for others involved in the leadership of SMSE and encourage them to take a longer term view on innovation and consider using a variety of leadership styles and behaviours contingent upon their circumstances. This may also encourage other academics to explore innovation leadership in the context of SMSE.

My own model of leading SMSE has become a practised formula, which embraces aspects of theory and aspires to construct an idealised model of innovation leadership. I typically establish close personal working relationship with all colleagues, especially software engineers. I regularly spend time in whiteboard sessions working across organisational disciplines such as marketing, sales, finance and operations with the software engineers. I also take engineers to meet large customers to learn how they use software. Although the 2020 coronavirus pandemic has enforced home working and social distancing resulting in an increased use of email, I have still attempted to personally engage colleagues using collaboration tools like MS Teams and Zoom, so these sessions have continued. Under normal working conditions, I prefer personal engagement with individuals and groups in both formal and informal environments. Whilst I recognise that culture change is difficult, I do believe from my personal experience that leaders can influence cultures over time and can actively encourage a creative climate through what they say and do. I typically establish an ideation process and product council that represents different stakeholder groups. Innovation is a frequent topic with all colleagues. Time and budget are set aside for horizon scanning and consideration of the challenges and opportunities of the future. Within the expected bounds of affordability, budget is established for exploratory innovation, and some interesting value creating ideas have emerged from this approach, particularly in areas like machine learning and data analytics. Organisations that I have led have usually scored well on engagement surveys, attrition is typically low and valuations on exit are better than industry averages.

This research has forced me to confront the possibility that other leaders do not run their firms the way I do, but they still achieve good results in the medium run. The firms included in this research are all led by competent executives with vision, passion and compassion. When I interviewed them, I found that I liked and respected them and had empathy with the challenges that they faced. However, they tended to have a more single-minded focus on cash and cashflow then I do.

That is not to say I am ignorant to the significance of cashflow, just that I seem to have less anxiety about it.

Despite the different approach to leading software engineers, the engineers interviewed were not unhappy nor did they generally represent attrition risk to their firms. In fact, the less organisational change that the firm was likely to undergo the better as far as most engineers were concerned.

The consistency of response from PE firms also surprised me as historically I have been able to garner support for a more radical innovation agenda.

My concern for the firms in this study and other SMSE that I have spoken to since the field research remains that whilst they may have viable businesses in the short to medium run, at some point they will face new market conditions, customer needs that change beyond their ability to respond with incremental innovation, or new competitor technology. Any of these challenges could be the *“gale of creative destruction”* that sweeps them aside.

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APPENDIX 1: RESEARCH CONSENT FORM

I give my consent to participate in an audio recorded interview on leadership and innovation in British small to medium sized software enterprises. I am participating on a voluntary basis and I am free to decline to answer any question or to leave the interview at any time without giving a reason. I also understand that I can withdraw from the research at any time up to one month following the interview without giving a reason.

I understand that all information is anonymous and confidential.

I understand that the interview will be audio-recorded and transcribed. Only the researcher (Paul Stanley) will hear the audio-recording of the interview in full.

I understand that the research output of the interview will be analysed and used in the creation of a final thesis written by Paul Stanley and submitted for consideration of the award of a Doctor of Philosophy (PhD) degree by York St John University. Extracts from this thesis may also be quoted in other publications and presentations.

Name:

Signature:

Date:

Signature of researcher:

If you have any questions about this research please contact:

Paul Stanley
York Business School
Lord Mayor's Walk
York
YO31 7EX
Email: paul.stanley1@yorksj.ac.uk

Mobile: 07990 002236

This research has been approved by the Ethics Committee of York St John University. If you have questions or concerns about the research and want to discuss this with an independent person then please contact Nathalie Noret, Chair of the Cross School Research Ethics Committee (n.noret@yorksj.ac.uk).

This project is supervised by Dr George Boak of York St John University (g.boak@yorksj.ac.uk).

APPENDIX 2: PARTICIPATION INFORMATION SHEET

Who is the researcher and what is the purpose of the research?

Paul Stanley is an experienced tech company CEO and a post-graduate student at York Business School. He is collecting data from British small to medium sized software enterprises (SMSE) in order to try to understand what leaders do to influence innovation in these organisations.

What type of data are being collected?

The research will be based on audio recorded interviews with senior executives and software engineers in British SMSE. The data will be analysed to explore deeper insight into what leaders think, do and say in relation to influencing innovation and how their behaviours are interpreted by the software engineers that work with them.

What will participation in an interview involve?

The interview will be scheduled at a date and time that suits you. Email confirmation of date time will be sent out at least a week in advance of the interview. The interview will take between 60 and 90 minutes and will typically occur in the workplace or another location convenient to you. The interview will explore your views on how innovation is encouraged in your industry and your company. The interview will be recorded and then transcribed.

Will I be identifiable?

No. All transcripts will be anonymised so that any personally identifying information has been changed or removed. Data will be stored securely in password protected drives and files and treated in compliance with York St John University policy.

Can I withdraw from the research?

Once you have agreed to participate in the research you can withdraw at any time up to one month following the interview. If you wish to withdraw then please email Paul at paul.stanley1@yorksj.ac.uk.

What are the benefits of taking part?

Innovation is important in all businesses, but seems especially important in the software industry. By sharing your experience, ideas and views you will be contributing to creating a better understanding of how best to lead innovation within organisations like your own. Taking time to reflect on what works and what does not work in your own organisation and experience could influence your immediate environment. This is also an opportunity to take part in an original research project which offers the opportunity to experience research from "the inside", which in itself might be interesting and informative. You may also be interested in receiving a copy of the findings of the research.

If you have any questions please contact:

Paul Stanley, York Business School, Lord Mayor's Walk, York, YO31 7EX
Email: paul.stanley1@yorksj.ac.uk **Mobile:** 07990 002236

This research has been approved by the Ethics Committee of York St John University.
This project is supervised by Dr George Boak of York St John University (g.boak@yorksj.ac.uk).

APPENDIX 3: EXECUTIVE LEADER INTERVIEW

Preliminaries

Explain purpose

The purpose of this interview is to understand what you think, say and do as a leader in this organisation to influence innovation, particularly in relation to the software engineers that you work with. Innovation could be the development of new products, services or feature functionality. It could also be new ways of working that might, for example, improve efficiency, quality or collaboration.

Consent

Are you happy to take part in the interview?

I would like to record this session so that I can capture the full richness of our conversation. Are you happy for me to do that?

Anything that you say will be anonymised as explained in the consent form that I sent you prior to this meeting. Please could you sign the form here indicating your consent to participate in the research?

Section 1: Background

Please tell me about your own background and how you came to be [ROLE] at [FIRM]?

Section 2: Innovation

Tell me about innovation at [FIRM] – prompts might be:

- How do you define innovation? What does innovation mean to you?
- Types of innovation?
- Dimensions of innovation:
    - Product versus process
    - Radical versus sustaining
    - Incremental versus revolutionary
- Importance of innovation? In this company? In this market?
- How much time do you spend on innovation and doing what?
- Track record in innovation?
- Difficulties?
- Funding/investment in R&D?
- Successes and failures?
- Learning?
- Critical success factors?

Section 3: Individual impact

Tell me what you THINK/DO/SAY to try to influence innovation? - prompts might be:

- Think about an example of an innovation that went well at [FIRM] – what was your influence? What did you learn individually and at an organisational level?
- Think about an innovation that did not go well at [FIRM] – what was your influence? What did you learn individually and at an organisational level?
- Are there any specific things that you consciously do to influence innovation? What do you think the impact of these things is?

- How would you describe your relationship with developers/software engineers in relation to innovation? How do you think they feel about innovation within [FIRM]?
- Intended and unintended outcomes?
- Balance between creativity and "grind"?
- Constraints? (TIME/MONEY/RESOURCE)
- Frustrations?
- Top 3 tips that you might offer to someone else?

Closing

- Any questions from participant?
- Thank them for participating.
- Re-iterate what will be done with their data.
- Explain timescales for analysis and write up.

APPENDIX 4: SOFTWARE ENGINEER INTERVIEW

Preliminaries

Explain purpose

The purpose of this interview is to understand your views on how the leadership of [FIRM] seek to influence innovation within the business by their behaviours - what they do and say. Innovation could be the development of new products, services or feature functionality. It could also be new ways of working that might, for example, improve efficiency, quality or collaboration.

Consent

Are you happy to take part in the interview?

I would like to record this session so that I can capture the full richness of our conversation. Are you happy for me to do that?

Anything that you say will be anonymised as explained in the consent form that I sent you prior to this meeting. Please could you sign the form here indicating your consent to participate in the research?

Section 1: Background

Please tell me about your own background and how you came to be [ROLE] at [FIRM]?

Section 2: Innovation

Tell me about innovation at [FIRM] – prompts might be:

- How do you define innovation?
- Types of innovation?
- Dimensions of innovation:
    - Product versus process
    - Radical versus sustaining
    - Incremental versus revolutionary
- Importance of innovation? In this company? In this market?
- How much time do you spend on innovation and doing what?
- Track record in innovation?
- Difficulties?
- Funding/investment in R&D?
- Successes and failures?
- Learning?
- Critical success factors?

Section 3: Individual impact

What do you think the business leaders at [FIRM] do to influence innovation? - prompts might be:

- Think about an example of a successful innovation within [FIRM]. What do you think the leaders of [FIRM] did to influence that success. What did you learn individually and at an organisational level? What influence do you believe that your leaders have on the outcome?

- Think about an example of an unsuccessful innovation within [FIRM]. What do you think the leaders of [FIRM] did to that may have influenced this outcome. What did you learn individually and at an organisational level? What influence do you believe that your leaders have on the outcome?
- Are there any specific things that your leadership seem to do to influence innovation? What do you think the impact of these things is on you/others/process/organisation?
- How would you describe your relationship with leadership in relation to innovation? How do you think they feel about innovation within [FIRM]?
- Intended and unintended outcomes?
- Balance between creativity and "grind"?
- Constraints? (e.g. TIME/MONEY/RESOURCE/OTHER?)
- Frustrations?
- What advice would you offer to leaders seeking to influence innovation with people like yourself in this organisation?

Closing

- Any questions from participant?
- Thank them for participating.
- Re-iterate what will be done with their data.
- Explain timescales for analysis and write up.

APPENDIX 5: PE INVESTOR INTERVIEW

Preliminaries

Explain purpose

The purpose of this interview is to understand your views on the executive leadership of innovation in investee SMSE firms. I am interested to understand your views on how executives influence innovation within the business by their behaviours - what they do and say. Innovation could be the development of new products, services or feature functionality. It could also be new ways of working that might, for example, improve efficiency, quality or collaboration. I am also interested in your perspectives on owner-managers and how they might differ in traits, behaviours and experience to the CEOs that you select yourselves.

Consent

Are you happy to take part in the interview?

I would like to record this session so that I can capture the full richness of our conversation. Are you happy for me to do that?

Anything that you say will be anonymised as explained in the consent form that I sent you prior to this meeting. Please could you sign the form here indicating your consent to participate in the research?

Section 1: Background

Please tell me about your own background and how you came to be [ROLE] at [FIRM]?

Section 2: Innovation

Tell me about your experience of innovation in portfolio investment companies – prompts might be:

- How do you define innovation?
- Types of innovation?
- Dimensions of innovation:
    - Product versus process
    - Radical versus sustaining
    - Incremental versus revolutionary
- Importance of innovation? In investee companies? In your markets?
- As an investor, how much time do you spend considering innovation?
- Track record in innovation?
- Difficulties?
- Successes and failures?
- Learning?
- Critical success factors?

Section 3: Support for innovation within investee firms:

- Discuss investment preferences?
- How do you feel about investee portfolio companies innovating?
- What type of innovation do you support?
- How is such innovation funded?
- Do you apply additional capital to support innovation?

- How would management secure additional capital to fund innovation?
- What concerns might you have about SMSEs innovating?
- What do you think the business leaders in your investee firms do to influence innovation?
- Think about an example of a successful innovation within one of your investee firms… What do you think the executive leaders did to influence that success. What did you learn individually and at an organisational level? What influence do you believe that your leaders have on the outcome?
- Think about an example of an unsuccessful innovation within one of your investee firms… What do you think the executive leaders did that may have influenced this outcome. What did you learn individually and at an organisational level? What influence do you believe that your leaders have on the outcome?
- Are there any specific things that executive leaders seem to do to influence innovation? What do you think the impact of these things is on the organisation?
- Are you aware of the relationship between leaders and engineers in relation to innovation? How do you think they feel about innovation within you investee firms?
- Constraints? (e.g. TIME/MONEY/RESOURCE/OTHER?)
- Frustrations?
- What advice would you offer to leaders seeking to influence innovation with people like yourself in this organisation?

Section 4: Owner-managers and experienced CEOs

- What is your experience of owner-managers of SMSE making the transition to private equity ownership… examples of positive and negative experience?
- How do you support owner-managers making the transition?
- Are there problems that they face? What type of problems?
- Have you ever had to replace owner-managers? Discuss what happened…
- What behaviour, traits and experience do you select for?
- How do you select executive leaders? (process and external support?)
- How do CEOs lead innovation? Any differences between owner-managers and recruited CEOs? How do they relate to engineers? How do they manage engineers? How do they motivate engineers?
- What outputs are you looking for? Success criteria? What does good look like?

APPENDIX 6: EXECUTIVE TRANSCRIPT SAMPLE

TRANSCRIPT OF INTERVIEW RECORDED AT 18:46 ON 24 JANUARY 2018 AT FIRM2'S OFFICES

Interviewer text is shown in capitalised italic script.

ME: HOW DID YOU GET INTO THE BUSINESS?

I got into the business through studying locally at [UNI NAME]. I started the business whilst at university, feeling that was my destiny. Got involved in contracting locally for some family firms through finding problems that the family members were having with their own work. Initially, I did a bit of unpaid work to help solve those issues. Erm, worked locally for some IT firms and other software engineering companies. And weirdly fell into this position because I needed to find extra revenue that the job wasn't providing to me and had a desire and a need to get more money fundamentally to build a house that was meant to take 15 years within 8 months because my wife had fallen pregnant.

So, we built that house in 10 months. So at the end of that I had a family, I had a house and had a viable business that had afforded me the opportunity to build a 6 bedroom house from the base of a 1 bedroom cottage without taking much more mortgage on. After university I did do some work in industry, but within 3 or 4 years I was running my own business. I had a desire to run a business, but I needed to pick up some knowledge. But I had spent a good number of years providing consultancy before going into industry. A backward step in some ways – well in terms of salary at least. I spent a lot of time in and got up to quite a senior level in a local oil and gas firm, and at that point took a chance and went out on my own. We had just finished doing the house, so I didn't have much in the way of finances. However, I had a consistent client who was fairly sizeable, and I had a very good relationship there, so there was some revenue coming in. At that point I had a clear idea of what the business would be, but it is not what it is now. We entered into the market locally to enter into a product called [NAME OF A CRM SYSTEM]. The main reason was it was a product that was forever growing.

There was a desperate need for CRM systems and business management systems. Typically, oil and gas companies had been using IBM Lotus Notes and the like. There was a movement to a MICROSOFT stack. However, some of the competition, or people that we deem to be competition now, they were moving away from the MICROSOFT stack because they were finding that they couldn't get the engineers and the skill sets to do it. Of course, that is where some of my experience previously had been and I could fill that gap in the market that I had identified. At that point I was working alone, but I realised that there were two or three people locally that had the skill sets that then I could call on so I could build a small team very quickly should I need to. [CUSTOMER COMPANY NAME] as an example, and I didn't realise at the time that they had been one of the companies that had been looking at this type of stack. And within the first 12 months they gave us a contract worth about £300K, so a good chunk of work.

So, I owe the starting up of our organisation to a customer that I had a relationship with who was willing to take a punt basically. I think they were happy to take this punt with us for a number of reasons. I see myself as a good developer, but I am not a brilliant developer. But my skill set is about building relationships and being able to talk in non-technical terms when required so I can build rapports. I am probably as much a salesman and business development manager as I am a techie. I think it was all really down to the rapport.

ME: SO HAVING ESTABLISHED THE BUSINESS AND STARTED TO GENERATE REVENUE, HOW DID YOU THEN GET PEOPLE TO JOIN YOU?

Well, at that point it was very much around relationships with *[OWN FIRST NAME]*. At this point the clients we were engaging with were really engaging with *[OWN FIRST NAME]* and would be a client of *[OWN FIRST NAME]*. So, *[OWN FIRST NAME]* was doing the work. And I was building up the revenue and the organisation and I was taking on staff behind me to learn what I was doing and also building our own products which we could then actually sell to the industry. So by the time these projects were 12 months old we were starting to pull in our staff and actually make them more client facing. So within the 18 to 24 months *[OWN FIRST NAME]* was then doing more of a managerial role and suddenly the clients were dealing with [FIRM2] and not *[OWN FIRST NAME]*. This was initially an evolution, naturally occurring. But when I realised what was happening I pulled together a plan and that came together pretty quickly.

ME: AT FIRST YOU WERE DOING EVERYTHING, THEN YOU GOT SOME PEOPLE TO HELP YOU. DID YOU HAVE ANY THOUGHTS ABOUT THINGS LIKE STRUCTURE AND ORGANISATIONAL CULTURE AT THAT POINT?

Well, that took a while to be honest with you. If I am totally honest with you, I think we have only just started to get to that sort of thing in the last couple of years. I think it, erm, building a small team, erm, comes with many challenges – cashflow probably being one of the top. Erm because of that you are chasing yourself all the time. So because of the cash you don't have the time to certainly do things. Erm. You're learning your processes. Although you have processes in place you always learn that your processes are not quite good enough. Often you need to evolve them, you need to change. Erm, I think it probably was when we started to get a turnover of staff that you realise that the culture actually probably wasn't there. Because they were going elsewhere for a reason. And we needed to really understand why that was because they're likely going for a cultural change as a developer as well as , yes, they are interested in money and they've got bill to pay as well. But they are as much about their working life. Actually what they have in their teams and how they are contributing.

The environment that they are working in. The types of solution that they are being able to solve for people. So they are very much more than actually your typical employee in a lot of industries I would say. So if we were losing them, why? What was it that we weren't able to give them? And in some cases, it was because they were doing the same jobs quite regularly. In other cases it was because we weren't able to pay them competitively. But one of the reasons we weren't able to pay them the same wages as elsewhere was because we weren't working as efficiently as we probably could have been. So, we had to take a step back. We had to build a strategy.

ME: WHEN YOU TOOK THAT STEP BACK, WHAT DID YOU THEN DO?

Well, the realisation was in order to make this thing – because we've got a number of businesses the problems always looked a bit more difficult if I am honest because a lot of what we were doing was building enough resources while keeping cashflow right in order to build products and keep all that going. So, keeping them involved in what was going across the group of companies if you like, and not just on what their role was. Giving them a lot more involvement in the decision so coming to them with potential problems, and this is what we look like form a management team… on a – on a weekly basis we have project meetings where we determine and we tell them how much have we got in the bank. How much money is actually sitting there right now? What is sitting in debt? Why is it in debt? What's sitting in projects that's coming up? What's our opportunity pipeline? So that they know right across the business what that business is looking like. And I think they like it – that level of knowledge. And the business has never been in a position where the information is scary… erm, but I think the fact of the matter is, erm, because we trust them we went them to be involved in it. They are involved in the good and the bad.

ME: SO, WHAT IS IN IT FOR THEM THEN? IF THEY KNOW THINGS ARE GOING WELL FINANCIALLY, HOW DOES THAT IMPACT THEIR OWN LIVELIHOOD?

They are really bought in. I mean, I have got a team now here… their message to me – we had a conversation about this only the end of last year – about how we were and where we are moving and direction, and they said to me, "But [CEO NAME], you've got a team that want to be working for you." That's what they are putting forward, so if that is true, then for them to get a true understanding of all aspects of our business is important. So they really want to be involved. We are putting a member of staff – changing his role right not – into a customer service representative. Somewhere that we identified as a team where we need to get stronger. He has gone into that role purely off the back of – because he is the one that seemed most worried about that offering that we are giving to those customers. So, he's brought this forward saying that he thinks we should be doing this better.

He's trying to find a solution. He's part of the management team and he doesn't even know it. He's making these kind of decisions with us. So I think the culture is there in the fact that we are actually all in this together.

ME: DO THE DEVELOPERS HAVE ANY ECONOMIC INTEREST IN THS SUCCESS OF THE BUSINESS? DO THEY HAVE SHARES OR PROFIT SHARES OR ANY OTHER ECONOMIC INCENTIVES?

No, but we wouldn't be against that either. We have talked – we have talked about doing this. I think it obviously helps to have vested interest in anything. It obviously makes you feel that you probably want to do a little bit more. Erm, and I think it is probably something that we will end up doing in some respects whether it's a profit share or whatever. But as a growing business it has always been something that I have struggled with because you want to give your staff more, but actually, coming back again to cashflow, there is only so much you can do. And usually, if anyone suffers in a small business it is us two *(MEANING CEO AND OTHER FOUNDING DIRECTOR)*. So, we are the ones – you know – that at certain points, have dropped our salaries or have reduced our salaries to nothing for periods just to get by and make sure that the business survives.

ME: DO YOU THINK THAT THE STAFF UNDERSTAND AND APPRECIATE THAT?

I think no. I think that is where the transparency probably isn't there. So again, you tell them what's in the bank, you tell them what's in the order book, and you tell them what's in the pipeline. But, whether they need to know that level of detail – I don't know.

ME: WHAT ABOUT PROJECT RELATED BONUSES? DO YOU EVER TRY TO INCENTIVISE IN THIS WAY?

No. We haven't. Again, we have a plan in place that we have started to do with HR this time last year *(HR IS ONE OF THE DIRECTOR'S WIVES WHO WORKS PART TIME TO DO PAYROLL AND IS NOT AN EXERIENCED OR QUALIFIED HR PROFESSIONAL)* and there are two bonus schemes that we are looking at. And one of them is to do with completion, but it actually has to be down to quality of product. So again, coming down to customer service, there is no point in actually delivering something if it is going to fall over and fail basically as a product when it is in market. So, it has to be very much tied to number of support tickets thereafter and how you do that. So again, it is a conversation we have had internally with the guys as well 'cos I want their feedback on what works for everyone with regards that piece.

They get bonus schemes on an annual basis, so fundamentally if there's profit in the business and we're doing well they get a bonus at Christmas for instance. And we generally try to do that while night out thing. We take them out every quarter.

ME: DO YOU THINK ACTIVELY ON A DAY-TO-DAY BASIS ABOUT INCENTIVISING INNOVATION?

No, not really. But if I am honest I probably should be. But I think again, the problem with incentivising anything is… is… it is more cash going out of the business assuming it is a cash incentive. But that might be one of the problems with how I manage this small business as I always think of incentives as meaning financial incentivisation rather than other. One thing that I am very clear on is I tell the guys when they do a good job. Every time they do a good job and I actually see that and they are going out of their way they get told and there is an appreciation there. And they get to use the premises as if it is theirs in some respects. So it is quite often on a Friday night they'll stay late and play cards and have a few beers in the office and we are happy for them to be doing that. Again, there are certain aspects where they need to be working from home, so it is an incentive for one of our guys for instance who lives a way out, quite happy that he works from home every Friday. And if he needs to do that on a Wednesday as well, happy for that to happen too. Generally, he'll take the Friday, and he chooses to come in on a Wednesday. So, we build in small things like this to give a little bit back and say you are doing a great job and thank you very much. And I think that kind of recognition is generally enough for the guys.

ME: DO YOU BRING THEM TOGETHER TO TALK AS A GROUP?

Yeah, although it is a small room, we get them in here every single week. What we typically do is we've got links to the engineers, and so we've talked about doing it more often fundamentally. What we do is, I always… I always, when I come in go round and have general chat and say where are we? And everyone's involved in that conversation so we are speaking to each other. So although it is not a strict sort of AGILE SCRUM meeting, but it is not dissimilar in some respects. Every week we will have or try to have a project meeting in here. The sales team on a Friday at 3 o'clock they have a two-hour meeting basically. It goes through our sales strategy, it identifies everything that we have been able to achieve or have not achieved off that strategy and how we action a change for the next week.

I think that is probably where a lot of my… er – my, that's my structural element – I am actually doing BD *[BUSINESS DEVELOPMENT]* for the business, so if nothing else that's where a lot of my importance is put. And that works, it works very well.

ME: THINKING BACK OVER THE RECENT PAST, COULD YOU PICK A PROJECT THAT YOU THINK WENT WELL AND TALK ABOUT THAT FROM THE PERSPECTIVE OF YOUR ROLE AS A LEADER AND YOUR INTERACTION WITH THE SOFTWARE ENGINEERS?

We did a project for [CUSTOMER NAME]. It was part of [MAJOR O&G COMPANY PROJECT NAME]. It was an umbilical riser pool and monitoring system which fundamentally took in three sensors – winch, line out and pressure – fundamentally 20mA outputs which we need to take in, digitise, do some fancy logging and develop a graphical kind of user front end for it. Erm, I think that project went well for a number of reasons. One, we built a very good rapport with the customer in that respect.

ME: WHEN YOU SAY "WE", WHO TALKED TO THE CUSTOMER?

Well, me – I talked to the customer. But the software engineers did talk to the customer too. You see, initially, I build up the rapport, talk to the customer to build their confidence in our company. And then, at the right technical points I would get the technical team involved. Now in that situation, a technical director, [NAME], and a senior developer, [NAME], basically got involved in the technical piece. So first point of call, first thing to do was make sure you've got the right people involved at the right time. That is a thing that a lot of software development companies get wrong and we've got wrong in the past as well. Erm, once that was in place and because we had the right people involved we were able to plan and design that solution really well. Now, the success of our project… yes it went on budget, it was on time and the solution couldn't have gone better. There wasn't one single bug in all 26 operations. The success of that project wasn't because we coded it well. It was because the developer that we actually had communicated with the project team.

Basically, we could actually trust in him to do that piece. But nicely, we always had our reporting capabilities. Because we were doing the project meetings not only with the customer but internally [NAME OR FELLOW DIRECTOR] and I at any given time always knew exactly where that project was – why it was on time and if there was a problem with it – for which there was only a couple of things – one, a lap top didn't turn up so we had to source a replacement to it and communicate that back to the customer – but it was that communication piece because we could trust that employee to do that piece very well for us. Now the employee in particular - [NAME] – he is our senior engineer. He is the first ever engineer that we have had. So he has 6 or almost 7 years of basically internal influence. So now, just an example, he runs our London office for us. So, he is our longest standing member of staff. He knows and works exactly as we do. And fundamentally, we can almost leave him to run projects himself.

ME: THANK YOU – SO WHAT DO YOU THINK YOU DID IN TERMS OF YOUR RELATIONSHIP WITH HIM AND OTHERS AT VARIOUS STAGES TO KEEP THE PROJECT ON TRACK?

Erm – as an advisory. Almost making sure that those communication paths were still happening. You know? I would say, right ok this is something that we should be communicating to the customer. And I think again, it is a common failing of an engineer, to sit themselves within a bubble and solve the problem first and get to communication with the customer secondary. Of course there are times when you want to do an element of that when things become urgent or they want to know that the problem is expiring in the customer's eyes, they want to know something is happening. And I think sometimes all it takes is a little nudge, yeah, every now and again from my perspective calling in on the customer from an account management perspective and making sure everything is going well there and almost feeding that positive feedback back to the technical team, so they can hear it from two sides. Yeah, erm, yeah, erm, projects on track – everything's going well. [NAME's] happy – which is the gent that we were dealing with.

ME: THANK YOU. NOW, IF YOU THINK BACK TO A PROJECT THAT DID NOT GO SO WELL, WHAT DO YOU REMEMBER ABOUT THAT IN TERMS OF YOUR INTERACTIONS WITH THE SOFTWARE ENGINEERS?

Absolutely polar opposite to that to be honest with you. It is where I was the contact, well, there's actually been two or three to be honest with you over the last 7 years. And it is all the same fundamental mistake. So, not handing over the project – for one particularly company [*NAME OF MEDICAL COMPANY*] where the project in a technical term has been a success. But the project did not hit the timescales and I still think that although technically we did fulfil everything it was not as good a process as we could have put in place. Main reason for this is I didn't hand over technical management of that project early enough. So that by the time we were hitting designs and requirements a lot of the information was third party. In which case it wasn't coming straight from the customer and it was coming through the wrong person within the organisation and as such it had not been documented properly. If you start off a project at that level, you are never going to reach the customer's requirements if you haven't documented them correctly in the first place. Erm then of course because you are so far down that line you are deemed the account manager. Yeah, and of course because I was then the middle piece, and so too busy, I wasn't always available. And that's happened a couple of times. And that is why now, I don't do that. I basically take them in and then they are managed by the project teams.

ME: HOW "HANDS ON" ARE YOU WITHIN THE OFFICE ON PROJECTS?

Depending on the project, I am not doing anything on the development or testing of projects anymore if I am honest. But it is more about having time to do it rather than an active thing to be honest. Erm, not development – design – quite often. I see myself as having experience enough to be able to architect solutions and really question the guys to make sure that they are making the right decisions. I impose a lot of knowledge in on-line environments in particular. Especially around search engine optimisation. Some of the things might seem secondary for my developers, I have to remind them that we are carrying the investment for the customer and the objective is to get sales through the solution. In which case they need to be seen and almost trying to drive quality. What's more is that we analyse our web-sites using a set of reporting tools and those reporting tools fundamentally give you a score out of 10. How the hell is this optimised basically for this. Now when we optimise, well, when we are compared against our competitors, we have seen results varying between 0.8 and 3.6 out of 10 for them. Very seldom have we seen much else above that. However, as a company, our aim is nothing less than 9 and 9.5 is our aim. I'd rather get it up to 10 but only twice I think. But fundamentally we shouldn't be putting anything that's below 9 as a gate. We can demonstrate this to the customer using the reporting tool. So for example if it is the replacement of a website what we can do is report against that web site and produce a report in a PDF that actually shows them all the failings on that website – actually why it sits at that, and then at the end we will do exactly the same and say, look this is what we have produced for you. Now it is a great tool for people such as myself, but it is running the same type of algorithms as an SEO, so it is a good stamp that if we are doing it right then we've got a really good solution for the customer. So, 1 – making sure it is always in the process. The guys must all pretty much know that now they are all up and running. Looking out for slippage – so this morning I asked a very simple questions trying to keep them covered – where are we with regards our reporting. Oh well, we got an 8.7 at that and they seemed really happy. But I was, like, well it doesn't reach our quality criteria does it? And it's like, well, it is really high though. How do we get it to 9 or 9.5? And it almost like its saying look we are doing a really good job, but what the product you've actually produced here is of great quality, but let's see if we can get it to. And low and behold, 15 minutes and where did they get it? Yeah. And it's not enforcing… it is just standing there to drive that little bit firmer quality out of something and making sure that we are setting a standard. And that's what I am about. That's where I am, er, where I get involved.

ME: WHAT DO YOU THINK THE BALANCE IS BETWEEN FACE TO FACE COMMUNICATION AND EMAIL OR DOCUMENTED COMMUNICATION WITH THE SOFTWARE ENGINEERS?

Yeah – I do use those differently put probably not on purpose if I am honest. I do follow up now with certain factors so again, another example, especially now we've got distributed. So, we've got our BD down in London and we've got some guys in here being quite active and I need them to work on certain things together. So, I will communicate by phone or by face first of all just to put ideas together so that I can gauge responses to certain things and then all being well, I will follow up with a formal email that introduces those ideas to them both [ENGINEERS AND CUSTOMERS] and then basically file that away. That type of thing absolutely. But it is with customers when we are project orientated, I would prefer to pick up the phone and talk about certain things. But if it is something that is going to be recorded, needs to be recorded for the project, then it is definitely written.

ME: THINKING ABOUT WHERE NEW IDEAS COME FROM WITHIN THIS ORGANISATION, YOU SEEM TO HAVE SOME INNOVATIVE IDEAS YOURSELF, ARE THESE RESPONSES TO WHAT YOU IDENTIFY IN THE MARKET OR ARE THEY IDEAS THAT YOU COME UP WITH INDEPENDENTLY OF THE MARKET?

Well, both I would say. You learn a lot from customers actually and you learn a lot from projects, so one of the beauties that we currently have in the business that we run is that we are building bespoke solutions for a really varied customer base. The projects that we are working on are diverse beyond what I ever thought they would be. In any given week we've got multiple mobile apps, we've got back office systems, we've got a whole business management system that we are currently writing with customer portal, sub-contractor portal, full internal email document management and business management processes. With an applications for couriers to collect with RFID tags and the likes. That's one project that's diverse in its own kind of rights with the technology stacks we are using and the reasons we are using it. But then, if you are using C# and 4 to 20 mA sort of conversions at one end and you've got a satnav at the other it means that from all of those different types of industry you are seeing standards change.

Which you can apply to other business. Other businesses, and other ideas, and other industries. And I think a lot of ideas are borne out of that very simple concept. Especially when we are looking at an industry such as marine industry or the construction industry where some might say that they are slightly behind in terms of their adoption of technology – they're catching up but… In comparison with other sectors, it is very easy to apply changes to some of these industries that are maybe a bit further ahead in the times. So, there's elements like that. Erm, and then I guess there's getting with the team and we can get – I mean – as a business I would say we are innovative for a number of reasons. One, you are actually forced to innovate sometimes because you've got, you've got pressures on you around being efficient. Because of cashflow, because of time constraints and the like so when you are looking at innovation we are looking at actually having the time to innovate. If you don't have the time to innovate, why don't you have the time to innovate? So, one, either your processes etc aren't good enough in as much as you're not making the money in the timescales that you should in order to have the time to innovate. Or something is going wrong, which means that you are getting squeezed for time all the time. It is generally about that time piece.

Now, there's two angles to that. One is keeping up with projects. The other is, how that's seen across the board here. Looking at our own usage of our systems and tracking that element. Erm, when we are speaking to our guys, we all think that we are actually building our own internal systems to actually manage that really well. So from a management perspective, we've got elements in there that allow us to see what we actually need to see. But from their perspective, OK, they don't get the time to innovate, so we say well what do you suggest then? So, keeping them in, well OK, what's the return on we doing that? You know? So, if that is taking you a couple more minutes every hour to put the time in, and you are going to be happier in your job, then what is it going to take to actually solve that and build that interface which is actually going to do that piece? And we are actually allowing them to make some of these decisions. Now that builds, well, it goes back to your culture. You know, actually making them feel like they are involved in it. But actually, they're helping you innovate some of the change within your own business.

Which actually improved it. Now, you can see that over time. And especially when you look at the team that we've got right now, erm, you interviewed somebody earlier on that I don't know if I should measure him or whoever, but – very – very – good. Where he has got one of those mindsets where, you know, he is not bound by time in the fact of, he is not a 9 to 5 member of staff. He goes away at night and he thinks about how to improve things. Whether that's within a project or whether that's within the organisation. He thinks about how he likes to work. And I will actively get emails in the night saying, let's have a chat about this in the morning or I've got an idea about how to improve that. That's not something that you build into culture in an organisation. Whilst working for an organisation. That's something that a person has. And that's the type of thing I used to do when I was at [FIRM NAME] where I used to work. And, if I am honest with you, and I don't know if you've got the same view, but I don't think there are as many of those type of people around anymore.

I think there is a more 9 to 5 type of culture, where I've certainly seen more of that in the past. There's one or two who seem to actually still have it. Still want to do that kind of thing. And fundamentally, building a team of people that are not all those people. They're not all those same features that they've got. You have got the hobbyist who is off at night playing and building his own games. Trying out new tech and stuff, not necessarily for us or for the business. But he's getting that knowledge. When he comes in at 9 o'clock in the morning he is considering those ideas in how own projects. But then you've got the educated person who fundamentally knows the processes and they follow the processes all the time, but they are interested in reading and writing papers. And they understand a new set of algorithms that you should be considering for search etc. Because of that piece, but again, they are doing that in their own time because they have got an interest in it. So, when they are thinking about how to tackle or design a project, they are taking those kind of pieces. And then you've got people that completely, er – they are uneducated – not educated in the slightest. They haven't gone through the formal university. But they've got here because they've got a true love and understanding of computers. The innovation that they come with is far vast – not necessarily just a programming language necessarily. It is how we bring a team of, a collective team of, well all these features – that's your innovation within your organisation. You can't have an imbalance of too many of them, one or the other. You need that pairing. And I think that's what we try to build here is a culture which allows the innovation to happen.

ME: SO THINKING ABOUT THESE DIFFERENT TYPES OF PEOPLE, SOME OF WHOM ARE 9 TO 5 AND OTHERS WHO REGULARLY GO BEYOND THEIR CONTRACTED HOURS, DO YOU EVER THINK ABOUT HOW YOU HIRE FOR THAT?

No, if I am honest I don't. They way, err, the way we – again coming back to making sure you are picking a solid mix of skill and personality, erm, how we hire, I don't know if I have mentioned this or not, but I, erm, allow the team to hire. So, my, my, thinking on this is yes great they can be a developer and they can have the skill set to do that, but if you've not got a personality then you've not got a good mix and you're not going to get on with the team, what's the point? So, typically we would, well, I would do a first interview – well, usually more informal if I am honest. To try to gauge what the person is about rather than whether they are a good fit for the team or what their experience is etc etc. But then if they… if I believe that they are pretty good and they can take the next step I get the team down basically. And so, it would be depending on their role who would speak to them. I would take two of the guys – generally a lead and another. And invite some of the young guys to see the processes as well. And they interview the people to see how good a fit they would be. Again, first interview – just a simple Q&A session. Pass that and then the guys will get them in and will usually do a couple of hours basically, working on something with the team, giving them small tasks and it is really about communication.

For me, innovation is not necessarily a new way of doing something. It's looking at a cleaner, potentially more efficient – bringing an advancement in some area. Whether it is in time, quality or experience. That's it basically for me. So, we have seen a lot of innovation within industries where it is not a completely new idea. They are actually just bringing an advancement to an existing potential product by considering what is becoming more and more normal for other users.

So when we started looking at [*NAME OF PRODUCT*] we deemed it innovative. It was only deemed innovative because no-one was using touch screens at that time in that environment on those types of solutions. However, it was normal everywhere else. And what we seen there was, right, everyone was becoming far more familiar with these products, well using certain products in certain ways. And yet we've got an opportunity to turn that, well, pull in an industry that's a similar type of environment that has always been deemed "clunky" erm, and innovate while applying something to make it more user friendly and simpler to use and hopefully we'll bring a return on investment through efficiency.

So it's erm, I think, there's always a situation, always a trend where people are coming out with truly innovative solutions, yeah, erm. The initial introduction of robotics, for example, when you were the first person that's coming out with that new idea – that's true innovation. For me, that is where you are actually coming out with something that no-one else has really considered. Something hat nobody's ever done before. Then, you've got like a secondary thing. And that is the thing that I think we mostly get involved in. Where we are looking at two main things: doing things better, with technology that is being used elsewhere. Basically. Hmmm.

ME: DURING THIS PERIOD OF GROWTH, WHERE YOUR TEAM ARE UNDER PRESSURE TO DELIVER, IS THERE EVER A SITUATION WHERE YOU HAVE TO LIMIT THE OPPORTUNITY FOR CREATIVITY AND INNOVATION IN ORDER TO FOCUS ON SHORT TERM DELIVERABLES?

Yeah, ermm, there is – yes, there is. I think that is less so now. There definitely has been at various points in the past. Erm, we've got again erm, where we've failed on that in the past is by failing to set expectations. So, if we have under-priced something and we've tried to meet deadlines that are not realistic then of course you are literally just getting the solution build and out the door. That's not where we add value. Erm, and of course that's easy to say now that we are a little bit older and you've got a little bit more money in the bank and it's probably got a better pipeline than we have ever had in our life. And because we've done it without ever bringing any external cash into the business and we've really done it organically, I think that's the difference between starting that initial business, especially the way we've done it – that's the difficult bit. You've done it over the years, you've made it simpler for yourself, so apart from that, we probably weren't always servicing our customer properly. Because we weren't giving ourself, we weren't affording ourself the time – to have the time to do that properly. Because actually the way we were winning work was by doing it cheaply and doing it quickly.

And you know, that adds nothing to anyone. There's still people that want that – of course there is – but we are not adding value to their business.

ME: DO YOU HAVE ANY OTHER THOUGHTS ON THE GROWING PAINS AND HOW THAT IMPACTS ON INNOVATION?

Yeah, erm, I think, erm – well, I said a couple of things there with regards to the history. It is easier now – it is easier now if I planned towards this stage. But I am still going to grow. Well, up until now within the [NAME] business, I have kept that to a size where it is small and stable while we build the products. But, we've got an ability to grow that fairly substantially at this moment, so, when you look at a £500K turnover company as it stands, we've got a very, very reasonable opportunity to turn that into a £2.5MM turnover this year, minimum. 500% growth. So, how do you do that organically without taking cash in. So, we've done our projections for this year – I can't. So fundamentally that puts strain on unless I go and raid cash that allows us to continue that, but the time though, it just comes down to two things basically – money and time.

ME: THANK YOU. EARLIER YOU ALLUDED TO INTRODUCING SOME STRUCTURE TO THE ORGANISATION. HOW MUCH STRUCTURE DO YOU BELIEVE IS ENOUGH AT THIS STAGE?

Yeah, so currently in the business, what we've currently got is myself who is titled the managing director, but fundamentally I am on the business development side.

We’ve got a technical director [NAME] who, well, his involvement is basically in the project meetings on a weekly basis. And, there should he need to be to give us some advice around architecture and solutions. We have got a lead project engineer. We have got – and we are just moving this gentleman in from 1 February – a lead customer service engineer taking care of the project team. And we have got our lead CRM, again, completely different vertical, but he’s running the London thing at the moment.

That is basically our management team. And then underneath that we have, well, so from a structural perspective other than that we have external services. So things like our accountancy and payroll is handled completely externally, and what needs doing in house is one of our wives. Our HR for example is external service or one of our wives. Our IT is external service and this is all working for us. The beauty is that the IT is managed by one of our team so we have got a sole point of contact for that internally, HR falls under my remit and accounts is handled by a book keeper, but where needed [OTHER DIRECTOR] gets involved in that. But if we grow five-fold it has to look substantially different to be honest with you. The difference really comes from my side – the bit that allows us to grow. I become more strategic and less operational to the organisation. So I am still the foot soldier at the moment, going out and seeing clients and doing meetings and getting work. I don’t want that to be removed because I still think there is importance to that – having client engagement at director level. But actually the bit – if allowing this to happen got us to this point is that I have got a strategy, I have got a growth plan. But the thing is, I cannot execute this as being the man on the ground as well. I just don’t have the time to do it. So, the big problem that I have is that I am not a massive believer in taking a well-oiled machine – and I believe we are getting there now – and putting people interjected between myself and the team. And therefore without giving opportunity for the team to grow into those kind of positions. The struggle that I do have, however, is that some of the team that we do have are young. Not necessarily that they are too young. But they are young and they haven’t been in those positions, they have been mentored into those positions which takes time to do it. So therefore it is kind of a sensitive thing for me because it is more a thing about what I want for the team rather than what works for the company. So it is something that is a… err, it’s an internal battle. I probably know what I need to do, but don’t know when to do it.

I think it is important to understand that one of the things a small business does is give itself a bit of an injustice as well if I am honest. And whether we manage this properly or not, because we are innovative, we are creative thinkers and we are trying to do a good job for our customer. You see typically, we are building products for our customer. We are a service company. As such, they're coming to us with an idea which we are developing. And a lot of the time, the successes that they get out of their product is due to the ideas that we actually produce or evolve on their behalf within that project design and scope. And I think that is really positive in terms of that's why they come to us. However, we straight away have given away that intellectual property as part of that. And whether you undervalue that as a business, as a small business, well I think we absolutely do.

APPENDIX 7: ENGINEER TRANSCRIPT SAMPLE

TRANSCRIPT OF INTERVIEW RECORDED AT 16:56 ON 18 MAY 2018 AT FIRM4'S OFFICES IN EDINBURGH

ME: PLEASE TELL ME A BIT ABOUT HOW YOU CAME TO BE AT FIRM 4

I was at uni in Edinburgh and studied computational physics graduating in1996 and joining FIRM4 in 1997, 6 months later. So, I have been here for about 20 years and grown up with the business. It's one of the most interesting things to follow along the process when there were about 30 people to now when we are in 7 countries.

ME: HOW IS SOFTWARE DEVELOPMENT ORGANISED HERE?

At FIRM4 we have teams, but not fixed role, for example, architecture and programming. I do a lot of everything going from design and architecture, I am currently doing a lot of stuff in security and am hands on. I am involved with the office move and a lot of the IT stuff. I guess because I have been at FIRM4 for a long time I get involved in all kinds of stuff and I guess I am a bit unusual in that side of things.

ME: IT SOUNDS LIKE YOU HAVE A BROAD ROLE.

I guess most people do not have quite as broad a remit as what I have. Yeah, I just do everything basically. Get dragged into sales, going to a meeting in Brussels next week to see a prospect. Sales engineering, sales support, starting with a power point and beyond the basic but looking at how things are really going to work and keeping them happy. I don't do as much coding as I would like. The company started with C++, we then moved to C#, and then there is all the periphery like Java script, etc a lot of different stuff. We have a policy against open source due to liability and support and stuff, but can be frustrating at times. The banks want to know who wrote stuff and our contracts often require that commercially.

Personally I don't get time to write hobby software. We have this culture of paid overtime and concentrating on the job, so I do lots of overtime and don't go home and play with computers. I could go and work on a project, or find something that is useful to FIRM4, do that and get paid for it.

I have never worked anywhere else and I am happy here. It can be a frustrating company to work for. Sometimes it is a bit disorganised. A bit more structure and rigour would be nice. Because you are focused on what the customer wants, it is often drop everything and do what the customer wants now. It can be quite stressful. Resourcing is what it is and there is always ten times more to do than can actually ever be achieved. Trying to get through the day can sometimes be a bit stressful. But in a way I completely agree with F4EX1 that you don't want to get into that kind of jobsworth situation. You know, I am not going to do that because that's not my job. That's not my title so I am not going to do that. So, yeah, finding a balance… I think sometimes maybe we go a bit too far. But maybe we have gone too far the other way and we just leave people to get on with it and do whatever they feel like. Maybe having some ideas about the best way of doing things and writing them down occasionally might be useful.

ME: TELL ME ABOUT YOUR RELATIONSHIP WITH F4EX1.

F4EX1 is a startup engineer who has been here 30 years and has never had the pressure from others to put structure in place. To some extent he has resisted that. He doesn't want FIRM4 to turn into [NAMES A BIG TECH CO] where you have this process that you work through and you have to fill out these forms. You are not allowed to do anything unless you have done that and then you can't get anything done. There is in many ways a start-up culture, but with the good and bad. You know, that start-up culture of you can get things done. Just go and do them. And put in the overtime to get it done. Balanced again, maybe, is there a better way of doing this? Is there a more advanced way of doing this? Maybe learning from past experience and not making the same mistakes again.

ME: IS THERE A FORUM TO TALK ABOUT THESE ISSUES?

I think so. I must say I am unusual as a software engineer as I am not a manager leading a particular customer project or anything like that. Not working on a fixed team means I tend to bounce around things quite a lot. So, you will probably find that my outlook is quite different to maybe a more junior engineer working on a particular project solving particular problems. They probably find it more structured.

I think there is a background feeling that maybe a little bit more structure would be useful. There is no formal forum or structure to discuss this, although it could be done at a project level. We allow project managers to run projects the way they want, so each project can innovate individually. Collectively, the way of sharing that knowledge and improving from one project to the next – I don't know if that is really there.

ME: HOW WERE YOU HIRED?

Well, I suppose I found FIRM4. I was looking for a job out of university. Through some software federation membership I was able to send in CVs to a lot of different places. Mine happened to land on F4EX1's desk at just the right moment. They were desperately looking for someone. It started on a 3 month contract or something. A month into it they asked if I wanted to go permanent. However, it has all changed since then. We now have a HR… not exactly sure what his title is. There is a guy that does the HR… again, relatively recent. Erm, I don't know exactly what he does as I have not been particularly involved. Definitely hiring and firing, he has been travelling around to a lot of offices recently. Don't know if he involved in payroll or pay negotiations and stuff like that. He's relatively recent in the last year or two and I don't think we had a specific person for that until then. I guess it was a role that was taken on by other people prior to that. I guess we've just reached the point where it requires a single person to do all that.

As a company it has really about incremental growth, project by project, and you turn around and the thing has expanded.

ME: HOW AWARE ARE THE ENGINEERS OF HOW THE BUSINESS IS GOING?

Part of the bottom line… erm, there have been previous things that have sort of come out of the blue. Sometimes we have had an email talking about winning a major customer or losing a major customer or whatever. Something that has changed over the last few years is that we have started having these kind of group calls. These are global calls with the whole company involved. But I wouldn't know the company financials off the top of my head. Even though it is publicly available data, it is not really talked about within the company. I guess if you compare it to other tech company start-ups that are externally funded, the company is wholly owned and run by F4EX1, so people don't have share options. So, people are not focused on how the company is doing financially. It is much more how we are doing for projects – which projects we are winning. Which customers can we make happy and what customers have problems, rather than what's our bottom line and what's our revenue. By and large, as long as people get paid every month, they don't really care, other than they like to see pay rises, obviously.

We get paid for our hours of course, but there are no targeted bonus structures… we just get our pay and that's that. My personal experience is that the pay rises tend to be rather arbitrary. It seems to be that if the company is going well you might get a pay rise but it kind of comes out of the blue. I'm not great at chasing that sort of thing. I don't think engineers are primarily motivated by money – as long as I can pay my mortgage and do everything I want to do… my motivation is that I like innovating, I like doing something new. I like solving a problem. A boring answer I guess. Getting something working or solving a customer's problem. Fixing an issue. It's rewarding. I'm quite often involved in deployment and remote installations. Starting a pilot. Finishing a pilot. It's rewarding. When I look at our share of [SOFTWARE ON HARDWARE] it is pretty impressive and something I am proud of.

There are different level of innovation. The massive light bulb moment. There's the light bulb around how we fix stuff, like remote installation that I came up with. It was customer driven – customer needed to roll out 10,000 devices and we wanted to simplify installation. It could have been done by sending out engineers with CDs, but there was a systems based solution that has allowed us to automate. I stayed up all weekend to come up with a prototype. It was a customer problem and then there was a light bulb moment. It was years ago now, but I had to sell the idea into F4EX1. If he likes an idea it is great but if he doesn't get an idea it is hard to make him understand and it is probably not worth it. If it is major and he is not involved you have to sell to him. If it is project based, then that project will just get on and do it.

ME: CAN YOU TELL ME ABOUT THE CULTURE NAT FIRM4

It is amazing how hard people work here – why do they do it? It is very customer focused, making the customer happy. People get into that culture and want to make customers happy and make meaningful progress. We are not siloed and we spend time in the customer offices talking to them which make it very direct with engineers actually talking to people.

ME: WHAT WAS THE BEST INNOVATION

Project [NAME] which I took from idea on the sofa at home to roll out on 3,000 devices. A sense of ownership.

ME: PROJECT THAT DID NOT GO WELL?

We have had projects that fail. One particular one was a market problem – we had solved the technical problems. But then the customer that was ready to go pulled out and then due to competitive issues we didn't want to go up against the larger hardware vendors. I think when we started off we were definitely disruptive. We were a challenger company coming into a market which basically did not exist. Trying to create a market opportunity in a market place which was very much dominated by the major hardware vendors. Having gone through that process now, I think we have kind of gone through that disruption, and we got to change the market and we've kind of opened up that market for multi-vendor software stuff. So, it is a relatively big market with more than 3 million devices world wide and we are on 10% of them. But it is dominated by the larger hardware vendors. But there are a lot of small countries and a lot of small banks – it is quite a difficult market. There are not many players in it because there are probably easier targets to be honest. It is easier to become FACEBOOK than it is to become FIRM4. Which is slightly disappointing. 90% of our revenue comes from the existing installed base. Thinking medium to long term I don't think that is going to disappear in the near future. It is an interesting time – just in a very general sense there is a lot of talk about automation and the disruption of jobs. Which is interesting because as an industry that is effectively what we have been doing for the last 50 years.

Although we have been automating jobs in the banking industry, we have not really thought about automating our own jobs, building a machine that can design and code instead of us. The job of software engineering has always been evolving and changing. In a sense it is easier – we don't have to write machine code now because we have higher level languages, so I would see any of that stuff as just more tools. The design is really the inventive bit. That's really what software engineers do – it is not sat writing code really. For any decent software engineer it is about innovating. AI, no matter how clever it is going to get, is not going to start coming up with new products. CEO is usually involved in the big new ideas, but most of the other innovation comes from the software engineers. Of course there is a huge range of what we could describe as innovation. The light bulb moments through to the day-to-day decisions. A lot of it is driven by customer requirements. Discovering those bigger issues, I guess CEO is out talking to customers asking what problems do you have and what can we fix? That is where our biggest ideas come from. From the smallest idea from the smallest client just wanting us to figure out how to stop this machine from falling over.

ME: WHAT IS THE TYPICAL PROFILE OF FIRM4 SOFTWARE ENGINEER?

We have surprisingly low turnover and a surprising number of people who have been here for a very long time. There are quite a few people who have been here longer than I have and then there are the new guys, but in fact some of those have been here for 15 years. CEO talked about getting bright people in young, but we wouldn't just hire someone because they've got a first in computer science. They have to fit in with the culture – the way we do things. I guess flexibility is an important thing. It is difficult to put into words, but the sort of person who comes in and expects to follow a written process, and go through and apply a bunch of named software engineering design principles probably isn't going to fit in. We are much more, get in there and fix the problem. Get on with it and move onto the next problem. I'll be generous and describe it as fluid. Trying to do things in a dynamic way rather than trying to work through some sort of fixed programme.

So you get very academic, targeted, probably very talented engineers who probably wouldn't fit in very well. In fact, we've had a couple quite recently. Very targeted kind of strait software engineers, but they've done things and ended up not fitting in very well and so they've moved onto something else. I think it would be more be about their personality rather than just is this the finest software engineer in the world. One of the great things about this firm is it is kind of a family atmosphere. We don't have politics and in fighting because we don't have different departments. Nobody is trying to build their own empire. It is a very sociable company, even though we don't tend to have social events. Pizza evenings and things like that. I suppose in a way it is the sort of culture that a lot of companies are hoping to build, where people work together.

Whenever somebody leaves they always say it has been a great place to work. So working environment is important and keeps people here. Doesn't matter if you are well paid if you are not happy.

I grumble about things all the time, so take everything with a pinch of salt. But the chaos. When I realise I can't achieve something – when I get to the end of the week and find I have not had the time to work on what needs to be done… I have something with a deadline for Tuesday, and it has been a stressful week, and I am going to be working the weekend. That can be frustrating. If I could let it go… but you get the end of the week and somebody is shouting about what has not been done.

ME: WHAT IS THE STRUCTURE AT FIRM4?

The structure is intentionally very flat. We don't have strict job titles – no one saying I am the boss. There are project managers. A good thing, but if you want to know who to go to, there is only CEO. No-one want to grumble to the boss.

ME: HOW DOES THE PAID FOR HOURS CONCEPT WORK?

You put in a weekly timesheet which can be stressful as you are noting things down all the time and it is easy to lose track of what to charge things to. I guess assessing that model compared to the fixed price plus bonus model, superficially it would seem like the open overtime would encourage people to stay for the hours, an obvious way of gaming the system.   We don't have that problem because everyone is so busy all the time and people don't have time to sit around or be on Google. Most of our software engineers are here in Edinburgh, but we have some decent sized support teams elsewhere like Mexico and Italy. Testing is a separate role. We should use more automated test tools, but it is not taken on as much as I would like. I need to put it in place and push for unit testing. Making it part of the culture and setting up a framework. It has never come to the top of the pile. Can be frustrating. There are a lot of things that it would be nice to sort out. There are a lot of things were people are getting by, and there are things we could do to make life easier if we had time.

As a software engineer I am tempted to look for the mathematically correct solution, but there are different solutions for a startup with a small group of people trying to get things done. But in a larger company you cannot do that. There needs to be balance between the two extremes and it varies by cultures, companies and people. I think the trend towards AGILE programming is very current. My take on this is the difference between doing good AGILE programming and jumping in and not knowing what you are doing is hard to tell sometimes. But we don't have a formal AGILE process yet although we focus on some of the tenets of AGILE, like dev ops and people working right through the programme. So in a sense we have been an agile company for nearly 30 years but we just don't use the same terminology.

I think a lot of the move towards AGILE is for people who are used to having more process to feel happy about less formality. But we are at the opposite extreme and should move back towards the centre.

There is so much technology available – a ton of stuff that I want to use and toys I want to play with.

A majority of the innovation is emergent here. There is not a formal innovation strategy. We just ask what does the customer need? Looking back over the last 20 years we have done lots of stuff, but we don't think of it as innovation – just as problem solving, but it does create new things.

APPENDIX 8: PE INVESTOR TRANSCRIPT SAMPLE

TRANSCRIPT OF INTERVIEW RECORDED AT 14:30 ON 14 OCTOBER 2018 AT PE1'S OFFICES

ME: TELL ME HOW YOU CAME TO BE WORKING AT PE1

I had been working in M&A for [LARGE US CORPORATE] and met [FOUNDER OF PE1] through a couple of deals. I liked him, what he was trying to do. It was different. The London private equity community was very samey at that time. He had a different vision and was building a diverse team. Not all Brits or Americans from the right universities. Europeans. Different experience. So, I was one of the first here. The first [NATIONALITY]. We are still a small firm, but I think we do a nice job and think differently to others.

ME: HOW DO YOU THINK ABOUT INNOVATION?

Well, we like innovation, but not too much. You see, we are a PE firm. We are investing in something that already works and we can see an opportunity for growth. It is all about growth for us. If you are innovating to make something better – more competitive – more differentiated – and we can see the growth, then fantastic. But if you want us to pay for something new – unproven – not fantastic. It is not that we don't like innovation – of course we like new things and we get very excited. We are just very clear on what makes our investment model work.

ME: SO, WITHOUT PUTTING WORDS INTO YOU MOUTH, WOULD YOU SAY THAT YOU FAVOUR INCREMENTAL INNOVATION?

[YES IN NATIVE LANGUAGE], yes… I mean we feel that we know where we fit, and we position our investments carefully for the LPs *[LIMITED PARTNERS OR "LPs" ARE THE INVESTORS IN PE FUNDS]*. If they want exposure to high risk start-ups then they will invest somewhere else. It is not our game. If management want to make some changes and can show a case, then good. We will take a look. We want evidence though and we are not speculative.

ME: WHAT TYPE OF CHANGES?

With software firms it is often features and functionality. This makes sense for me. If you keep the product fresh than it makes customers stickier. We want them to stay with us – we like software because of annuity revenue. Sometimes customers need a change because of regulation or compliance. We have no choice, but when we work in a high compliance sector, we already have this in the plan. It is not really innovation – we have no choice. Competition can also be a reason, but I find this can be overstated by management. With most software, customers are reluctant to move and so it is not always essential to make the changes.

ME: ANY OTHER TYPES OF INNOVATION?

Ah, innovation.. mmm.. it means a lot of things. Maybe doing something different – platforms, or moving to cloud – we have a lot of that. It is not new or the first time, but it is first for the company. We like this change to SaaS *[SOFTWARE AS A SERVICE]* because it creates a subscription model and we see value, but it hits short term revenue rec *[RECOGNITION]* and you have to start building again, but it is better because of smoothness and predictability. Then we see bigger valuations. It is still innovation.

ME: AND HOW IMPORTANT IS INNOVATION FOR YOUR PORTFOLIO FIRMS?

It is difficult to say because they are all so different. If we have done a good job and bought the right business, then maybe not so important – the innovation has been done. It is now about fuelling growth either organically or through M&A – we like both. If the firm already has something that we can scale, then that is better for us.

ME: HOW DO YOU FUND INNOVATION?

It has to be in the plan. You see, our model is all about gearing. We have to make our money work hard. This means we cannot leave cash on the table. If a business needs cash for something that we have planned, then fine. If it needs cash because of a problem, then we understand. But if a business wants to do something out of plan and needs cash then this is more difficult. We would usually be very cautious, and we would want the business to fund this out of cashflow. It is very rare for us to start writing cheques because someone came up with a great new idea. You could argue that we miss opportunity, but it is just not our model. We are very clear on our strategy. We expect our portfolio companies to be clear too.

ME: WHAT IS YOUR EXPERIENCE OF INNOVATION IN YOUR PORTFOLIO COMPANIES?

Mixed, I think – you know, with good companies they have a plan and things come up, but they execute and grow and everything is fine… sometimes they have an idea and if we trust the team and they have done a good job we can support. But it is difficult for us to invest more for this type of thing. Sometimes things don't go so well. Maybe we make a bad investment. Maybe management doesn't work out. Maybe the market is difficult. Innovation might be necessary to reposition the business or create value in a different way. But we would expect all the basics around running the business well to be there first.

ME: DO YOU HAVE AN EXAMPLE OF INNOVATION THAT HAS WORKED OUT?

Some. We had this business that you know - [MENTIONS COMPANY NAME]. It was OK and we had managed to grow it and then split it. We sold part of the company and it was amazing because we already got our money back. But we didn't know what to do with what we had left. The old CEO had run out of ideas and really wanted to retire. We found a new guy and he had ideas and because we were in the money we felt we could help. It was a good journey. We found a data angle and trade buyers really liked it. But honestly, this is rare. Normally, we don't like this sort of thing.

ME: SO, WHAT MADE THIS ONE WORK?

Well, Investco… well [FOUNDER'S NAME] really, was in a good mood because we already had our money back. We liked the new CEO – he was smart and he had done it before. It wasn't a big investment either because we already had the data. We just needed to make it work. The chairman [NAME REDACTED] said, "it was like finding change down the back of the sofa." [LAUGHS]. They had a good team – really good software guy running IT and they had done a good job in understanding customer demand. We had a lot of confidence in the plan.

It is a lot easier to say, "yes" to something that builds on what we already have. I have sat in lots of Board meetings listening to smart CEOs try to persuade me of reasons to vary from the plan – the original thesis. It is probably no coincidence that this happens when the core business is experiencing problems. We try to be supportive, but we know from bitter experience that sticking to the knitting is almost always the right thing to do with these businesses.

ME: YOUR USE OF ENGLISH IDIOM IS IMPRESSIVE – I WOULD NOT KNOW THE SAME PHRASE IN [LANGUAGE]… [WE LAUGH]

I have been here a long time.

ME: TELL ME ABOUT ONE THAT WAS NOT SO GOOD?

Wow. Where do I start? I have a list. You see, when we make a mistake on an investment then there can be lots wrong. But… innovation and software… yes…

when I was at [US FIRM NAME] we had an investment in a nice business called [NAME REDACTED] that was very specialist providing [DESCRIBES SPECIALIST USE CASE]. The owner was a good engineer and he had built this business over many years. We invested and he stayed involved but took some money out. It was a good market and we were growing geographically. He had lots of ideas always and a nice guy, but kind of like a butterfly. But he came with an idea that sounded great because it extended the firm into an adjacency – didn't seem like such a big stretch. But he was not so close to the business anymore and the project just went on and on… the customers didn't really want the new software… everything was wrong and he got upset and the board got upset and he quit (to be honest, before we fired him) and we canned the project, but it wasted a lot of money and even worse a lot of time, because we could have – we should have – just stayed focused because nothing was wrong really with the original business.

ME: DO YOU THINK INNOVATION IMPACTS THE VALUE OF YOUR INVESTMENTS?

Everyone likes the idea of an innovative firm because there is a feeling that this is strategic. We see software firms selling for crazy multiple all the time. Sometimes they have never made money – sometimes they never do. That is not our type of investment. We are conservative mid-market. We like firms with intrinsic value, predictable growth and decent earnings. I think this unicorn idea is interesting and some people have made money – more at the venture end of the market. It isn't in our DNA. The firms we pick are often behind the scenes – you've never heard of them. They do something really important and they have a defensible niche. It is only when that niche is attacked that we might consider the need to innovate – very reactive. However, we do like firms to have the ability to innovate and this is the paradox for us. We like the capability, but we don't like the risk. We feel our job is to manage risk. To help the firm stay clear and focused. Our businesses usually sell on multiples of EBITDA, not revenue – I know it is boring, but therefore, we have to have EBITDA.

ME: WHAT IS YOUR EXPERIENCE OF OWNER-MANAGERS MAKING THE TRANSITION TO PE OWNERSHIP?

Some of them really get it and they are well prepared and ready for the change. Many struggle. Quite a few don't make it. The fact is that working with PE does not suit everyone. We will work hard on helping them understand how we work – what matters to us. We are tolerant of personalities. But the thing we cannot live with is consistent failure. There are always “buggeration factors” in every business – we know that – we see it all the time. But good executors manage this and still find ways to succeed. A couple of years ago, I read a piece in HBR *[HARVARD BUSINESS REVIEW]* about how PE firms hire CEOs. It was US centric - these things often are, but I thought it was BS. I mean, they were saying that we value experience less than ability. We want both. If someone has already executed well and got a good exit, then maybe they got lucky, but probably not. Especially if they have done it more than once.

ME: DO YOU THINK OWNER-MANAGERS KNOW WHAT THEY ARE GETTING INTO WHEN THEY TAKE PE INVESTMENT?

Of course, some of them do. Sometimes it is not their first time. But to be fair, many do not really understand. Maybe they have started a business and run it themselves for many years. Often we hear incredible stories of how people have funded and developed their businesses. They typically come to us because they need money to grow or they need to realise some capital themselves. We prefer it when we are investing alongside an entrepreneur and we are aligned. But even then, they have often been used to doing things their way. We are not overly formal, but we do have some governance requirements. Even that can be difficult sometimes. When we are in the bidding process, then of course we are selling – it is very competitive. If we win and we make an investment, then we need proper controls to be in place. I sometimes wonder if this is a shock for the entrepreneur – at first we are selling and we are trying to make them feel we are the best firm to work with, then we are the buyers and we want to be sure we got a good deal.

ME: DO YOU PERSONALLY GET INVOLVED WITH THE SOFTWARE ENGINEERS?

Not really. I mean, I am a finance guy to be honest. I am great with EXCEL and I can use my Mac and my iPhone, but I don’t really know much about this stuff. We have to let the CEOs do their job. They are sometimes quite technical themselves. Maybe we have a chairman that knows this stuff sometimes. I think some of the bigger PE firms have people on the staff who might know about software, but we are quite boutique-y and it is not really our thing. Maybe we meet them at some event – off-site strategy or social sometimes, but I don’t feel it is my job or I can add value here.

APPENDIX 9: SUMMARY OF THEMES

#	Theme
1	The individual SMSE executive leaders interviewed primarily used instrumental and transactional leadership styles and rarely undertook exploratory innovation.
2	The SMSE executive leaders interviewed were primarily focused on cashflow and survival which seemed to influence the innovation leadership behaviour of these SMSE leaders.
3	The external focus of the executive leaders of SMSE interviewed seemed to have consequences for communication with engineers.
4	The SMSE executive leaders interviewed appeared to be more focused on exploitation than exploration.
5	Awareness of the impact of structure, culture and climate varied between the SMSE leaders interviewed.
6	The SMSE executive leaders interviewed believed that project success was related to clarity of vision, communication, and leaving the engineers to do their job; they felt that project failure was related to poor communication.
7	Of the executives interviewed, the owner-managers and PE backed executives appeared to have different attitudes towards recruitment and retention of engineers.
8	The software engineers interviewed recognised innovation leadership behaviour but did not generally discuss their leaders shifting between different styles.
9	The software engineers interviewed were not primarily motivated by financial gain.
10	The software engineers interviewed valued having time to explore, learn and play.
11	Most of the software engineers interviewed wanted to maintain existing company culture.
12	The software engineers interviewed believed that they were the main source of innovation in their firms.
13	The software engineers interviewed accepted the external orientation of their leaders.
14	The software engineers interviewed had mixed views about leader praise and recognition.
15	The software engineers interviewed had a low interest in commercial issues.
16	The software engineers interviewed associated project success with control and independence and project failure with poor communication, compromised technical objectives and time pressure.
17	The PE investors interviewed valued specific innovation leadership styles most closely related to execution.
18	CEOs established credibility with the PE investors interviewed by demonstrating their execution capability against the initial investment thesis.
19	The PE investors interviewed frequently replaced owner-managers with CEOs who had prior PE experience.
20	The PE investors interviewed preferred to invest in firms that had established product market fit and a proven and scalable business model.
21	The PE investors interviewed leveraged their equity investments with debt and so intentionally restricted cash available to SMSE.
22	Most of the PE investors interviewed claimed to support investment in innovation if funded from the existing cash resources of the business and subject to approval of a business plan.
23	The PE investors interviewed had limited direct exposure to software engineers and trusted their CEOs to manage these relationships effectively.

APPENDIX 10: GROUNDED THEORY MEMOS

Memo 10.1	To see ourselves as others see us
Date	January 2018

F2EX1 and F2ENG1 had materially different views of their intersubjective experience. F2EX1 sees himself as a caring and inspirational entrepreneur who is building a business that he started alone after university. He believes that he provides an exciting and challenging environment for young programmers, all of whom have been recruited from his former university. He discussed culture in the context of artefacts related to the nature of the office, which he said was like a common room with old sofas, a big TV, a fridge and microwave and a tolerance for allowing the programmers to hang-out at the office after work and have a beer whilst playing computer games on the big screen. He also considered that allowing the engineers to select their own colleagues through the interview process helped to re-enforce the culture of the business and did not recognise this as a potential diversity issue. There is no professional HR employed in F2. Although a software engineer by training, F2EX1 has made the transition to being the primary sales and commercial leader of the business. He left university with a strong technical skill set, but does little programming himself, although he does review code most days and enjoys coaching the programmers to improve their software development skills.

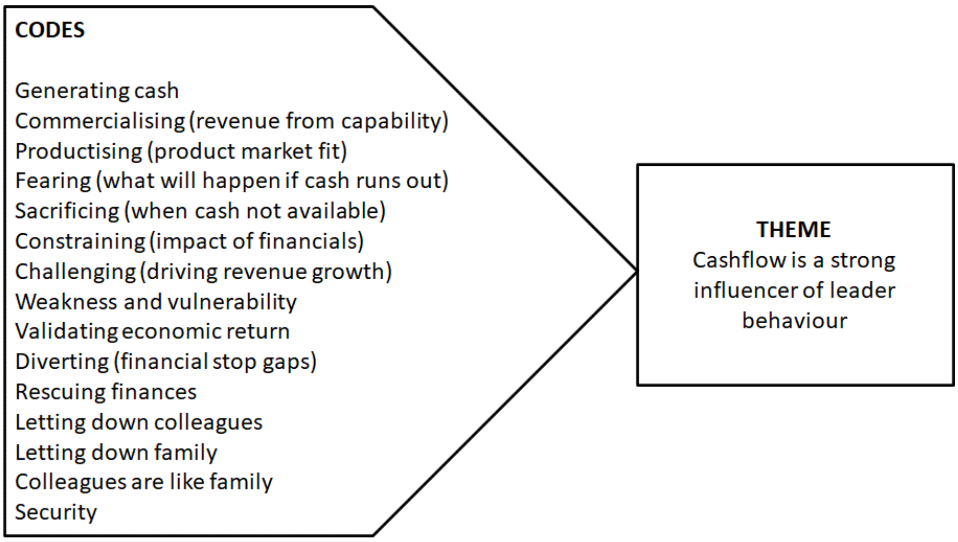
F2ENG1 generally enjoys working at F2 because he likes the nature of the work and the company of the small software development team he works with. However, despite the firm still being quite small, he does not have a close relationship with F2EX1 who he rarely sees because F2EX1 is frequently out of the office. As a result, he feels his relationship with F2EX1 to be relatively formal. He discussed a specific habit of F2EX1 to review code overnight and then leave emails for the engineers to come back to the next morning critiquing the code. He found this annoying for several reasons. First, critiquing code that is not fully developed and tested made little sense to him as dealing with the issues raised by the CEO in the emails was often on the next day's "to do list" and would be resolved anyway. Secondly, he felt dejected by the style of communication – not just because it was by email but because each individual issue was sent as a separate email and he interpreted a negative tone to the emails. Thirdly, he felt that the F2EX1's technical skills were dated and views on some aspects of coding using a modern language and methodology were outside of F2EX1's experience. He also objected to the contractual insistence that any software that he developed whilst employed by F2 would be deemed the intellectual property of F2, even if it was developed in his own time and outside of the office.

Literature to explore	Leadership, culture, motivation, diversity.

<table>
<tr><td>Memo 10.2</td><td>When it’s over, it’s over</td></tr>
<tr><td>Date</td><td>April 2018</td></tr>
<tr><td colspan="2">F4EX1 is a PhD software engineer who came to the UK to study and started his own contract programming business after university to make a living. During this time, he became involved with providing software for a specific industry and decided to develop his own hardware vendor independent platform to serve customers in the industry and give them an alternative to the hardware specific software of the large technology firms. At the time, this was a radical innovation that challenged the oligopoly of the major hardware vendors and gave customers the opportunity to run hardware from multiple different vendors using the same software stack. The business has developed well over almost 30 years and has afforded him a good life and secured the financial future for himself and his children. Despite the economic success of the business, F4EX1 has always stayed close to the original software application that he developed and has consciously pursued an incremental and path dependent trajectory. The hardware technology that his software supports is now in decline due to structural and technology changes in the industry that it serves. F4EX1 has been offered the opportunity to sell his business to one of the three major hardware vendors in his industry on several occasions but has always declined, valuing the combination of independence and expectations of future earnings higher than the exit valuation on offer. Arguably, the business now only has “run-off” value as the opportunity to sell F4’s software is shrinking in line with the contraction of the core market. Despite this, F4EX1 is not inclined to consider the possibility of exploring the application of skills and software to other opportunities and says he is happy to live on licence and maintenance revenues in the declining business, managing the cost base downwards appropriately. His view was always that F4 was a project, it is just a project that went on longer than expected. He has tried to set aside a percentage of resource each year for R&D and exploration but says that by February each year he takes the decision to put that resource back into supporting existing customers with the existing product.</td></tr>
<tr><td>Literature to explore</td><td>Types of innovation, ambidextrous innovation and leadership, path dependency, absorptive capacity, strategy, resilience, entrepreneurship.</td></tr>
</table>

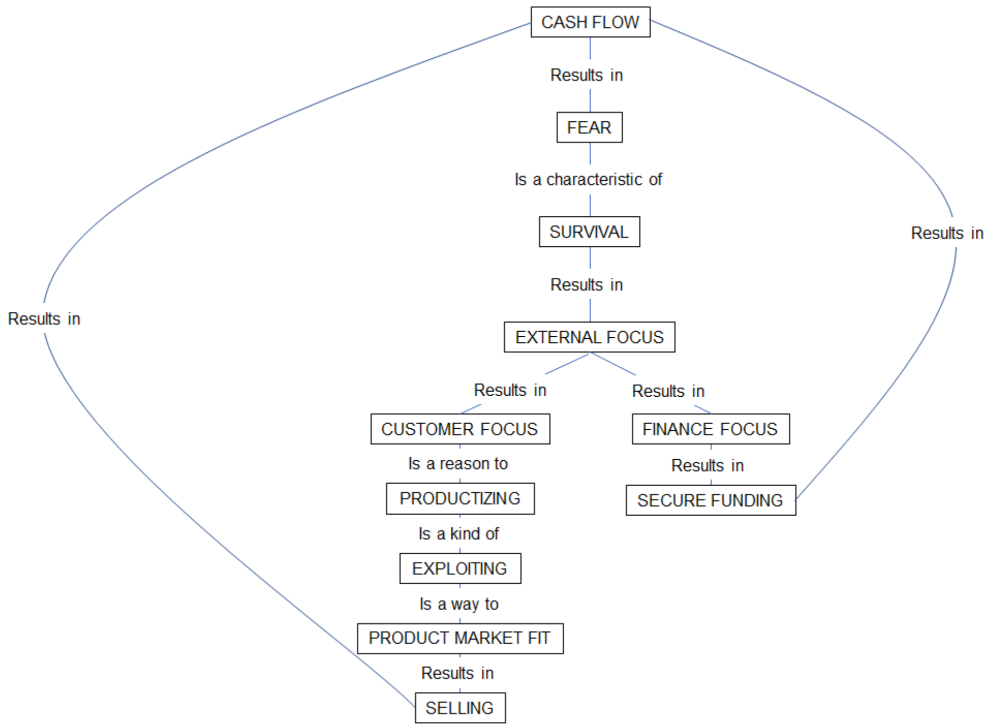
Memo 10.3	Show me the money
Date	May 2018

Following interviews with executives and engineers in the first four firms, a strong theme is emerging around the importance of cash and cashflow. Although the firms all generate cash and appear sustainable, each of the leaders displays considerable concern about survival and cashflow. Some express this in terms of concerns about letting down colleagues and early investors who, for three of the firms, included family members. They each discussed the journey from inception to achieving product market fit, during which time they seem to have developed a habit of parsimony whilst also managing the challenge of repositioning the original entrepreneurial idea. The largest and most economically successful firm abandoned the initial market application for their software and repositioned the firm in an entirely new sector vertical within the first year of operation. Two of the firms have experienced diversion from their original plan to generate short-term cash through contract project work to survive but were then able to steer back on course. The impact of survival fear and cashflow prioritisation seems to be common to these firms and is a theme to explore in the next interviews.



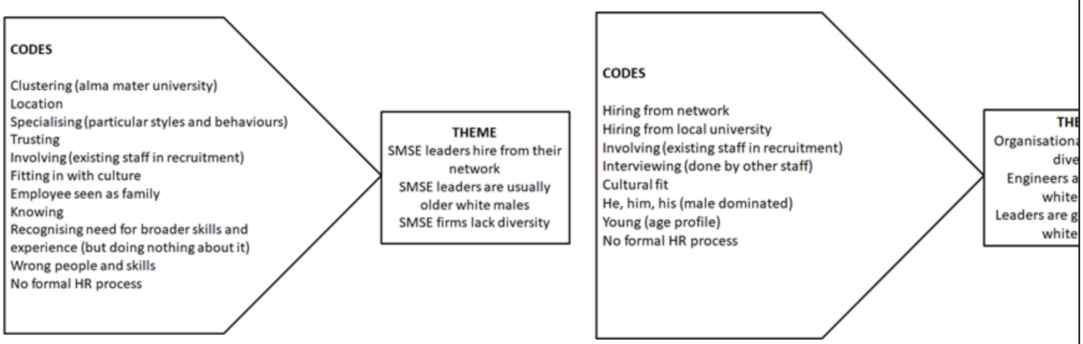
From a theoretical sampling perspective, trying to include a mix of larger and smaller firms that are both owner-managed and PE backed in the remaining sample will allow comparison to explore if this theme is consistent across firm size and ownership.

Literature to explore	Entrepreneurship, entrepreneurial leadership, innovation leadership, leader anxiety, cash and cashflow

<table>
<tr><td>Memo 10.4</td><td>Show me the money (Part 2)</td></tr>
<tr><td>Date</td><td>September 2018</td></tr>
<tr><td colspan="2">Continued analysis and further interview data has brought together themes relating to cashflow, survival and leader behaviour, prompting the development of an integrative diagram based on initial codes and categories.

</td></tr>
<tr><td>Literature to explore</td><td>Entrepreneurship, innovation leadership, leader anxiety, cash and cashflow + ambidexterity (Tushman and O’Reilly 1996 etc) and Ahmed (1998). External focus of SMSE leaders.</td></tr>
</table>

Memo 10.5	Male, pale and stale
Date	October 2018

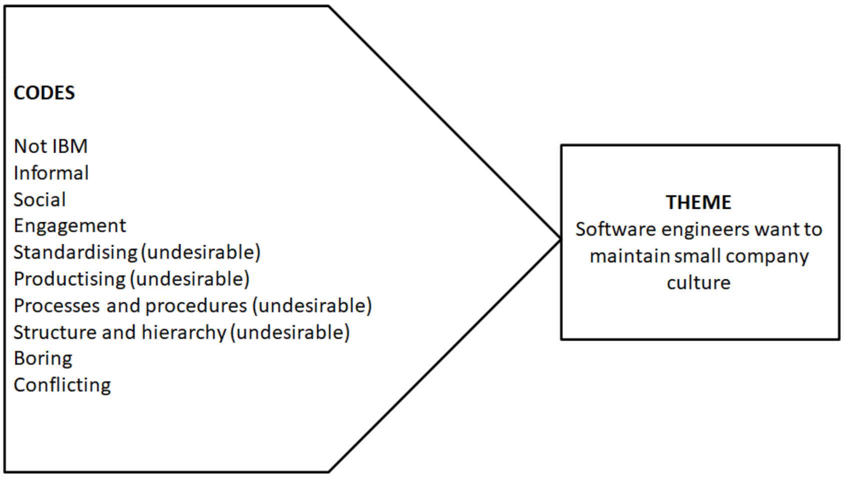
F6EX1 referred to his leadership team as “male, pale and stale” suggesting this normal for SME technology firms in the UK. Analysis of the coding supports themes relating to a lack of diversity for the engineer population more than the leaders. This has also been observed by the only female engineer among the interviewees. The lack of professional HR people and processes is highlighted again. The hiring processes in SMSE seems to consolidate homogeneity and mitigate against diversity. There is probably another paper in this narrow but important area.

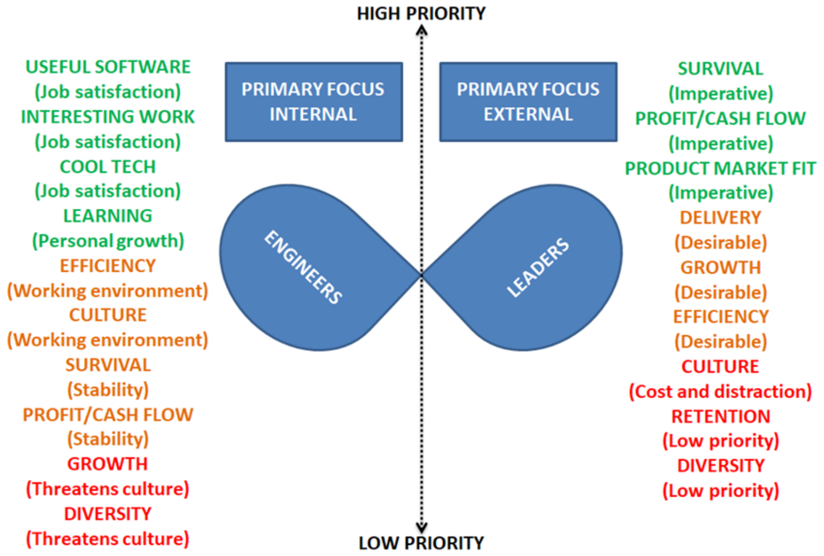


Literature to explore	HR and recruitment in SMSE/SME. Diversity. Culture. HR: Skinner et al. 2003; Dietz et al. 2006. IT industry sources on diversity.

Memo 10.6	We like it how it is
Date	November 2018

Software engineers show limited interest in the commercial aspects of the firms that they work for. However, they seem very keen to maintain the culture of their current organisations and see growth that might come from commercial success as a threat to the culture and working environment that they enjoy. The narrative is explicit from many of them, including one of the more experienced engineers stating that if they end up with significant bureaucracy and ISO accreditations then he may as well be working for IBM. Others cite Google as a firm that was “cool” and “fun” but is now just another massive bureaucracy (in their view). The long-term interests of the engineers seem to be misaligned to the long-term interests of the leaders.





Literature to explore	Engineer motivation and culture e.g. Schein 1996. Full range leadership model. Self-actualisation. Creative climate.

<table>
<tr><td>Memo 10.7</td><td>Initial thoughts on… leaders</td></tr>
<tr><td>Date</td><td>December 2018</td></tr>
<tr><td colspan="2">Summary of ideas emerging from analysis and codes from interviews with leaders:

• SMSE leaders who are owner managers have a narrow knowledge of leadership theory and a narrow range of styles (CATEGORY: LEADING)
• SMSE leaders who are CEOs of private equity backed businesses have a broader academic understanding of leadership and evidence the considered use of more styles (CATEGORY: LEADING)
• SMSE leaders of PE backed businesses are less likely to be subject matter experts (CATEGORY: LEADER EXPERTISE)
• All of the leaders share some information about business performance with their engineers but all accept that the engineers have limited interest (CATEGORY: LEADER COMMUNICATION)
• Some of the leaders actively consider and promote an innovation culture and are conscious of creative climate (CATEGORY: CLIMATE)
• All of the leaders are primarily concerned with cashflow, but those in PE backed businesses seem less stressed by it (CATEGORY: CASHFLOW)
• All of the leaders are concerned with product market fit and cite concerns about cash flow as the primary limiting factor on innovation (CATEGORY: CASHFLOW)</td></tr>
<tr><td>Literature to explore</td><td>Culture and climate (Amabile 1996; Ekvall 1996). Leadership of innovation (Hunter and Cushenberry – recommended by George)</td></tr>
</table>

Memo 10.8	Initial thoughts on… engineers
Date	December 2018

Summary of ideas emerging from analysis and code from interviews with 13 software engineers:

- Engineers are primarily motivated by having the opportunity to work on interesting projects and getting the time and space to develop software that they judge to be of a high standard (CATEGORY: MOTIVATION)
- Only one of the engineers has innate loyalty to their employer and the others would move if a more interesting opportunity arose in terms of technical environment or development challenge locally (CATEGORY: LOYALTY)
- None of the engineers stated that financial reward was a primary motivating factor (CATEGORY: MOTIVATION)
- Two of the engineers received modest project/task related bonuses (CATEGORY: REWARD)
- Three of the engineers received modest bonuses based on annual performance (CATEGORY: REWARD)
- None of the engineers had meaningful equity in the business (two had small amounts of equity and viewed it as a “lottery ticket”) (CATEGORY: REWARD)
- All engineers stated that the culture and environment of the business was important to them and some three of them worry about the implications of commercial success being growth and a change in culture (CATEGORY: CULTURE)
- None of the engineers is really interested in the financial performance of their business other than ensuring it can continue to pay them and that there is interesting work coming in (CATEGORY: MOTIVATION)

Literature to explore	Motivation/hygiene (Herzberg) and self-actualisation (Maslow). Culture and climate (Amabile 1996; Ekvall 1996).

Memo 10.9	Initial thoughts on… private equity
Date	December 2018

Summary of ideas emerging from analysis and code from interviews with 6 of the private equity professionals (one PE firm still left to interview at this stage):

- PE executives conscious that owner managers may be narrow in leadership experience and are willing to replace owner managers with more experience PE CEOs
- They try to find CEOs with a track record of leadership and successful exit rather than just subject matter expertise (CATEGORY: PROVEN EXPERIENCE)
- Prefer businesses to fund their own R&D through free cashflow rather than invest further funds to develop speculative ideas – but they will leave surplus cash in the businesses to support innovation rather than taking dividends (CATEGORY: CASHFLOW)
- Prefer investments with proven product market fit (CATEGORY: PROVEN EXPERIENCE)
- Prefer “exploit” over “explore” due to the normal timescales of an investment (typically less than 7 years) (CATEGORY: INNOVATION STRAGEGY)
- Would be unlikely to back a new investment based on “explore” and do not see it as their primary role to speculate in this way (CATEGORY: INNOVATION STRATEGY)
- Rely on experienced non-executive chairpersons to support and coach leadership when required (CATEGORY: PROVEN EXPERIENCE)

Literature to explore	Impact of PE investment on SMEs and CEOs.

Memo 10.10	Culture and climate
Date	January 2019

It was interesting to note the lack of detailed understanding of culture and climate. 11 of the executives were graduates. 2 had PhDs. 2 had MBAs from well-known business schools. All the executives were experienced with a minimum of 10 years of business experience up to over 40 years. The executives discussed “culture” in broad terms, focusing primarily on artefacts. Even in the younger businesses, executives mentioned culture, but with little ability to articulate what they meant by this.

The executives in F1 and F5 were the only ones to discuss culture in the context of their awareness of it, their ability to influence it, and the consequences of it. Only F1EX1 expressed a clear view of how culture might change over time as the business grows. F1EX2 discussed an understanding of the different types of culture, specifically mentioning “engineering culture” (but seemingly distinct to the “engineer culture” discussed by Schein 1996). F1ENG1 also mentioned “engineering culture” and F1EX2 explained in her interview that this was a term that was in common usage within the business. F5EX1 was involved in culture change and had a level of change management understanding grounded in Kotter but seemed unaware of the literature on the difficulties of changing culture (e.g. Alvesson and Sveningsson 2008).

Overall, the understanding of culture and creative climate were at best intuitive rather than grounded in theory. When asked about the culture, executives were generally positive and felt that they had a “good culture” and that their engineers were engaged and motivated. However, there was little evidence in the interviews of the executives doing anything specific to try to influence culture in a positive way. Even at F5 where F5EX1 knew that part of his challenge was culture change, it was not clear how this was being executed. The evidence from most interviews was that the executives were somewhat fatalistic about the culture of their organisations and although they claimed to have happy and engaged engineers, in most organisations there was an acceptance of “churn”. The private equity (PE) backed executives demonstrated a higher awareness of the business impact of this and had all considered retention strategies – including quarterly salary reviews in F1 to ensure they remained competitive. None of the executives viewed equity shares for the engineers as an important factor in engagement and retention.

Literature to explore	Many different ways to organise work (Handy 1999); climate is transient but culture is long lasting (Holbeche 2006); culture based on inter-generational belief systems (Schein 2017); artefacts/symbols, assumed values, underlying assumptions (Schein 2017); organisations and creative climate (Amabile 1996; Ekvall,1996; Amabile 1988); difficulties of culture change (Alvesson and Sveningsson 2008).

Memo 10.11	Investment thesis
Date	March 2019

The INVESTMENT THESIS code category was the most consistent in the PE investor interview data. The code categories primarily related to the potentially attractive features of software investments – consistent codes across the PE firms were:

- MARGIN (codes which related to high gross margin)
- ANNUITY (revenue)
- PREDICTABLE (revenue)
- POWER (market power/pricing power)
- CASHFLOW (good cashflow)
- EXIT (high exit multiples)

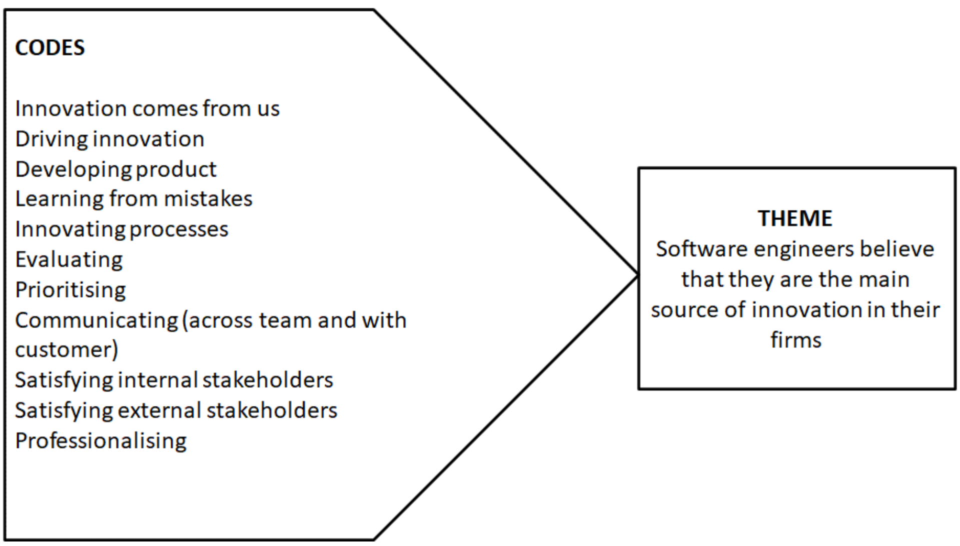
Despite this positive and consistent thesis, the fate of PE backed SMSE CEOs seemed less certain. Code categories of ADAPTING, COMPETENCE and FOCUS were constructed from codes that reflected:

- PROVEN EXPERIENCE (Prior PE experience and prior exit experience)
- VALUE (value creation in the context of PE leveraged investment)
- LIFESTYLE (making the transition from owner-managed to PE backed)
- EXECUTING/EXECUTION (against an agreed business plan)

As noted in the Alix Partners research, high numbers of newly backed PE CEOs are replaced by their investors.

Literature to explore	Bililies, T., Warren, K. and Roger, I (2017) Annual private equity survey: replacing a portfolio company CEO comes at a high cost, Alix Partners

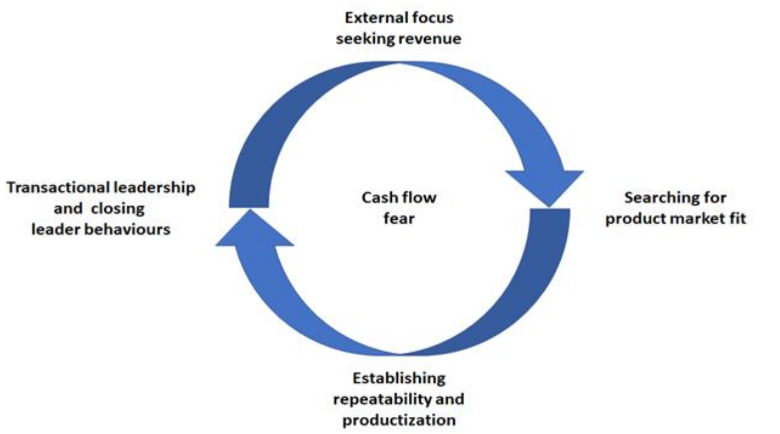
Memo 10.12	Land of hope and glory
Date	November 2019
In leader interviews, I asked about the use of incubators, local tech hub support and the R&D tax credit system. The Government's Tech Nation 2018 report highlights the importance of the creative industries and technology sector. Despite the ease with which R&D tax credits can be claimed, none of the firms had made a claim. Only one of the firms had made use of local incubator and hub facilities. The leaders did not see themselves as being part of a national effort or benefitting from central or local government support. The tax credit incentive seemed to be a simple awareness issue. However, the lack of engagement with other support initiatives seemed to be more a feature of relative priority and time management, focus on dealing with immediate issues, and retaining a sense of independence. This is reflected in codes and categories, with the INDEPENDENCE category having validity in many of the leader narratives. The policy and execution challenges that this implies for a government keen to encourage innovation in the creative and software industries seem considerable. Issues seem to be access, reach, engagement, communication, ease of access, and the psychological impact of compromising independence and being seen as weak for taking help.	
Literature to explore	National systems of innovation (Chris Freeman), annual Tech Nation reports, R&D tax credits, incubators, technology hubs, clustering. Moultrie and Young 2009 research. Entrepreneurship. Entrepreneur motivation.

<table>
<tr><td>Memo 10.13</td><td>Who’s driving?</td></tr>
<tr><td>Date</td><td>October 2018</td></tr>
<tr><td colspan="2">Both leaders and engineers claimed to be the main source of innovation in the SMSEs. The leaders were primarily externally focused and had relationships with customers and other external stakeholder which they represented as “demand pull” resulting in incremental path dependent innovation set in the paradigm of the existing market and platform. However, the software engineers also claimed primacy, often giving examples of original ideas for incremental process and underlying architectural improvements that did not relate to explicit customer demand. Even when leaders defined perceived requirements for new feature functionality, the creative cognition of the software engineers was required to develop the software to support the functional requirement.

</td></tr>
<tr><td>Literature to explore</td><td>Leadership of creative people (Mumford, Scott, Gaddis, and Strange 2002). Absorptive capacity. Organisational learning. Networks. Organisational creativity. Software engineer creative cognition.</td></tr>
</table>

Memo 10.14	Use both hands when pedalling
Date	October 2019

Despite the literature on ambidexterity, the leaders interviewed for this research were primarily focused on perpetuating the life and relevance of their existing single product software applications. The trade-offs discussed in the ambidexterity literature were rarely discussed or evident in these firms. Some of the literature suggests a balance between exploitation and exploration (bicycle), other writers suggest that a small amount of budget might be set aside for exploration (penny farthing) but the SMSE in this study were exploitative unicycles!

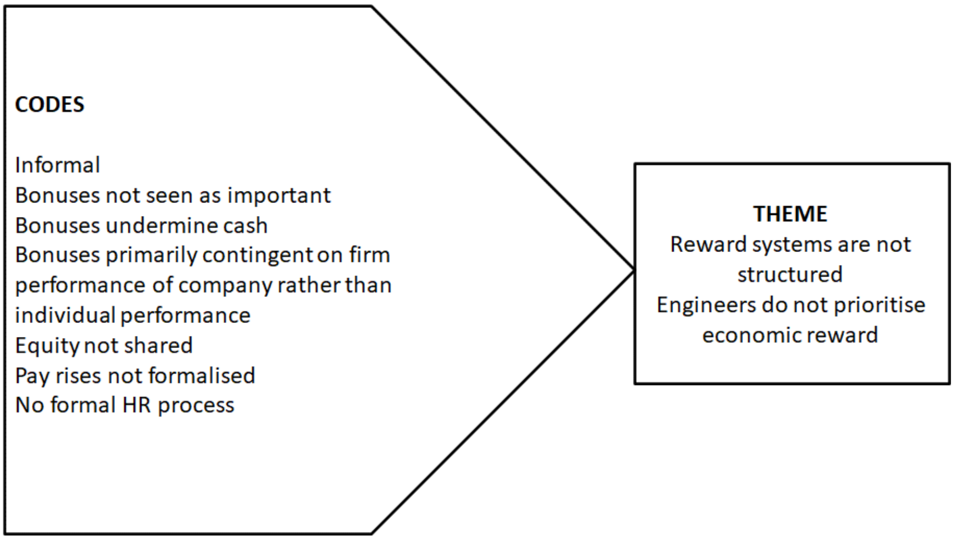
Once the software had found product market fit, the leaders concentrated on path dependent and incremental innovation stimulated by perceived customer demand (demand pull).



Literature to explore	Ambidexterity (Downton 1991; Tushman and O'Reilly 1996; Vaccaro 2012; Zacher and Rosing 2015; Van de Ven 2017; Uhl-Bien and Arena 2018). Innovation literature relating push and pull (Schumpeter 1912 vs Schmookler 1966; Rothwell and Zegveld 1985; work of Prof Chris Freeman and SPRU). Absorptive capacity. Path dependency.

Memo 10.15	Don't show me the money
Date	December 2019

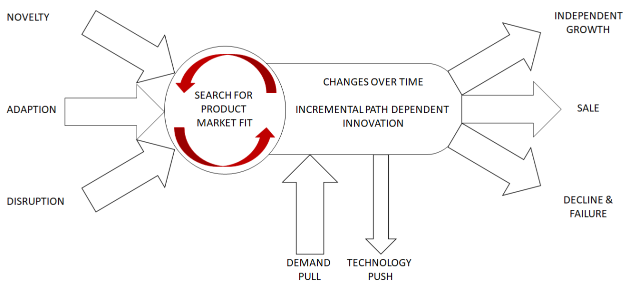
The engineer interview transcripts and coding show consistency of views in relation to rewards. Most engineers had reported that they were not primarily financially motived, other than being able to afford a comfortable lifestyle. Interviews with leaders did not suggest that this was explicitly recognised, and some leaders did offer transactional incentives for project or sprint completion. One firm located in a technology hub felt the competition for engineers so intense that they reviewed salaries quarterly. However, most firms did not feel this pressure. Few engineers had equity rewards in the firms. The two that had a small amount of equity did not seem to explicitly value their shareholding and one said that they considered it a lottery ticket that had been gifted to them. There was no evidence of formal compensation and benefits strategy and no formal HR.



Literature to explore	Engineer motivation, SME/SMSE rewards, HR in SME, motivation hygiene (Herzberg), self-actualisation (Maslow), transactional leadership, equity as an incentive in SMSE/SME. HR: Skinner et al. 2003; Dietz et al. 2006.

Memo 10.16	Schumpeter and the innovation journey of an SMSE
Date	September 2020

SMSE seem to show strong parallels to the small firms that Schumpeter discusses in his early work (1912/1934) as opposed to the large US firms of his 1942 book. They exploit a craft skill to serve a well-defined niche and leverage a largely local network to develop and sell their solutions. The initial entrepreneurial motivation is not entirely economic, but they do try to occupy a defined niche and defend margin through specialization or differentiation. These firms seem susceptible to the "gale of creative destruction" and have limited strategic resilience as they are often single product companies. Some of the leaders seem to explicitly acknowledge this risk (e.g. F4EX1). Only one of the SMSE leaders interviewed had a well-defined strategy to grow, enter new markets and diversify the application of the software development and machine learning capability.
Interviews with leaders about their journey from inception often revealed an initial period of searching for product market fit. The inception of the business was generally more characteristic of explorative or radical innovation, but once product market fit was established, then all the businesses seemed to become focused on incremental exploitation of a single paradigm based on a defined market segment and single software application. Once this phase was entered, then focus shifted to repeat sales and customer/market led path dependent development. One of the firms had a clear plan to continue to grow and exit PE ownership as a public company. One of the firms seemed to be in the early stages of decline. The remaining firms were all considering a sale at some unstated point in the future. Although concerned about survival and cashflow, the leaders did not seem to identify innovation and diversification as a strategic response to reducing fragility.



Literature to explore	Demand Pull (Schmookler 1966); Technology Push (Schumpeter 1934 and 1942); Coupling Model (Rothwell and Zegveld 1985); Path dependency (Boland, Lyytinen and Yoo 2007); disruption (Christensen 1997); stages: inception (radical and explorative) versus maturity (incremental and path dependent). Fragility. Horizon scanning. Nelson and Winter/Kamien and Schwarz (1981). Government statistics on SME survival rates.

Memo 10.17	So what?
Date	August 2020

Trying to frame how the findings support or differ to the literature is at the heart of the contribution to knowledge. The interview narrative and coding provide many possible avenues for further research, but the main thrust of the thesis relates back to the original question on the impact of leader behaviour on innovation in SMSE.

Innovation is strategically important (Pikkareinen et al. 2011; Pisano 2019).	**Dominated by cash flow, SMSE innovation becomes reactive and incremental.**
Simultaneous exploitation and exploration (Tushman and O'Reilly 1996).	**Focus on incremental exploitative innovation. Budget is not made available for exploration.**
Variety of styles and behaviours (Oke, Munshi and Walumbwa 2009).	**Leaders are transactional (Bass 1985) and instrumental (Antonakis and House 2014).**
Open and divergent leader behaviours (Zacher and Rosing 2016; Van de Ven 2017).	**Leaders are closed (Zacher and Rosing 2015) and convergent (Van de Ven 2017).**
Multiple innovation leadership roles (Van de Ven et al. 1999).	**Innovation leaders in SMSE are critics and institutional leaders (Van de Ven et al. 1999)**
Leaders influence culture and creative climate (Amabile 1996; Ekvall 1996).	**Leaders pay limited attention to culture and creative climate.**
Processes to capture and prioritize innovation (Goffin and Mitchell 2017).	**No formal process to capture and prioritize innovation.**

Literature to explore	As listed in diagram.