Maintaining Agility: A study of obscure New Product Development practices in small and medium sized manufacturing enterprises to understand how they maintain relevance to their markets

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ABSTRACT

This thesis describes a sociocultural study which addresses the question of how New Product Development (NPD) practices in small and medium-sized manufacturing enterprises (SMEs) are influenced by obscure practices, deployed to meet emerging challenges that enable SMEs to remain relevant to their markets.

Prior research in this area has assumed that a company's innovation potential can be objectively explained by looking at critical factors such as peoples' skills (e.g. leadership), company resources, capabilities, and its external orientation. However important, these variance-based approaches are generally discussed in isolation from the dynamic and idiosyncratic contexts where they emerge (such as the NPD process). As a result they fail to provide a holistic view of the phenomena that promote agility and innovation.

This study's purpose was to develop a methodological approach to explicate obscurity in SMEs' innovation practices. To achieve this, the study employed a design-led qualitative research strategy to bring to the forefront the underlying contextual, situational and relational phenomena impacting a common core practice in manufacturing SMEs, their NPD process. The aim was to increase our knowledge of the notion of obscure practices in their effort to meet their emerging challenges.

The research began by developing a theoretical model to consolidate ideas derived from:

1.Strategic management variance literature, which led to a multi-level theoretical framework (people, firm, and external levels).
2. Models of NPD processes, which led to the adoption of a generic process-model (Initiation, Development and Implementation) used as periods to study organisational practices.
3. Sociocultural literature, which led to the adoption of Activity Theory (AT) to guide analysis of NPD activities.

The study approached its methodology in order to meet two key requirements. With regards to the sensitivities of the SME context (such as the disruption to participants' day to day practices), the study developed a design-led process-mapping tool for data collection that provided rich insights in an engaging and fast way, whilst it allowed the triangulation and visualisation of the data, which was collected from staff members across different expertise and positions. In addition, an Activity Theory framework was adopted as a means to analyse the data and make sense of its complexity in line with the need to capture multi-level phenomena across different periods of the NPD process.

The thesis provides a number of contributions to contemporary design research and beyond. First, it demonstrates the value of integrating variance and process-based research approaches and the richness of insights gained by applying them to organisational settings. Second, it argues for the usefulness of 'obscurity' as a term to describe the not-well-articulated practices that take place in the day-to-day business, as opposed to terms such as hidden, invisible, silent, and/or tacit. Third, it shows the value of the adopted research method (i.e. the Pytheas tool), to surface obscurity in innovation practices in a non-prescriptive, fast and engaging way by enabling participants to self-reflect on their own practices and by visualising organisational contexts in such a way that the richness and the depth of the practices can be captured and better appreciated. Consequently, the contributions of the study primarily concern design practitioners and strategists who need to find ways to better construe the organisational settings to which they are called to offer their expertise. Businesses may also benefit by this method as it provides a platform through which members can develop a greater awareness of their respective strengths and weaknesses and, through the visualised outcomes, it offers a legacy that businesses can use, revisit and refer to during their efforts to achieve agility and increase their innovation potential.

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DECLARATION

I declare that the work contained in this thesis has not been submitted for any other award and that it is all my work. I also confirm that this work fully acknowledges opinions, ideas and contributions from the work of others. The word count for this thesis is 85,956 words, as certified by Turnitin.

Any ethical clearance for the research presented in this thesis has been approved. Approval has been sought and granted by the University Ethics Committee on September 2009.

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Date: 29th June 2015

Chapter 1.
Introduction

1.1 *Research Context and Intend*

Much has been written and discussed about the challenges organisations face in today's turbulent economic conditions, in order to remain resilient and achieve growth. It is increasingly recognised that in order to remain agile and successful, organisations cannot rely anymore purely on efficiency, but need to foster a culture of innovation. Indeed, UK government and economic policies have high on their agenda the conditions associated with innovation and its vital role in supporting economic growth. Similarly, business executives and entrepreneurs desire to both learn how to make their companies more innovative and to measure just how conducive their companies already are towards innovation. They have recognised that their companies not only need to find out how to offer breakthrough products and services, but also how to reinvent themselves. There have been inspirational stories for their support from companies such as Apple, Google, IBM, and Amazon, to name a few, published in both literature, media and the various conventions so often as to have become cliché. Yet, despite being undoubtedly great examples of design and innovation excellence, they also represent particular contexts and business models rather than elixirs for success to any business type, and this reality tends to be often overlooked by innovation gurus and a great many prescriptive tools about 'best practices', deriving from practices found in large, multinational or small, high-growth technology organisations. Such prescriptions generally neglect the idiosyncrasies and heterogeneity characterising most types of Small and Medium-sized Enterprises SMEs, making them operate differently from large organisations. Therefore, findings from large organisations are not representative to how innovation is supported within the SME sector. SMEs practices are often described as hidden, invisible, silent or tacit – for there is a certain level of obscurity attached to them. For instance, a great deal of SMEs success is said to rely heavily on practices such as strong interpersonal and informal relationships and their ability to cleverly make use of their limited resources to compete within niche markets, as opposed to the resourceful and well-established larger organisations. This issue is further exacerbated by conceptualisations and measures of agility and innovation performance that pay more attention to 'easily digestible' quantifiable inputs/outputs such as resources, structures, capabilities, but less to the harder-to-measure and obscure determinants of innovation culture such as peoples' practices, behaviours, interactions and relationships. With few exceptions, there has been a tendency to view SMEs from a top-down perspective, emphasising the heroic actions of the 'lone entrepreneur' and

undermining the significance of other ‘unsung’ members’ practice. Lack of sensitivity to obscure micro-processes and their dynamic links with other phenomena influencing SMEs practices suggests theoretical and methodological deficiencies, which considerably affect our understandings of the dynamics of SMEs innovation practices, leaving an important gap in knowledge with several implications for potential investment and support towards the sector.

Therefore, the purpose of this research is to address the need for design practitioners and strategists to find appropriate ways to explicate SMEs’ innovation practices that pay particular attention to the role *obscurity* plays in their efforts to meet their emerging challenges and remain relevant to their markets.

1.2 *Aim of the Study*

This thesis aims to increase our knowledge of how New Product Development (NPD) practices in small and medium-sized manufacturing enterprises (SMEs) are influenced by obscure practices, deployed to meet emerging challenges that enable SMEs to remain relevant to their markets.

As noted, there is much anecdotal and empirical work that discusses factors argued to promote agility and innovation in organisations, and the challenges associated with managing the process of innovation making. Likewise, there exist many theories, models and tools in business and management literature that prescribe guidelines for 'best practices' to NPD success. This study does not seek to challenge these or identify new ones. Rather, the study aims to explicate the underlying phenomena impacting NPD by consolidating and aligning these to the dynamic contexts where they emerge. A clearer and more holistic understanding of the role of *obscure practices* to agility and innovation is valuable on both industrial and theoretical grounds. More precisely, this study seeks to develop a methodological approach that will enable design practitioners, strategists and businesses to explore and visualise obscure[1] NPD processes and associated practices in order to enable them to increase their awareness and, hence, better manage their innovation potential.

To achieve this, the study will initially review studies relating to SMEs to identify the underlying characteristics that make them operate differently from larger organisations. Further, the study will refer to strategic business and management literature to synthesize a multilevel, integrated conceptual model of the relationships between phenomena suggested to impact organisational agility and innovation. These include phenomena associated with the micro-level (peoples' characteristics) and macro-level (internal context and external environment) organisational characteristics. In addition, the study will refer to NPD literature to select a process-model to use as a time-based framework for the study of organisational practices. Next, the study will refer to socio-cultural literature to identify a theoretical, analytical methodology to enable the study of organisations from a multilevel perspective.

[1] By obscure practices the study refers to those practices that have been previously described as hidden, invisible or tacit and as a means to adopt a more pragmatic term (something that is not well articulated but can be found and recorded) as opposed to implying that they are 'hidden' therefore one cannot study them.

Ultimately, the research will attempt to explore the underlying phenomena in industrial practice by addressing the questions; Are there ‘obscure practices’ deployed by SMEs during NPD? To what extent do they affect SMEs ability to remain agile, innovative and therefore meet emerging challenges? Is their strategic importance being recognised or underutilised by the organisations themselves?

Finally, the study aims to demonstrate how a multilevel, integrated approach can provide rich insights into the contextual, situational and relational phenomena that impact on SMEs’ practices.

1.3 *Research Approach*

1.3.1 Research design

A summary of the research design is presented in this section; the full description of the research philosophy, strategy and design is described in Chapter 3. The study employed a qualitative approach based on Robson's (2002) flexible design (described in Section 3.3) and a design-led research method for data collection (section 3.6) to explicate the underlying contextual, situational and relational phenomena impacting NPD. The rationale for the use of a design-led research strategy is that the NPD is complex process where activities are often obscured, socially embedded and highly dependent to both the *situation/context* and the individuals involved. This suggests that only through the investigation of the social *activity* where *relationships* and *communication* takes place within a *network* of internal and external actors, can in-depth knowledge and understanding of the phenomena in question be externalised.

The research strategy followed two phases of research. First, the research study conducted a pilot case study with a manufacturing SME. Insights gained there led to the development of a design-led process-mapping tool, which was then used to capture rich insights of the complex dynamics of four SMEs' NPD practices from a multilevel, integrated and social process perspective.

The tool was used in interviews with SME staff to provide a stimulating and engaging platform and encourage a deep reflective discourse in a relatively short amount of time that conventional interviewing techniques would not have allowed. This design-led method focused on the interplay between the relational, situational and contextual phenomena manifesting in processes of NPD.

A multi-level theoretical framework (people, organisation, external levels) and a generic NPD process model (Initiation, Development, and Implementation periods) were used in conjunction with a socio-cultural, practice-based framework, namely Activity Theory (AT) (section 3.2.1), for the analysis of the collected data in Chapter 5. Rich phenomenological insights were derived from the personal points of view of SMEs' staff from a variety of functional and power positions, which the study construed as 'bundles of practice' instead of isolated entities.

AT analysis of the bundles formed descriptions that were interpreted and contextualised in Chapter 6 in order to present:

- *Theoretical knowledge of the value of consolidating and investigating organisational agility and innovation from a multilevel, integrated approach that aligns together variance, process and practice-based theories (section 3.2.3), enabling the construction of a more holistic view of organisational phenomena, that often remain obscure in day-to-day practice.*

- *Practical understandings of the impact 'obscure practices' – i.e. not recognised or underutilised, have to SMEs' agility and innovation potential and how the study's approach may first, assist SMEs to recognise and understand the value of their 'obscure practices' and second, provide strategic design researchers with an approach to investigate key insights of the phenomena needing to be considered in studying the SME context.*

Case study and interview procedures are described in more detail in Chapter 3 and Chapter 4. Figure 1 presents the research process this study followed and its relation to the structure of this thesis.

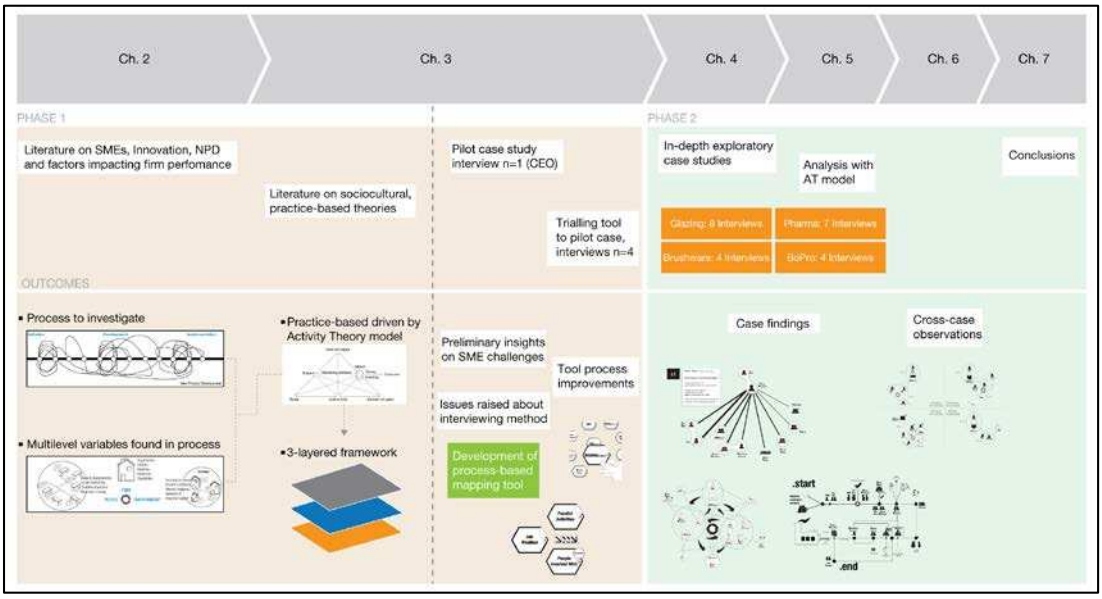


Figure 1. Research progression and thesis structure

1.4 *Thesis Structure*

The thesis is structured according to the research process followed, that is, understanding the context, fieldwork data gathering and analysis, synthesis of the findings and conclusions. The chapters are organised as follows:

Phase 1

In *Chapter 2. Literature on Practice, Innovation and the SMEs Context***,** central theoretical issues of studying agility and innovation are examined from multiple points of view and it is partly a review and a synthesis of key concepts discussed in empirical and industry literature. First, it describes the increasing recognition of the importance of agility and innovation to business. Next, it outlines the curious case of SMEs and reviews key issues and characteristics that suggest a unique case to study, including the limited affordances of explanations such as invisible and silent design and tacit practices. Then, the chapter moves into innovation literature and presents key multidisciplinary perspectives surrounding the concept of innovation. Next, it outlines key theories of studying organisations from two perspectives, variance and process-based, and considers them from a multilevel, integrated view. Finally, it proposes a multilevel theoretical model (people, organisational, external levels) of key organisational phenomena impacting NPD for investigation in industry.

Chapter 3. Research Methodology comprises two sections: First, it presents the research philosophy, strategy and design, influenced by the findings of the literature review and the derived socio-cultural, practice-based approach, in particular the principles of Activity Theory to the study and analyse organisational practices in NPD. Second, it presents a summary of findings derived from a pilot case study used to establish a practical focus for the study that led to insightful observations from which conventional interviewing techniques were trialled and questioned. The preliminary findings are discussed and a set of methodological requirements is presented, followed by the description of a design-led process-mapping tool developed to guide case study research in Chapter 4.

Phase 2

Chapter 4. Data Collection Case Studies: Case Vignettes of Manufacturing SMEs briefly outlines the case studies and the people interviewed by the study, presented in more depth in the following chapters. Criteria for sample selection are presented, followed by an introduction to the companies, organised according to three themes; A general information 'About the company', the process of 'Getting to know the company' and an overview of the structure and 'The way we are organised'.

Chapter 5. Data Analysis through the Activity Theory model presents the data analysis of the four manufacturing SMEs' NPD practices, driven by key principles of the Activity Theory model.

Chapter 6. Surfacing Obscure Drivers to Innovation: Cross-Case Observations of the NPD Journeys details cross-case observations derived from data analysis, organised according to key NPD periods to present theoretical and practical understandings of 'obscurity' in SMEs practices.

Finally, *Chapter 7. Conclusions* re**-**presents a summary of the findings, describes the study's contributions to theory and practice, and proposes further work and research recommendations.

Chapter 2.
Literature on Practice, Innovation and the SME context

2.1 *Background and Context*

2.1.1 Conditions for growth, resilience and survival: Agility, performance and innovation

Today's increased and unprecedented rate of change at all levels of society[2] leaves organisations[3] struggling to sustain an organic and long-term growth and resilience in the resulted hypercompetitive market conditions (Johannessen, Olsen, & Lumpkin, 2001) (also NESTA, 2009). To be agile, companies need to proactively, flexibly and rapidly act and meet emerging challenges and opportunities through innovative responses (Bessant, Francis, Meredith, Kaplinsky, & Brown, 2001). More precisely, companies need to creatively respond to two critical continuously shifting arenas (Bessant et al., 2001);

a) *The internal (to the company) efforts to constantly search for applications of own expertise and resources into developing a new product that may ultimately be used by others (e.g. customers), and*
b) *To do this within a highly uncertain external environment with little or no control over important events (that may be taking place on the other side of the world) and/or other actors' behaviours, and to manage to actually sell the new product in the end.*

It is generally argued that organisations that focus on innovation can achieve sustainable competitive advantage (e.g. Zahra & Covin, 1994) and overall business success (e.g. Nonaka & Takeuchi, 1995). Success, it is argued, is inextricably linked to the capacity of an organisation to develop innovative products[4] on a continual basis (Kelley & Littman, 2005; Varis & Littunen, 2010). As Baregheh, Rowley, and Sambrook (2009, p. 1323) note, it is especially important for companies to innovate as a "response to changing customer demands and lifestyles and in order to capitalise on opportunities offered by technology and changing marketplaces, structures and dynamics". Hence, the argument follows, when organisations are innovative and adopt practices with this

[2] Such as in the economic climate, environmental challenges, demographic and organisational changes.
[3] Organisations referred to throughout this study concern specifically industrial, commercial and SME manufacturers.
[4] The term 'product' refers to "something produced by physical or intellectual effort" (Merriam-Webster, 2014 [Online]), in which 'something' can be represented by a tangible artefact, service or system and the process through which it is created.

goal in mind, they increase their chances to succeed and remain agile. In this vein, Bessant, Lamming, Noke, and Phillips (2005, p. 1366) argue that;

> *"Innovation represents the core renewal process in any organisation. Unless it changes what it offers the world (product / service innovation) and the ways in which it creates and delivers those offerings (process innovation) it risks its survival and growth prospects".*

In the UK, in particular, *organisational innovation* is currently "at the very heart of the UK government and corporate agenda" (Patterson, Kerrin, Gatto-Roissard, & Coan, 2009, p. 8). Likewise, more and more business managers are said to embrace the view that innovation at all aspects of the company has to be positioned high in their strategic agenda (ibid. 2009). To help achieve the conditions needed to innovate, a multitude of theoretical models, tools, services and policies both from academia, industry and government bodies exist today. Yet, striving for innovation (or innovativeness) as a means for a company to renew and adapt (i.e. change) to contemporary trends is not a new idea. For instance, as back as in 1934, the economist Schumpeter, was amongst the first to voice the need for organisations to renew the value of their assets through innovation (or 'creative destruction' - see e.g Acs & Audretsch, 1987 for a review of the "Schumpeterian" hypotheses).

Back in the 19th century, innovation (a term not as extensively employed at the time) and its associated processes, was first seen as an important component to competitive advantage and was pursued, in an integrated way, as a means for economic and technological change (Baregheh et al., 2009). In his historical discussion, Freeman (1995, p. 8) pointed to the early realisations of the value of investing in innovation in systematic ways;

> *"…it was in Germany that the major institutional innovation of the in-house industrial R&D department was introduced in 1870. Product and process innovation by firms took place of course more than a century before that, but it was the German dyestuffs industry (Beer, 1959) which first realised that it could be profitable to put the business of research for new products and development of new chemical processes on a regular, systematic and professional basis."*

As a consequence, specialised Research and Development (R&D) departments were developed under the belief that, through them, organisations could be driving innovation by allocating their resources towards R&D activities (Freeman, 1995). This view still persists today as investment in R&D is considered a key indicator of an organisation's innovation activity and an important precondition for success. Many scholars have

challenged the bias towards R&D (e.g. Adams, Bessant, & Phelps, 2006; Barge-Gil, Jesus Nieto, & Santamaría, 2011) as these activities may be said to be particularly central to science-specific work and are generally practised by large organisations (at least in formal and established ways) who have the resources that the majority of smaller organisations lack (Hall, Lotti, & Mairesse, 2009).

Regardless of the tremendous amount of interest surrounding the concept of innovation, many argue that it remains ill-defined and, in many occasions, controversial[5]. For example, it is suggested that regardless of the many years of research in the area, we still somehow lack adequate comprehension of innovation practices and its workings (Wolfe, 1994), especially in heterogenic and idiosyncratic organisational contexts such as Small and Medium-sized Enterprises (SMEs) (Edwards, Delbridge, & Munday, 2005). More recently, scholars have even began to challenge the general bias to positivity attached to innovation and instead explore the negative impact it may have on organisations (e.g. catastrophic disruptions) (Cobbenhagen, 2000; Marsili & Salter, 2006; Rosenbusch, Brinckmann, & Bausch, 2011; Sears & Baba, 2011). Others (Patterson, Kerrin, Gatto-Roissard, et al., 2009) have pointed out that the term innovation is being avoided by professionals because it generally lacks a shared meaning and innovators are accompanied by a negative stereotype.

Away from the various incongruences surrounding the topic of innovation, a major interest of this study is to consider two areas of organisational reality; the actual context (i.e. the organisation) where novel responses to internal and external challenges are being created and the people who are involved in the practice.

Organisational characteristics such as the type and size of the organisation is an important factor to be taken into account prior to any study around the management of the innovation making (Damanpour, 1991; Nelson, 1991). As organisations vary in many ways[6], so can be argued is the way innovation activities are carried out and the types of inter- and extra-organisational phenomena that influence them. Yet, one general view is that innovation has been particularly studied in large organisations and a lot less in SMEs (e.g. Macpherson & Holt, 2007; Moultrie, Clarkson, & Probert, 2007;

[5] Before presenting some of the work that belongs to this area, it would be sensible to assert that this study has no intention to resolve the numerous issues that have been suggested to accompany the concept of 'innovation'. Yet, it is my belief that by seeking for a better understanding of the main reasons behind the 'problems' in the area, will certainly help formulate a more coherent argument towards the research question I originally set out to explore.

[6] E.g. between for-profit (private) versus not-for-profit (public), manufacturing versus service, large versus small, as well their national, regional and local context within they operate (Tidd & Bessant, 2009).

Oke, Burke, & Myers, 2007). Commonly, the majority of examples of 'best' innovation practices seem to derive invariably from studies of large organisations with the view that SMEs can be approached as scaled down versions of them (Carmichael, Turgoose, Gray, Todd, & Nadin, 2000). While it is sensible to recognise that innovation is equally important to every organisation regardless of size (Mosey, 2005), it is also reasonable to argue that organisational characteristics such as size and the context in which practice takes place, may have an immediate impact on the innovation behaviours of the organisation (Damanpour, 1996; Tidd & Bessant, 2009).

The following sections address the important size-based characteristics of agility and innovation by focusing on the relatively under-researched area of the SMEs[7] practices. The following sections also attempt to provide some general facts concerning the importance of SMEs in our society and the reasons why more research is needed in order to better understand the idiosyncratic nature of their innovation practices. Their key characteristics (as suggested by scholars and practitioners, including personal experience) are discussed hereafter in order to construct an initial picture of the different ways innovation activities are carried out in comparison to their larger counterparts (Acs & Audretsch, 1987, 1988).

2.1.2 **The curious case of SMEs**

It is without a doubt that small organisations are very important to the economy on a worldwide scale. In Europe only, 99% of all enterprises are classified as belonging to the small business sector[8] and this essentially makes them 'the lifeblood of the economy'[9]. In the UK in particular, SMEs are said to generate "a good deal of innovation" which in turn "comes business growth", as Iain Gray, the Technology Strategy Board's Chief Executive commented at the announcement of a new package of measures to support innovation efforts in small organisations (Technology Strategy Board, 2011). Despite the numerous government reports such as those deriving from the Department of Trade & Industry (DTI) and EU Commission bodies regarding the critical role of the small sector to employment, economic growth and quality of life, there is a general scepticism about their effectiveness. For instance, among the most influential authors

[7] SMEs and 'small' or 'small-scale' firms, organisations, companies are used interchangeably throughout the text.
[8] European Commission (2003).
[9] Davies (2009).

whose notable work focuses exclusively on the small-scale sector, Storey (1994) and Curran and Blackburn (2001), share the view that the impact of small organisations in the economy has been relatively underestimated. Curran and Blackburn (2001) went as far as to argue that there is a general lack of high-quality research and attention from policy makers to small businesses. The authors pointed to some of the reasons to blame for this;

i) The tendency for small organisations to be seen as less central to the economy compared to the large and multinational ones,

ii) The difficulty of defining exactly what is to be considered as a 'small' organisation – and that poses serious implications to research as well,

iii) The major adversities in researching the complex characteristics that small organisations' possess.

Curran and Blackburn (2001) further contended that regardless of the different categories provided by the EU Commission[10] in describing different types (according to size and annual turnover) of small-scale enterprises, they are occasionally referred to by researchers and policy makers in their generic term, 'Small and Medium-sized Enterprises', or SMEs. The implication here, according to the authors, is that by defining all small-scale enterprises as SMEs is to preconceive all organisations fewer than 250 employees are somewhat the same. More importantly, Curran and Blackburn (2001) argued that the lack of exceptional research in the small business sector is a product of its complicated nature, as it attracts a multi- or cross-disciplinary interest (Curran & Blackburn, 2001, p. 5). Indeed, a review of the literature in the small business research brings about results from disciplines such as sociology (e.g. Wenger, 1998; Wenger, McDermott, & Snyder, 2002), anthropology, history, and even geography (Curran & Blackburn, 2001, p. 9), each one of which draws upon other disciplines (and vice versa) to inform their enquiry. Added with the terms like 'agility' and 'innovation' the majority of studies with an exclusive focus or aptitude towards the SME sector, seem to derive from Economic and Business sciences and its subcategories (Table 1)[11]. What is of a great interest to this study is that the majority draw on and overlap with the work of other disciplines and therefore validate the view of a multi-, cross-disciplinary

[10] The European Commission (2003) divided SMEs into three categories; i) Micro-businesses which employ fewer than 10 people, ii) Small businesses which employ fewer than 50 people, and iii) Medium-sized businesses in which employment does not exceed 250 people.

[11] The intention here is to offer only a glimpse and not an exhaustive list of innovation studies in small firms.

nature. Such multi-vocality is often assigned to the heterogenic characteristics that SMEs possess and are said to make them operate in distinctive ways.

Table 1. Typical disciplines studying innovation in the small business sector

Disciplines	**Characteristic studies and authors**
Strategic Management	(Marsili & Salter, 2006; Wiklund & Shepherd, 2003; Wong & Radcliffe, 2000)
New Product Development (NPD)	(Harmancioglu, McNally, Calantone, & Durmusoglu, 2007; Lindman & Martti, 2002; Millward & Lewis, 2005; Mosey, 2005; Moultrie et al., 2007; Owens, 2007)
Design Management	(Acklin, Cruickshank, & Evans, 2013; Bruce, Cooper, & Vazquez, 1999; Gemser & Leenders, 2001; Kleinsmann, Valkenburg, & Buijs, 2007; Verganti, 2009; Woodcock, Mosey, & Wood, 2000)
Entrepreneurial	(Glancey, Greig, & Pettigrew, 1998; Lipparini, 1994; Nooteboom, 1999; Varis & Littunen, 2010; Watkins-Mathys & Lowe, 2005)
Manufacturing	(Barnes, 2002; Freel, 2000a, 2000b; Laforet & Tann, 2006)
Knowledge Management and Organi-sational Learning	(Atherton, 2003; Higgins, 2009; Macpherson & Holt, 2007; Macpherson, Kofinas, Jones, & Thorpe, 2010; Thorpe, Holt, Macpherson, & Pittaway, 2005; Wiklund & Shepherd, 2003)

2.1.3 **SMEs characteristics**

Studies on the impact of the characteristics of small organisations in their ability to innovate have been somewhat fuzzy and paradoxical. This is because SMEs' characteristics tend to be highly situational and idiosyncratic; they offer, almost simultaneously, certain advantages as well as disadvantages depending on different situations and context of business. Again, it is important to recognise that SMEs, as all organisations, possess forms that differ widely and can span across any type of sector, industry etc. of the economy (Curran & Blackburn, 2001; Tidd & Bessant, 2009). Many characteristics therefore are expected to be idiosyncratic and specific in different forms of SMEs. Nonetheless, small organisations may be said to share a number of common (or popular) characteristics. A useful starting point consists of Spence (1999)'s literature review which identified six (6) key characteristics of SMEs. According to the author, SMEs are generally;

(i) *Owner-managed,*
(ii) *Independent,*
(iii) *Involved in multi-tasking activities,*
(iv) *Affected by resource limitations,*
(v) *Driven by strong personal relationships,*
(vi) *Favour informality.*

These key characteristics are briefly reviewed in the following paragraphs and organised around three themes: ownership, context and resource-limitations.

Ownership –Traditionally, small organisations are owner-based; they may be run by owners who have started the business from scratch, inherited it or acquired it as an on-going business and they may be the sole owners or in partnership with others (Curran & Blackburn, 2001). SMEs' owners are the central power-controllers and decision-makers in their organisations and therefore it is a rare case to suffer from conflicts between multiple stakeholders (a condition that may be found in large organisations). Because of the owner-managers' central organisational role, they significantly influence their organisation's innovation behaviour. Owner-managers have been previously described as craftsmen with special capabilities (Verhees & Meulenberg, 2004) that desire independence (Spence, 1999) and infuse to their companies an entrepreneurial spirit and dynamism susceptible to risk taking (Tidd & Bessant, 2009; Verhees & Meulenberg, 2004). This in effect is said to create an environment that reflects energy, enthusiasm

and passion for innovation (Tidd & Bessant, 2009). Yet, at the same time owner-managers may also be trapped by their over-optimism about their company's own performance and as a result maybe exhibit fierce resistance towards change and innovation (Woodcock et al., 2000). Similarly, their desire for autonomy may also create a 'fortress enterprise' mentality (Curran & Blackburn, 2001) which impacts the company's relationships with their external environment (e.g. local community) (Spence, 1999).

Context – Small organisations are thought to provide a context that is non-bureaucratic but flexible and agile, which allows them to be very quick in decision making as well as to adjust and improve both internally and externally according to changing conditions (Carmichael et al., 2000; Spence, 1999; Tidd & Bessant, 2009), as well as being eager to accept and implement change (Damanpour, 1996). Internally, this flexibility has several manifestations. First, SMEs are characterised by informal cultures that enable members to have constant dialogues and fluid management practices without the need to adopt formal and bureaucratic mechanisms (Farmer, 2008; Krackhardt & Hanson, 1993; Spence, 1999; Tidd & Bessant, 2009). SMEs possess relatively simple information systems (Verhees & Meulenberg, 2004) which is suggested to aid the quality of communication amongst the members by allowing everyone to know the ongoing status of the business (Tidd & Bessant, 2009). The flexible and informal context helps top managers at a strategic level to develop a shared and clear vision and communicate their motives and goals across the rest of the organisation (Verhees & Meulenberg, 2004). A key aspect to the SMEs' context is that it is primarily driven by social communities, characterised by strong personal relationships and a high members' loyalty to the organisation (Spence, 1999).

As in every other characteristic discussed so far, SMEs' context characteristics can also be very problematic. For instance, the informal and non-bureaucratic culture of small organisations may cause some serious adverse effects. Spence (1999) argued that small organisations exhibit a type of mistrust to bureaucratic control mechanisms such as international standards because they are perceived as "a major investment of time, finances and energy, none of which are likely to be in ready supply" (p. 164). As a result, SMEs tend to avoid formally documented procedures (Woodcock et al., 2000) and formal planning (Bell, Crick, & Young, 2004) and lack systems for project management control (Tidd & Bessant, 2009). The lack of formal systems is suggested to impact a company's ability to effectively monitor their own performance and collect crucial information about market opportunities and competition (Woodcock et al., 2000). Lack of such innovation-capturing mechanisms is a key factor to the notion of 'hidden

innovations', a term used by I. Miles and Green (2008) to described innovations as outcomes of the day-to-day practice which are not being recorded and may not be regarded as such by the organisations (see also Abreu, Grinevich, Kitson, & Savona, 2009). However, many of the phenomena that take place in SMEs are neither necessarily formally explicit nor 'visible' to an outsider. For example, Bell and colleagues noted that much of the strategic planning and vision may begin unstructured and informal but it then *evolves* into more sophisticated formats during the life cycle of the business (Bell et al., 2004, p. 28). Similarly, Chittenden and colleagues questioned the notion that formal bureaucratic controls, such as quality management, are any better from being carried out informally by a company's knowledgeable staff;

> *"There is no evidence to suggest that informal quality management based upon the personal involvement of business owners and employees with detailed knowledge of customer requirements is in any way inferior to more formal systems" (1998, p.85; cited in Spence, 1999, p. 166).*

The same stands true for traditional innovation indicators such as R&D activities, which are usually well defined in large organisations but not in small organisations. Research and development activities are not necessarily described in such terms in SMEs (Barge-Gil et al., 2011; S. King & Ockels, 2009), rather they may manifest in the form of market and customer research, or simply "research into people's tastes and preferences" (I. Miles & Green, 2008, p. 6).

Resource-limited – Perhaps the most typical characteristic that influences and differentiates SMEs' practices (in comparison to large organisations) is their lack of both financial and human resources (Bell et al., 2004; Bruce et al., 1999; Tidd & Bessant, 2009; Wolff & Pett, 2006). For instance, depending on the availability of skill resources, members of small organisations (especially at the management level) tend to be regularly involved simultaneously in a range of functions and responsibilities, i.e. they multi-task (Spence, 1999). Small organisations are said to operate day-to-day activities with fewer key internal skills and expertise compared to the large organisations (Moultrie et al., 2007; Tidd & Bessant, 2009) as "they have little room for functional specialists" (Verhees & Meulenberg, 2004, p. 136). Resource limitations force SMEs to assign key practices (such as design) to be carried out by 'silent practitioners' who do not call their actions nor identify themselves as having these roles (e.g. designers) (Gorb & Dumas, 1987).

The lack of adequate financial support forces small firms to be primarily occupied with the day-to-day running of their business, making sure that they survive in the short term, as opposed to pursuing the high-risk and long-term innovative projects (Freel, 2000a; Tidd & Bessant, 2009; Verhees & Meulenberg, 2004).This is because innovation activities in SMEs are far more challenging, in the sense that SMEs potential risk failures have far greater existential consequences, compared to large organisations whose abundance of resources may tolerate failure with less damaging effects (Rosenbusch et al., 2011). Financial limitations also means that innovations are created differently from the resource-rich departments for research and development (R&D) usually found in large organisations. Instead, SMEs rely heavily on personal relationships and involvement with their markets and their customers while actively making changes and improvements to their business to meet needs and opportunities (S. King & Ockels, 2009). Their ability to develop closer, more personal and direct contact with customers, suppliers, and other organisations (including competitors) allow them to support, a) the creation of trust relationships that large organisations might find impractical to achieve (Spence, 1999), b) the ability to be in a prime position for identifying new opportunities (Millward & Lewis, 2005), and c) to operate in niche markets that their larger counterparts are not (Verhees & Meulenberg, 2004). Furthermore, SMEs are able to compensate for their lack of resources by resorting to external support. By being good at networking (Tidd & Bessant, 2009), small organisations are able to develop new competencies (Verhees & Meulenberg, 2004), obtain and use new knowledge through regional networking and benefit from spill-overs from both academic and private research at large organisations (Acs & Preston, 1997). In contrast, it has also been argued that there is a general lack of trust to engage with potential external services (Freel, 2000a).

2.1.3.1 Summary: The challenge of exploring SMEs innovation practices

A number of observations can be made based on the above review of the SMEs idiosyncratic characteristics that have an immediate relevance to the study. First, small organisations are suggested to differ not only in size but also to operate differently from the large organisations. This implies that innovation activity in small organisations may not only manifest differently but it may also be influenced significantly by the characteristics of the small organisations in question (Laforet & Tann, 2006). For example, the concept of agility is particular relevant to SMEs who "by nature it is less able to rely on resource or other factor endowments but must achieve competiveness through finding and defending niche positions in the market" (Bessant et al., 2001, p. 30). Therefore, it is suggested that findings derived from studying innovation performance in large organisations is not representative of how innovation is supported within the small business sector (Verhees & Meulenberg, 2004; Acs & Audretsch, 1988).

The first important aspect to take into consideration regards the case of the people who constitute the organisation. The role of owner-managers is a key aspect of consideration in studying innovation behaviours in SMEs. At the same time, SMEs' contexts support a culture of strong personal relationships both internally and externally. Hence, this reality highlights the importance to consider a second key aspect, the social aspects that surround innovation practices (and any organisational practices in that matter). According to Curran and Blackburn (2001), this social aspect contrasts the much "academic and media emphasis on the 'lone entrepreneur' model of the small business" which often treats organisations and entrepreneurs as being the same, while missing the important influence that other employees have to the organisation's practices (Curran & Blackburn, 2001, p. 6). This is not to imply a devalued role of owner-managers – far from that, they still are the leading controllers in their organisation and their personal goals, abilities and skills determine significantly the organisation's future. However, it is equally reasonable to expect that in their effort to remain agile and innovative, SMEs need to involve every organisational member one way or another as innovation making can take place at different levels and functional roles – the often unsung creative heroes. Likewise, it is crucial to explore the ways organisations devise their organisational settings and build *external* network business linkages attuned to their specific needs based on *appropriateness* (Bessant et al., 2001).

Researching the small organisation is a complex endeavour; apart from the issues around defining the small organisation (see for example Curran & Blackburn, 2001 for a detailed review on definition issues), the informality and spontaneity surrounding the activities of SMEs means that many phenomena are extremely difficult to be captured into a so-called 'objective' data. For example, Krackhardt and Hanson (1993, p. 104) pointed out that "if the formal organisation is the skeleton of a company, the informal is the central nervous system driving the collective thought processes, actions, and reactions of its business units". This is a very important issue that drives the study to adopt an appropriate theoretical and methodological approach in order to identify and understand such 'obscure' phenomena. For example, approaches such as the ones indicative to cases where research is sponsored by government bodies and who demand objective data that can be easily measured in order to justify expenditures and/or policies (Watkins-Mathys & Lowe, 2005) are unlikely to be fit for the purposes of this study.

Consequently, the above challenges are considered and further addressed in the rest of this thesis in more depth. This is done in the following sections and the review of literature concerned with the conditions (factors) and processes (and practices) of agility and innovation making towards the consolidation of a theoretical platform through which empirical research may be conducted. Initially, however, it is important to explain how innovation is understood by this study. The next section does exactly this by briefly reviewing some of the approaches and definitions adopted by researchers of different disciplines, followed by a selection of an approach found to have the most relevance to this study.

2.2 *Innovation in the Making*

Interest in organisational performance and innovativeness has produced bodies of literature that are well-established and broad, yet remain very fragmented. To a great extent, this can be traced back to two broad interrelated factors; a) the often puzzling and varied theoretical strands and definitions employed by the research society, industry, and policy makers, which in turn, b) drive the conceptual foundations i.e. the criteria and indicators devised to investigate, analyse and report organisational performance (Adams et al., 2006).

Similar to research in the SME sector, innovation has been generally studied and defined according to the disciplinary paradigm of the researcher (Damanpour & Schneider, 2006). Studies around the concept of innovation are as immense as the terminology used to describe it diverse. Scholars from fields such as economics, business, management, social sciences, and more recently design, approach the phenomenon from different perspectives, levels and dimensions (Crossan & Apaydin, 2010). Van de Ven and Rogers (1988, p. 645) argued that "such a pluralistic perspective is especially important in the study of innovation", a point of view also highlighted by Fagerberg (2005) who noted that the contemporary emergence of multidisciplinary scholarly approaches in the field of innovation highlights the difficulty of a single discipline to sufficiently respond to all aspects surrounding the concept. However, it is argued there is a general tendency from research to not integrate findings derived from different disciplines (Patterson, Kerrin, & Gatto-Roissard, 2009). Similarly, several scholars have stressed the problems posed by the lack of a single universal and multidisciplinary definition of innovation (e.g. Johannessen et al., 2001), although there have been some attempts (e.g. Baregheh et al., 2009). As Biemans (1992) argued, the ambiguity surrounding the definitions used to describe innovation have an undermining effect on our understandings of the phenomenon. Resolving this issue however is out of the scope of this study. What is of particular interest is that existing definitions generally describe a *process* where *people* within a relevant *context* produce novel *outcomes*, though with varying degrees of weight at each unit (Table 2). Innovation in a process-based fashion is concerned with the particular characteristics and activities of the creative individual, groups, or the organisation involved in the process through which existing ideas or products are applied in novel ways and develop new configurations not pre-

viously known by the developer(s) (Zaltman, Duncan, & Holbek, 1973). In this category belong the majority of the definitions, though there still are variations in terms of their emphasis.

Table 2. A list of multi-disciplinary definitions of innovation as a process

Technical outcome(s)	"…a complex activity which proceeds from the conceptualization of a new idea to a solution of the problem and then to the actual utilization of a new item of economic or social value".	Myers and Marquis (1969; cited in Zaltman et al., 1973, p. 7)
Multiple types	"…the process of bringing any new problem-solving idea into use. Ideas for reorganising, cutting costs, putting in new budgeting systems, improving communication or assembling products in teams are also innovation".	Kanter (1983; cited in West & Farr, 1990, p. 9)
Multi-level	"…the intentional introduction and application within a role, group or organisation of ideas, processes, products or procedures, new to the relevant unit of adoption, designed to significantly benefit the individual, the group, organisation or wider society".	West and Farr (1990, p. 9)
Multi-staged	"…the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace".	Baregheh et al. (2009, p. 1334)
Knowledge Creation	"…a process which covers the use of knowledge or relevant information for creation and introduction of something that is new and useful". "…the creation of new knowledge and ideas to facilitate new business outcomes, aimed at improving internal business processes and structures and to create market driven products and services."	Holt (1983; cited in Biemans, 1992, p. 7) Plessis (2007; cited inBaregheh et al., 2009, p. 1326)
Change	"…the act of putting together existing resources into new combinations".	Schumpeter (1961)

	"…change associated with the creation and adaptation of ideas that are new-to-world, new-to-nation/region, new-to-industry, or new-to-firm".	Patterson, Kerrin, and Gatto-Roissard (2009, p. 5)
Learning	"…a process of interactive learning in which those involved increase their competence through engaging in the innovation process".	Lundvall and Nielsen (2007, p. 214)
Relational and Contextual	"the invention and implementation of new ideas, which are developed and carried by people who engage in transactions (relationships) with others, over time and within an institutional context, and who judge the outcomes of their actions".	Van de Ven and Rogers (1988, p. 639)
	"a continuous and cross-functional process involving and integrating a growing number of different competencies [inside the organization]".	Cormican and O'Sullivan (2004; cited in Adams et al., 2006, p. 26)

One the most influential to this study's definitions was proposed by Van de Ven and Rogers (1988) who centred their analytical method to five central concepts; a) ideas, b) people, c) transactions, d) context and e) outcomes. According to them, the innovation process progresses from "the invention and implementation of new *ideas*, which are developed and carried by *people* who engage in *transactions (*relationships) with others, over time and within an institutional *context,* and who judge the *outcomes* of their actions" (original in italics) (Van de Ven & Rogers, 1988, p. 639). This definition clearly directs its focus on the key phenomena discussed earlier to characterise SMEs practices; the role of the people (relationships and transactions) and the context where they practice. More precisely, innovation here is seen as being part of the system that creates it, a system which Lam (2005) argued that is an "organisation" or "organising" (the latter being influenced by Weick's terminology, see for example Weick, Sutcliffe, and Obstfeld (2005). An organisation, as Hall (1987; cited in Hofmann, 1997, p. 723) defined it as:

> *"[…] a collectivity with a relatively identifiable boundary, a normative order, ranks of authority, communication systems, and membership-coordinating systems; this collectivity exists on a relatively continuous basis in an environment and engages in activities that are usually related to a set of goals; the activities have outcomes for organizational members, the organization itself, and for society."*

Therefore, while innovation may be conceptualised as the creation or adoption of ideas, products, and practices new to the organisation (Hage, 1999), it would be reasonable to assert that innovation, in its broader sense, is fundamentally an organisational phenomenon that involves simultaneously at least two levels; the *actor*(s) which might be an individual, a team and/or an organisation, and a *context* (both internal and external) where the actors operate in (Gupta, Tesluk, & Taylor, 2007).

This latter view of the innovation as a process consists of a central interest to this study as it embraces the inherent complexity of the phenomenon, the contextual and relational aspects involved to the generation of different innovative outcomes. The variety of outcomes of innovation needs to be clarified early and hence it is the topic of discussion in the next section.

2.2.1 Classification of innovation outcomes

Looking at innovation as an outcome is perhaps the most typical approach adopted by scholars within innovation research. Studies here have analysed the phenomenon in terms of its *perceived* 'novelty' (others have used alternatively the term 'newness' (e.g. Johannessen et al., 2001), radicalness (e.g. Schumpeter, 1961) or innovativeness (e.g. Garcia & Calantone, 2002)) from the perspective of the adopter, the developer, or both. Typically, advocates of this approach attempt to classify and measure innovation outcomes by answering the questions of 'what is new' (type of the innovation), 'how new' (its degree of newness), and 'new to whom' (perceived newness) (Garcia & Calantone, 2002; Johannessen et al., 2001; Sawhney, Wolcott, & Arroniz, 2006; Varis & Littunen, 2010). Generally, researchers tend to agree on the multiple forms of innovation types. Of note here; Schumpeter's five types of innovation also formed the basis through which taxonomies were later used by innovation researchers. According to this author, innovative outcomes may be distinguished between; "(1) the introduction of a new good, (2) the introduction of a new method of production process, (3) the opening of a new market, (4) the conquest of a new source of supply of raw materials, and (5) the carrying out of the new organisation of any industry" (Schumpeter, 1961, p. 66).

2.2.1.1 Technical outcomes

Research, particularly from the field of economics (Fagerberg, 2005), has shown a general bias towards the first two particular types, *product* and *process* innovations.

Both there two types have been often termed as *technical or technological innovations* (Knight, 1967) due to their technical nature. In short, product innovations refer to the development of new or improved products and/or services, whilst process innovations to improvements in the production methods which these products and services have been developed (or manufactured) (Fagerberg, 2005). The significant attention these two types have received can be partly explained by their association (often anecdotally) with an organisation's economic growth and employment (product), and significant cost reductions in terms of production resources, often accompanied by high staff redundancy (process) (Zahra & Covin, 1994).

2.2.1.2 **Organisation-wide outcomes**

Along with the technical innovations, other innovation types involve the new *ways of organising* the development and distribution of new goods or services (Lam, 2005). These organisation-level types have been argued to generally have a more 'humanistic' focus as opposed to the 'technological' or 'technical' one described earlier (Prajogo & Ahmed, 2006). In general, organisation-level types of innovation may include *new organisational forms and structures*, *new administrative or business systems*, *new plans and programmes* relevant to the organisational members, *marketing or commercial innovations* (sometimes labelled as *position* innovations), and *people innovations* (i.e. see Rowley, Baregheh, & Sambrook, 2011 for an extensive review of innovation typologies). In general, there is a consensus that the organisation-level types are complementary to the technical-level (product and/or process) since the former have an immediate effect upon the ways a new product or process is created. Finally, due to their organisation-level nature, these types are usually termed either as *administrative innovations* (Zahra & Covin, 1994), *social innovations* (Braun, 1980; cited in Biemans, 1992), or *organisational innovations* (Varis & Littunen, 2010).

2.2.2 **Degree of newness**

Another popular way to classify an innovation outcome is according to its "newness". In fact, this is among the most archetypal ways of understanding an innovation and has been consequently approached this way by many scholars (Johannessen et al., 2001). Similarly to the types-approach discussed above, the concept of newness has its basis to Schumpeter's work and his classification of innovations according to how radical they are compared to the existing setup. Radically new innovations refer to

something that is completely new and did not exist a priori. The extreme forms of radical innovation may refer to a new technical development (a new production machinery), or can be differentiated according to the level of change they impose, i.e. a product with a radical new meaning (Verganti, 2009), a paradigm innovation that changes how an organisation is perceived from both inside and outside (Rowley et al., 2011) or a discontinuous/disruptive innovation, often related to a technological breakthrough, and which may affect whole industries. In contrast, continuous improvement of an existing innovation is defined as incremental or marginal innovation. Radical innovations have typically attracted more interest and are often treated as having a greater importance to economic performance compared to incremental innovations (e.g. Schumpeter, 1961; Verganti, 2009). Yet, the importance of incremental innovations have received more appreciation more recently, as it is argued that the majority of economic benefits come from incremental improvements. Therefore, it is suggested that ignoring this would lead to a myopic view of innovation performance (Fagerberg, Mowery, & Nelson, 2005).

2.2.3 A general model of innovation typology

This seemingly clear-cut distinction between the types is in reality very difficult to maintain. For instance, an innovation can be context-specific. That is, a new product for one organisation might be used to support process innovation for another (Fagerberg, 2005). Others have argued that distinguishing between the various innovation types may not be as important as some might suggest towards our understanding of the phenomenon (Damanpour, 1991). This follows the logic that what we think as a single innovation outcome may have ultimately involved a number of other interrelated innovations to occur during the development process (Fagerberg, 2005; Zaltman et al., 1973). For instance, during the development of a new product, an organisation may decide (or be forced) to adopt or create both a new technology, a new production method, a new market, and /or a new organisational form (Harmancioglu, Droge, & Calantone, 2009). Consequently, it is argued that organisational performance may be more dependent on a harmonious existence between different types of innovations than a single type separately (Damanpour, 1991). In a similar vein, Kelley and Littman (2005, p. 3) argued that developing a single type of innovation such as a product, is not enough for organisations to excel;

> *"…a great product can be one important element in the formula for business success, but companies that want to succeed in today's competitive environment need much more. They need innovation at every point of the compass, in all aspects of the business and among every team member. Building an environment fully engaged in positive change, and a culture rich in creativity and renewal, means creating a company with 360 degrees of innovation".*

For the purposes of this study, it will adopt the integrated model of innovation typologies found in (Tidd & Bessant, 2009) (p.22) and defined as the "4Ps framework of innovation space" (Figure 2). This model provides a useful and simple way to encapsulate the various dimensions of innovation and its potential outcomes.

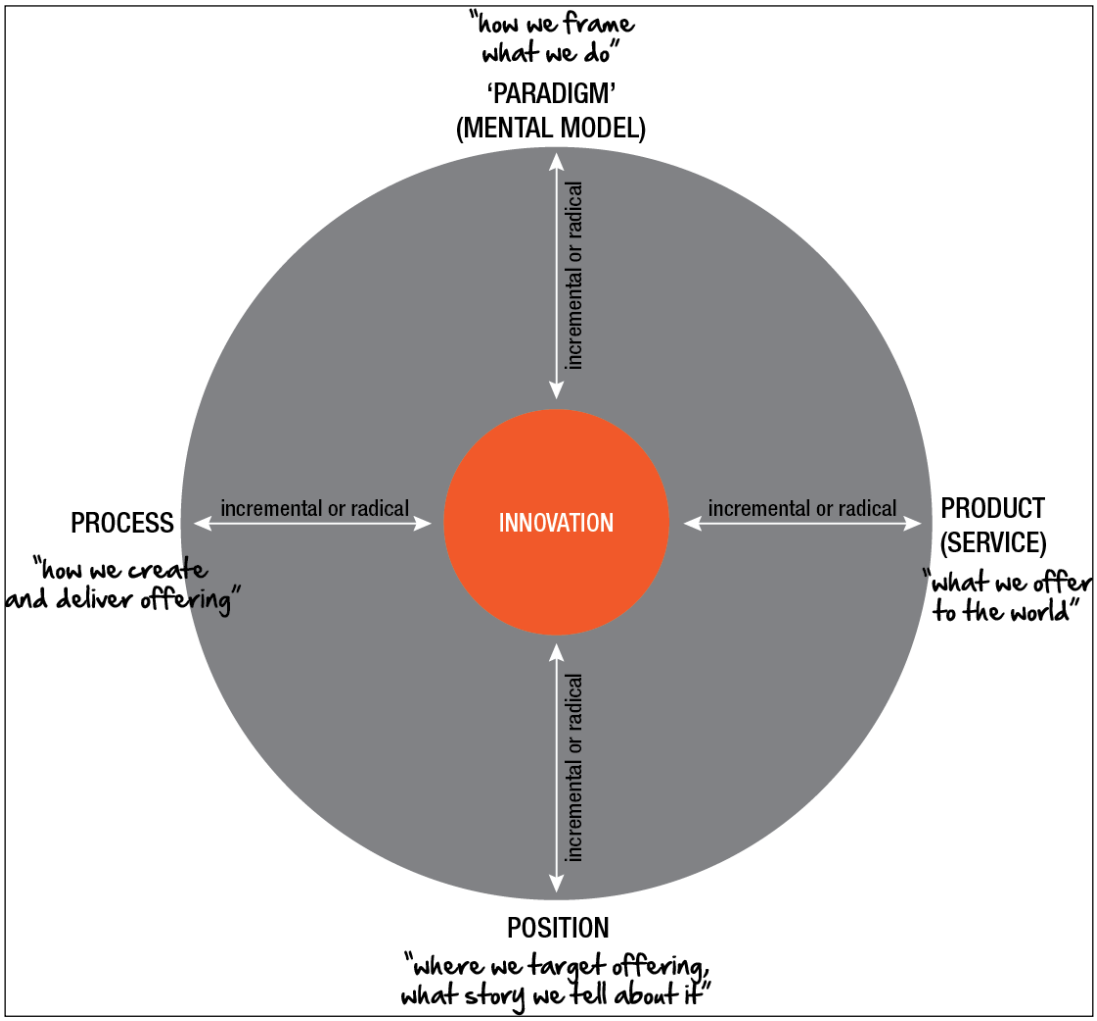


Figure 2. A modified version of Tidd & Bessant (2009)'s 4Ps of innovation space

2.3 *Theoretical and Methodological Dichotomy in Studying Organisational Innovation*

The diversity of disciplinary backgrounds studying the multidimensional and complex phenomena of organisational performance and innovation can be generally classified according to the ontological and epistemological approaches adopted by the study (Adams et al., 2006; Wolfe, 1994). The two most prominent approaches are the *variance* approach versus the *process-based* approach. Moreover, the two streams can be further distinguished by their level of unit of analysis; the individual, group, organisational and/or national level[12]. The following sections provide a brief description to the two streams along with their strengths and weaknesses and explain how these influence the theoretical and methodological directions of this study.

2.3.1 Variance versus Process research and the lack of integrity

Some scholars (e.g. Van de Ven & Poole, 2005) have questioned the epistemological and methodological approach to researching organisational performance through the deterministic, *variance* approach versus the temporal-based *process* approach (Mohr, 1982). Briefly, variance approaches address questions of *what* by investigating the causal explanations, i.e. the determinants and conditions necessary to bring about organisational performance and innovation (Van de Ven & Poole, 2005). In contrast, a process-based approach addresses the question of *how* and is primarily concerned with the examination of the process of a new development over time. Particular focus is placed on the temporal stages and connections between events throughout the creation process. The two streams are traditionally employed in isolation from each other, the reason being that they have a different focus, address different questions and units of analysis, while offering different advantages and disadvantages (see Van de Ven & Poole, 2005 and Wolfe, 1994 for an extensive review of the two streams).

Among the two, variance research (*Organisational Innovativeness (OI)* in Wolfe (1994)'s terms) is the dominant approach to the study of organisational performance and innovation simply because it provides easily digestible information of the level of innovativeness of the unit of analysis, i.e. the organisation. This is reflected in the methodologies

[12] For reasons of simplification, they are referred to as micro-level (individuals, groups) and macro-level (firm, external environment) throughout the rest of the document.

usually employed by researchers who generally favour statistical methods and survey research design techniques (Wolfe, 1994). A common critique for the variance approach is that it remains far removed from the actual practices and the actors involved and thus fails to open the 'black box' of the innovation process (Fagerberg, 2005). On the contrary, the process-based approach is argued to offer a more complex and dynamic view of innovation practices as it links the outcome with the various effects such as actions, events and contextual phenomena from which it emerged. This stream of research adopts both quantitative and qualitative approaches and "employs eclectic designs that identify or reconstruct the process through direct observation, archival analysis, or multiple case studies" (Van de Ven & Poole, 2005, p. 1314). While a process approach offers the ability to explore aspects of organisational processes that a variance approach does not, the complexity of the data it strives to analyse is also amongst its top weaknesses (Van de Ven & Poole, 2005).

However, the two streams also offer the potential for an integrative approach. N. King (1990) clearly envisaged such an integration in his recommendation for a research strategy that would study innovation in such a way as to "*make it possible to identify and understand influences on the process throughout its development*" (p.45). More recently, there have been already interesting developments of integrated, multi-level theoretical approaches to study organisations and in particular studies of organisational change and innovation. Such an example is found in Van de Ven and Poole (2005)'s pluralistic framework of studying organizational change. As the two authors noted, the combination of the two approaches is suggested to offer richer understandings of organisational phenomena than any one approach provides by itself.

For this reason, multi-level approaches are of paramount interest to this study. The following sections attempt to outline key insights from the two epistemological approaches with the aim to develop an integrated theoretical framework to guide the research study. Initially, the next section departs from a brief overview of the two main streams; at first, literature about innovation making and process management is reviewed. In particular, the focus turns to the New Product Development (NPD) process as it represents a common organisational practice of innovation making, with a broad range of multi-level (micro and macro) outcomes. The section ends with a generic process model that is adopted throughout the rest of the research study. Further, section 2.4 examines a broad scope of multi-level antecedents that have been found to impact the management of the NPD (hence innovation) process. These antecedents are discussed in line

with major multidisciplinary views and different traditional and emergent theoretical approaches. Insights derived from the two main sections are used to inform the creation of a general analytical framework to guide the research study.

2.3.2 **Processes of innovation making**

Drucker (2002, p. 95) particularly stressed the point that innovation does not simply happen by accident but by working towards it; "innovation is real work and it can and should be managed as other business activities. Innovation is the work of *knowing* rather than *doing"* (original in italics).

A fundamental question that can be said to matter most in innovation research is, of course, to understand how companies innovate. By looking at the innovation process, scholars are essentially concerned with questions around the why, how, when and what is created in the first place. A considerable literature has accumulated in recent decades, which has provided both anecdotal and systematic theoretical and empirical insights into innovation projects and their management by organisations.

One way to demystify innovation in its making is to look at the process through which new outcomes, whether tangible or intangible, are created. New Product Development[13] (NPD) may be seen as the ultimate end-goal for every organisation, in the sense that organisations exist, to a great extent, to serve – that is, to provide tangible and/or intangible goods and services to their 'customers'. These goods are critical to the survival, resilience and/or growth of these (and other) organisations, because every new development adds to their economic viability as well as differentiates them from competition through attractive and pleasant products that people are more likely to choose to buy (S. L. Brown & Eisenhardt, 1995). Moreover, NPD processes trigger the mobilisation, reconfiguration and adaptation of an organisation's capabilities and resources to effectively respond to internal and external needs and, in doing so, lead to the development of different types of novel outcomes. This recognition has led to the substantial amount of research interest in the dynamics of NPD (e.g. R. G. Cooper, 1996, 1999; R. G. Cooper & Kleinschmidt, 2007; Hart, 1995; Moultrie et al., 2007).

[13] The term 'New Product Development (NPD)' is used here to describe the process through which new products are developed in organisations. However, it is common for scholars from other disciplines to adopt a different terminology, such as 'new product design' by engineers and designers (although Moultrie et al., 2007 clearly posited 'design process' as a distinguished phase within NPD) and 'innovation process' by those in R&D domain (Hart, 1995). For reasons of simplicity and to reflect the interdisciplinary nature of NPD, this study employs the terms interchangeably (Hart, 1995).

2.3.2.1 **The New Product Development process**

Much research in NPD has sought to identify the key activities that take place throughout its process. According to Otto & Wood (2001, p. 5: cited in Moultrie et al., 2007), the New Product Development (NPD) process consists of;

> *''…the entire set of activities required to bring a new concept to a state of market readiness…including everything from the initial inspiring new product vision, to business case analysis activities, marketing efforts, technical engineering design activities, development of manufacturing plans, and the validation of the product design to conform to these plans, through to the development of the distribution channels for marketing and introducing the product''*

Most of the process-based definitions of innovation discussed earlier in section 2.2 fit well within the above description of the NPD process. In addition, one can easily integrate the five key elements proposed by Van de Ven and Rogers (1988) to impact the innovation process; ideas, people, transactions, context and outcomes. Hence, there is a general agreement that a high-quality NPD process and proficiency in managing and executing it is very important (R. G. Cooper & Kleinschmidt, 1995; Molin-Juustila, 2006). Some of the reasons for the above assertion include the decreased cycle time and increased innovation productivity as well because it "determines the degree to which businesses can meet and/or exceed demand, and thus succeed" (Harmancioglu et al., 2007, p. 400). Yet, one common attribute to the process of innovation making (i.e. NPD) is the notion of uncertainty (Fagerberg, 2005) and the inherent risks, unpredictable and highly complex nature of the various multifunctional activities involved there (Moultrie et al., 2007). Saren (1984) argued that this recognised complexity highlights not only the difficulties organisations face in managing the process, but also to outsiders in studying and understanding it. For this reason, mental models of the process have been created with the goal to know the 'what', why', 'how' and 'where' type of activities and construct a better understanding of these activities for both their management and improvement (Tidd & Bessant, 2009).

Scholars in innovation and NPD research have taken various approaches to modelling processes (Rothwell, 1994). Early process models envisioned it as a linear sequence of stages, effectively breaking down the process into a number of component parts (R. G. Cooper, 2001; Saren, 1994). In a comprehensive review of models of innovation and NPD processes, Saren (1984) distinguished three types of stage-based models arranged according to their complexity; department, activity and decision-based models. Activity-stage models are the best known and most widely used process models. One

of the earliest and most influential examples of an activity-stage model belongs to Booz, Allen, and Hamilton (1968). Their model illustrates the process as moving through six sequential stages. Initially, it begins with the (i) *exploration/ idea generation* stage, moving to the stage of (ii) *screening*, where ideas of potential new products are scrutinized based on technical feasibility, compatibility, resources etc. Commercial evaluation activities such as sales and costs take place during the (iii) *business analysis* stage, which then drive the actual (iv) *development of the new idea (i.e. prototype)* stage, and its (v) *testing* stage. Finally, the process terminates when the final product reaches the (vi*) commercialisation stage*, i.e. enters the market. Subsequent revisions of the model (Booz, Allen, & Hamilton, 1982) (Figure 3) includes a *new product strategy development* stage, where strategic objectives are set by the organisation (Biemans, 1992).

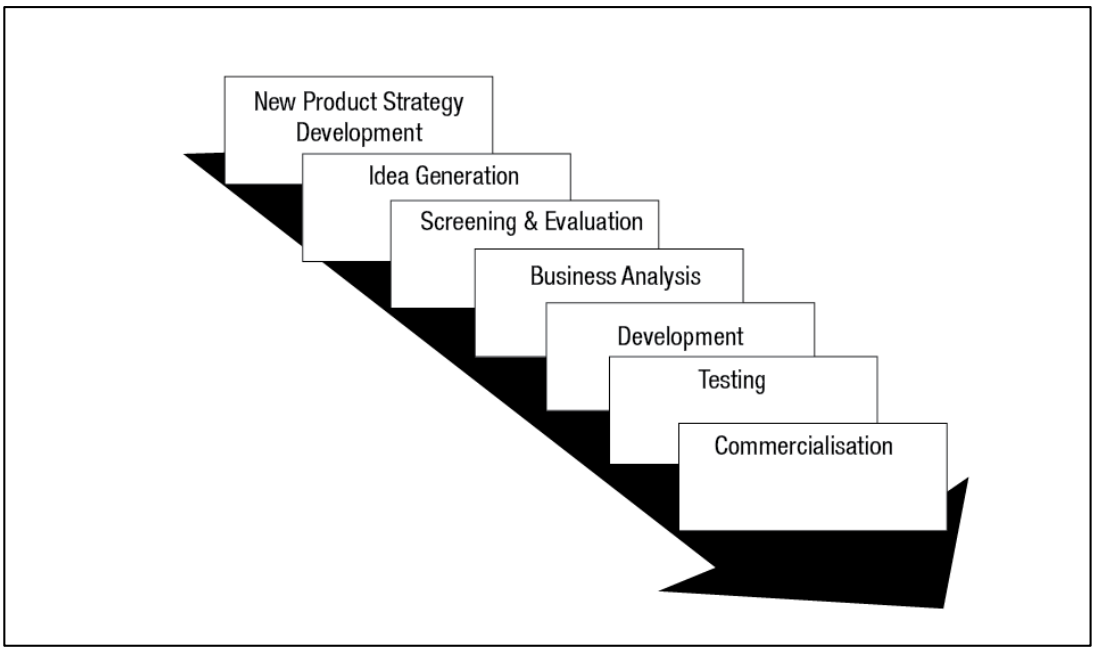


Figure 3. Booz, Allen, and Hamilton (1982) New product process

This theme has been the basis for the development of many subsequent model variations (Biemans, 1992; Tidd & Bessant, 2009). Many of these have attempted to provide more sophisticated models that resolve one of the major criticisms in the traditional sequential models; the notion of depicting the process as a 'linear' phenomenon. First, linear models imply an orderly stage to stage sequence and tend to ignore significant important phases of loops, feedback, revisions and decisions that may take place throughout the process and may lead to totally different innovative outcomes (see for example Kline and Rosenberg (1986); cited in Fagerberg, 2005). Moreover, linear models seem to suggest

that there are two ways through which organisations innovated; either through new opportunities arising through research activities that generate new outcomes ('technology push') or as a response to market demands ('market or need pull'). However, it has been argued that innovation making has a coupling and matching nature and that innovation success is essentially the interaction between 'technology push' and 'market pull' efforts (Tidd & Bessant, 2009).

Subsequent models adopted were more dynamic and recursive after recognising the existence of 'feedback loops' and factors influencing the process and have proposed various conceptualisations such as stages that take place in parallel with each other or have a cyclical character etc. Among these, the most popular process model is Robert Cooper's R. G. Cooper (1990) stage-gate process model (Molin-Juustila, 2006). According to this model (Figure 4), the management of the NPD process is based on the simultaneous participation of multiple functions. First, the process is divided into four to seven (depending to the type of company) major *stages*. Within each stage there are a number of *activities* that are undertaken by different organisational *departments* (although not explicitly shown in the model). Before each stage, there exists a gate where *decisions* (go/ no go) are made based on set goals and criteria. These gates serve as control points generally used by senior managers who make decisions as to whether to proceed to the next stage or not. As can be seen in its generic form in Figure 4, this stage-based model follows again a sequential process, although activities are done in parallel[14].

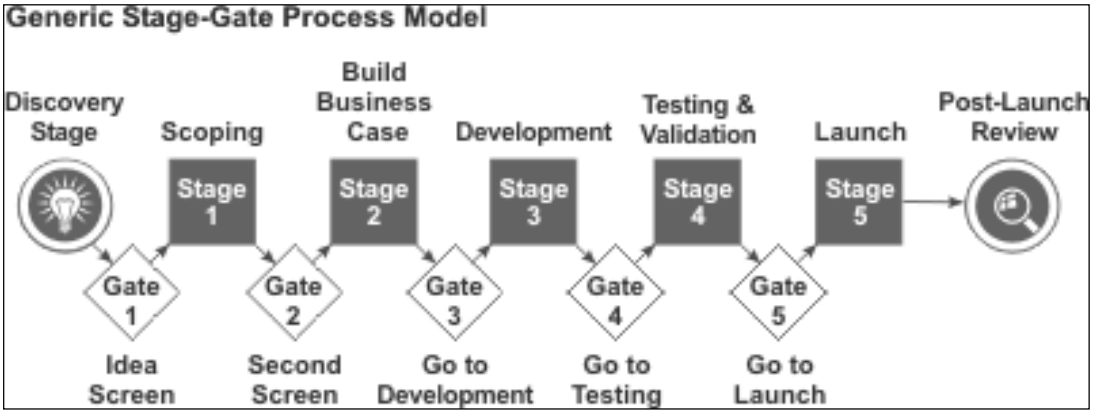


Figure 4. Cooper's generic Stage-Gate process model

While useful, stage-based models of innovation processes have attracted numerous critiques about their effectiveness to capture what goes on in the organisation during

[14] Adopted from http://www.zanthus.com/databank/innovation/innovation_management.php?aspr (Date accessed: November 2012)

the innovation process (see for example Saren, 1994). One typical one is that processes do not follow a “pass the parcel” approach but rather they often work simultaneously while functions overlap instead of being highly structured; Nonaka and Takeuchi (1995) for example used the “rugby” metaphor to describe the way a team moves from point to point by passing the ball back and forth. In addition, they focus only upon activities that tend to “fail to take account of the organizational pervasiveness of innovation and its socio-technical connectedness with all aspects of the organization” (Adams et al., 2006, p. 24).

Moreover, recent research has further acknowledged that as organisations operate within dynamic and unstable environments, so their processes constantly evolve and re-adapt through their historical development (Griffin, 1997). This in effect implies that it is very difficult to develop a generalised model of innovation process to fit every organisation in real life situations. Limits in linear models has led to attempts to describe more complex and more interactive frameworks (Tidd & Bessant, 2009). For instance, alternatives to stage-based models have also been proposed, such as those that have taken a system-based view of innovation, for example the conversion and response process models, which depict the process as either the transformation of inputs (knowledge, resources, skills) into outputs (former), or as an organisational behavioural response to some internal or external stimulus (latter) (Saren, 1984). More recent frameworks include the network-based approach, which sees the process of developing a new product from the point of view of networks, relationships and transactions amongst the people involved in the process (Biemans, 1992). However, all of the above examples, although very useful in describing certain phenomena (for example, network analysis, provides a view of the transformational role of actors and the dynamism of the structure), they say very little about the actual activities and elements like resources that are part of the process. An attempt to bridge the gap between them consists of the “blocks” model proposed by Saren (1994), yet as the author noted the model lacks the effective capture of the “interactions between stages, functions or organisations”.

While general models can arguably lead to poor simplifications of reality, researchers and practitioners can equally benefit by developing models as close to reality as possible in order to capture phenomena involved there, and simple enough to enable real life decisions to be made (Biemans, 1992). Tidd and Bessant (2009) suggested that instead of looking at process models as descriptions or prescriptions of how the process actually operates, it would be better (especially for researchers) to look at them as

'frameworks for thinking'. This way, the task would be to develop general representations of the process, yet flexible enough in order to enable the analysis of the process "in terms of activities, functions, decisions, information flows, input and outputs, internal and external actors, or as complex network of relationships" (Saren, 1994, p. 638). For the purpose of this study, it would be helpful to use a general conceptual framework as a starting point. A simple model of the NPD process will enable the research to focus attention on key aspects of the challenging task of managing and executing NPD. At its heart are aspects discussed earlier and which depict NPD as a core set of multi-functional activities, decision points, relationships and transactions across various phases that do not necessarily take place in an orderly way but rather are messy and may evolve over time in different contexts.

Van de Ven, Polley, Garud, and Venkataraman (1999) offer a relatively simple framework of the innovation process. The authors labelled it as the *innovation journey* and organised it into three main periods; initiation, development and implementation/termination where various actions and events take place (Table 3). Furthermore, through their longitudinal case study research where the authors explored a number of different innovation outcomes, they challenged many assumptions attached to many process models. For example, Van de Ven et al. (1999) supported the view that innovation making has a historical aspect to it. In what they termed as a *gestation period,* the authors suggested that innovation making does not necessarily *initiate* as a result of intentionally directed activities towards innovation. Rather, the authors found that before innovation making there exists a period (i.e. *gestation*) where a number of events trigger its initiation. Closely resembling Zaltman et al. (1973) discussion about *total change process*, the *gestation period* according to Van de Ven et al. (1999) contains many diverse events such as declining organisational health to changes in environmental conditions, the general society, various technological breakthroughs and so forth. In effect, these events generate a degree of awareness of threats and/or opportunities to the organisation whose course of actions often leads to the making of an innovation. On the other hand, these actions are not always done in a planned manner; quite often, there is a *chance* element to them and as ideas proliferate, the initial recognition of an opportunity for innovation (of any type) may not result in the form that was originally conceived. This is because, Van de Ven et al. (1999) contend, the decisions made by key organisational members about a particular course of action could, occasionally and coincidentally, intersect with the courses of action of other actors (internal or external level) and lead to the realisation of e.g. new opportunities or resources

(therefore incorporating political elements into the process). Hence**,** Van de Ven et al. (1999) found that the decision to proceed with the development of an innovation is rarely the result of a sudden spark of inspiration. Rather, the decisions that lead to innovations are dynamically and non-linearly cultivated by lengthy precipitating events, where multiple and coincidental sources of influence may come into play and cumulatively trigger the recognition of (new) opportunities.

Table 3. Aspects of the Innovation (NPD) process retrieved from Van de Ven et al. (1999, pp. 23-24)

Initiation period	Development period	Implementation period
1. Innovations are not initiated on the spur of the moment, by a simple dramatic incident, or by a single entrepreneur. In most cases, there was an extended gestation period lasting several years, in which seemingly coincidental events occurred that preceded and set the stage for the initiation of innovations. 2. Concentrated efforts to initiate innovations are triggered by "shocks" from sources internal or external to the organization. 3. Plans are developed and submitted to resource controllers to obtain the resources needed to launch innovation development. In most cases, the plans served more as "sales vehicles" than as realistic scenarios of innovation development.	1. When developmental activities begin, the initial innovative idea soon proliferates into numerous ideas and activities that proceed in divergent, parallel, and convergent paths of development. 2. Setbacks and mistakes are frequently encountered because plans go awry or unanticipated environmental events significantly alter the ground assumptions of the innovation. As setbacks occur, resource and development time lines diverge. Initially, resource and schedule adjustments are made and provide a "grace" period for adapting the innovation. But with time, unattended problems often "snowball" into vicious cycles. 3. To compound the problems, criteria of success and failure often change, differ between resource controllers and innovation managers, and diverge over time, often triggering power struggles between insiders and outsiders. 4. Innovation personnel participate in highly fluid ways. They tend to be involved on a part-time basis, have high turnover rates, and experience euphoria in the beginning, frustration and pain in the middle period, and closure at the end of the innovation journey. These changing human emotions represent some of the most "gut-wrenching" experiences for innovation participants and managers. 5. Investors and top managers are frequently involved throughout the development process and perform contrasting roles that serve as checks and balances on one another. In no cases were significant innovation development problems solved without intervention by top managers or investors. 6. Innovation development entails developing relationships with other organizations. These relationships lock innovation units into specific courses of action that often result in unintended consequences. 7. Innovation participants are often involved with competitors, trade associations, and government agencies to create an industry or community infrastructure to support the development and implementation of their innovations.	1. Innovation adoption and implementation occurs throughout the developmental period by linking and integrating the "new" with the "old" or by reinventing the innovation to fit the local situation 2. Innovations stop when implemented or when resources run out. Investors or top managers make contributions about innovation success or failure. These attributions are often misdirected but significantly influence the fate of innovations and the careers of innovation participants.

Furthermore, central to Van de Ven et al. (1999)'s argument is the notion of *shock events*; that is, new opportunities (or threats), while recognised, fail to be put into consideration unless there is some form of a *shock* event (e.g. change of ownership, sales crisis, product failure). To put it simply, *shock events* are important in that they attract the attraction that is needed and the focus of the company's top management (resource controllers) who decide whether to mobilise them or not. Furthermore, set-backs, overoptimistic plans, tensions and other unanticipated events and/or mistakes often lead to vicious cycles, all of which are typical characteristics of the innovation process. Van de Ven et al. (1999) also recognised the link between innovation and learning (this point is discussed in more depth in section 2.4.5.1), albeit they also noted that "much of the outcome is due to other events which occur as innovation develops – often making learning 'superstitious' in nature" (Tidd, 2006, p. 3).

What differentiates Van de Ven et al. (1999)'s framework from other similar simple models (e.g. Utterback (1974)'s three stage process; found in Biemans, 1992), is that it recognises that "the progress of any particular innovation along this journey will depend on a variety of contingent circumstances; depending on which of these apply, different specific models of the process will emerge" (Tidd & Bessant, 2009, p. 67). This recognition makes Van de Ven et al. (1999)'s conceptual model a satisfactory general framework for the analysis of the NPD process, as it provides enough flexibility to adapt to different organisational contexts.

The key point to take from the above discussion is that the innovation process incorporates a number of actions that take place as it moves through its various phases. NPD processes generally have a starting point (initiation), a mid-point (development) and an end point (implementation). For example, exploring how innovation making begins or what makes an organisation pursue it (a vital question in describing innovation efforts according to N. King (1990)), is essentially about looking at the initiation period. In a similar vein, R. G. Cooper (1999) called this period; the one that determines if organisations are 'doing the right projects'; this period also determines the potential 'path dependency' i.e. organisations risk getting locked into one path while being unable to find better ones (Arthur, 1994). Moreover, in Cooper's (1999) terms, the development period determined whether organisations are 'doing the right projects right' (i.e. how the process is managed). Finally, the implementation/termination period determines if organisations have essentially succeeded and benefited from their new development(s) (e.g. how it links up with its customers).

Moreover, a central characteristic of the NPD process is its social nature, that is, the people and the context (internal and external) where innovation making takes place and with each owning a set of distinctive characteristics. Stated simply, innovation making does not take place in isolation but rather it is subject to a variety of internal and external influences that impact the way it emerges. As noted, these influences have been generally agreed to exist along two levels; micro (people) and macro (organisation, external environment) levels and are at the centre of interest in the following section.

2.4 *The Innovative Organisation*

2.4.1 Introduction

Earlier sections attempted to provide evidence of the complexities inherent in any organisation embarking on an 'innovation journey'. As mentioned earlier, it is generally established that innovation is an organisational phenomenon, whose creation is a multi-stage process that is socially, contextually and situational-sensitive. Furthermore, it has also been made clear that the ability of an organisation to innovate is determined by multiple factors manifesting within its internal and external levels of operation (Adams et al., 2006). These factors have been the key focus of examination among numerous variance-based studies of organisational innovation that examine the specific organisational antecedents; its people (micro-level), the organisation itself and/or its wider external environment (macro-level). It is important to point out that the following discussion does not aim to provide an exhaustive list of factors that impact on the agility and innovativeness of an organisation as these have been systematically reviewed elsewhere (e.g. Crossan & Apaydin, 2010). However, an overview of the level based factors will allow the construction of a more holistic picture of the key phenomena and influences surrounding organisational innovation behaviours and help to inform the methodological approach of this study, which is to devise an integrated, multi-level framework. To do so, the following review of determinants to innovation is discussed in parallel with major theoretical approaches underpinning organisational research. Whenever possible, these determinants are conceptually linked to the three phases of the NPD process.

2.4.2 The Innovator: an early, psychologist model of innovation

Micro-level characteristics of innovation behaviour have been traditionally emphasised by scholars in the field of social science (e.g. psychologists, behaviourists, and cognitive scientists) as well as by economists and in business management, entrepreneurship and leadership literature. Historically, the increased focus upon the individual characteristics was adopted by scholars who studied the diffusion and adoption rates of innovation (Rogers, 1976, 2003). Among the most influential authors in the area was the innovation theorist, social scientist and economist, Joseph Schumpeter (1883-1950). In his book

The theory of economic development, first published in 1934 (see Swedberg, 1991 for an excellent review of his life and work), Schumpeter was amongst the first to link innovation efforts with economic and social change. In his early work, he construed a *psychological theory of innovation*. Economic development, according to him, "had to be seen as a process of qualitative change, driven by innovation, taking place in historical time" (Fagerberg, 2005, p. 6). *Change* and innovation was defined as *the act of putting together existing resources into "new combinations"* (Swedberg, 1991). But the responsibility of this combinatorial activity was attached to the special abilities of the individual *entrepreneur* to fight the prevalence of *inertia*, at all levels of society, in order to achieve their goals. Schumpeter called this as the entrepreneur's 'creative destruction', which emphasizes, first, the power of new combinations and second, the destructive nature of novelty and the threat it generally poses to existing settings (Cobbenhagen, 2000). Schumpeter's work was widely recognised as the basis of innovation and entrepreneurship (Dodgson, 2011; Swedberg, 1991) and had an immediate influence in the analytical direction taken by many scholars in the field; that is, the beginning of the 20th century and for about half a century a proliferation of studies adopted (explicitly or implicitly) Schumpeter's psychological theory of entrepreneurial behaviour (Fagerberg, 2005).

The personality trait approach is most clearly evidenced in the literature of strategic management, entrepreneurship and leadership where a number of descriptive and prescriptive writings attempt to link innovative activities with the characteristics, values and beliefs and self-efficacy of the individual leaders, champions, group of elites and/or the chief executives (Patterson, Kerrin, & Gatto-Roissard, 2009; Sears & Baba, 2011; Slappendel, 1996). Typical emphasis is put on personal antecedents such as age, sex, education level, values, personality, goals, creativity, and cognitive style (Amabile, 1988; Johannessen et al., 2001). Factors at the individual level have been particularly seen as determinants to creativity (Gupta et al., 2007). Hence, the *creative individual* has been often solely attached to personal characteristics such as autonomy and social independence (N. King, 1990). Regardless the major distinctions between creativity and innovation (see for example N. King, 1990), creativity has been often linked to a specific tacit mode of individual thinking and reasoning. For instance R. Martin (2009, pp. 5-6) argued that at the heart of "the creative instinct – the analysed flash of insight – [is] venerated as the source of true innovation" lies a particular type of *thought processing* and that is, intuitive thinking, a term described as "the art of knowing without reasoning". Intuitive thinking, R. Martin (2009) notes, is the answer against the domination of rigorous, quantitative thought processing found in many

organisations, the analytical thinking (constructed on the proponents of deductive and inductive reasoning) which “are built to maintain the status quo” and thus hinder innovative efforts. Although R. Martin (2009) suggested that both analytical and intuitive types are useful on different occasions, he clearly favoured the view that organisational innovativeness relies heavily upon the individual intuitive leader. Mastering analytical thinking with creativity and intuition consist of the basic elements of a more recent and popular concept adopted in design and business studies, the ‘design thinking’ (T. Brown & Katz, 2009; R. Martin, 2009). Martin’s distinction between analytical and intuitive thinking can be argued to closely resemble another often cited managerial and organisational level skill, that of *ambidexterity* (Crossan & Apaydin, 2010; Gupta et al., 2007); that is, the ability of a leader and/or an organisations to adopt both explorative and exploitative innovation strategies. In this sense, exploitative strategies are characterised by goals towards efficiency, incremental improvements and *convergent thinking*, while explorative strategies are associated with research, experimentation and *divergent thinking* (Patterson, Kerrin, & Gatto-Roissard, 2009). Again, the ideal scenario to success is suggested to be a combination of the two strategies. Whilst the concept of ambidexterity has been mostly linked to an organisation’s structural and contextual characteristics (e.g. Lam, 2005), it has also been described as trait characteristic of the leader (perhaps due to its relevance with the strategic orientation of the organisation).

Furthermore, theories such as the notion of the rational actor and his/her cognitive capacities, i.e. *bounded rationality* have been proposed as moderators and predictors of innovative behaviour (Cyert & March, 1963; March & Simon, 1958). For example, the concept of bounded rationality suggests that individuals have limited capacity with regard to formulating and solving complex problems (March & Simon, 1958). In response, they create simplified mental models to adequately deal with a given problem, although it may not be the optimal solution (Harrison, 1995). Innovation research borrowed ideas from decision-making theories and examined the kinds and styles of the top decision makers of the organisation as determinants of innovative behaviour (N. King, 1990). For instance, a common conception amongst decision-making theorists is that there are two broad types of decisions; programmed versus non-programmed (Miller, Hickson, & Wilson, 1999). As their term implies, a programmed decision is relatively routine and repetitive and a clear procedure for appropriately dealing with what already exists. In contrast, the non-programmed decisions are not routine-based and involve high levels of uncertainty, novelty, and complexity. Based on this logic, top executives should preserve their energy to deal with the non-programmed decisions (which may lead to innovation) and leave the routine ones to the lower management levels of

workers. According to Harrison (1995), there are four psychological factors that play an important role in the process of making decisions; (1) personality, (2) propensity for accepting or avoiding risk, (3) perception, and (4) the subconscious mind, all of which "influence the behaviour of the decision maker from the setting of the objective to the attainment of the final outcome" (Harrison, 1995, p. 25).

Upper echelon theory proposes that a leader is the reflection of the organisation and therefore his/her characteristics will significantly influence the decisions made and practices adopted by the organisation that they lead (Hambrick & Mason, 1984). Scholars have also stressed the multiple roles of the leaders. That is, leaders are thought to significantly influence innovative behaviours actively at the very early stages of the innovation process where strategic planning and personal search activities guide the creative practice that leads to novel solutions. Indirectly, their ability to create the right organisational climate, encourages initiation and coordination of the firm's staff members, and the making of the decisions for the effective adoption, implementation or rejection of an innovation idea (Crossan & Apaydin, 2010; Slappendel, 1996). While innovation is a disruptive, risky and costly endeavour, the necessary energy and resources to overcome inertia are owned, controlled and mobilised by the top management leaders (Prajogo & Ahmed, 2006). According to this view, organisational innovativeness is a function of its leader's behaviour, values, experiences and personality coupled with superior professional and creative skills and the ability to deal with complexity (Crossan & Apaydin, 2010). Moreover, individual leaders are emphasized in the strategic management and entrepreneurship field as the central cause of strategic change and innovation, assuming their role as 'strategists' with visionary capabilities as attributes to organisational innovativeness (Slappendel, 1996). *Transformational* leaders (like ambidextrous) have a key role in fostering an organisation's culture with *shared vision* and *values* among the organisational members (Patterson, Kerrin, & Gatto-Roissard, 2009). In their systematic review of innovation literature, Crossan and Apaydin (2010), identified several factors of innovative leadership. These factors include; tolerance of ambiguity, self-confidence, openness to experience, unconventionality, originality, rule governess, authoritarianism, independence, proactivity, intrinsic (versus extrinsic) attribution bias, determination to succeed, personal initiative, and tolerance of change. Yet, Patterson, Kerrin, and Gatto-Roissard (2009)'s literature review identified two main problems with the existing research of the leaders' impact to innovation; first, the majority of writings have focused on the link between leadership and *change* as opposed to innovation. Indeed, innovation is often associated with an organisation's efforts towards *change* either reactively – as in the need to adapt to certain changes

in its internal and/or external environment or as a proactive ambition to force a change on its own (Baregheh et al., 2009; Damanpour, 1991). Zaltman et al. (1973) provided an interesting conceptual link between change and innovation based on the *total change process* model, which generally suggests that organisations act upon opportunities (*performance gaps*) by imposing certain changes in their practices, structures and relevant functions to adequately respond to them and 'narrow' or 'bridge' the perceived *gap.* While innovation can certainly lead to changes in the system that produces it and therefore may involve a number of innovations, not all changes are innovations (or perceived as such) (Woodman, Sawyer, & Griffin, 1993; Zaltman et al., 1973). Therefore, in line with Woodman et al. (1993)'s suggestion, it is better to treat innovation as a subset of the broader construct of organisational change. Second, they agreed with Tierney (2008; cited in Patterson, Kerrin, & Gatto-Roissard, 2009) findings that despite the general recognition of top leader's role and characteristics in the innovation process, there is a lack of empirical evidence that explores the particular characteristics of leaders that promote organisational innovativeness.

Notwithstanding the role of single-minded entrepreneurial leaders as key drivers of organisational innovation behaviour (Eden & Ackermann, 1998), the emphasis put upon the trait approach of the 'lone entrepreneur' (Curran & Blackburn, 2001) has been questioned for a number of reasons. First, it relies on a simplistic line of thinking that presumes that certain individuals have special characteristics that determine innovation behaviour (Slappendel, 1996). Furthermore, it suggests that decision-making and problem-solving is a task of only a single or few individuals, an assumption that is unlikely within the social organisational settings (Van de Ven & Poole, 2005). In many cases there is more than one leader (multiple owner/managers) and hence their goals and motivations might be different but leadership may be exercised by any organisational member;

> *"…leadership as acts of influence (beyond mechanical compliance with routine directives) on organizational-relevant matters by any member of the organisation. It suggests that almost any individual in an organization may act as a leader and that different persons may contribute in different and diverse ways to the leadership of the organization." (Van de Ven et al., 1999, p. 111)*

Even in Schumpeter's eyes, entrepreneurs' personal qualities are bound to a time element, as their involvement in the creation of 'new combinations' is unlikely to be practised along their whole career (Slappendel, 1996). A very relevant idea here is the concept of intrapreneurship (De Jong & Wennekers, 2008); while entrepreneurs are usually

seen as acting independently, intrapreneurs are those employees characterised by a strong desire to take proactive initiatives towards innovation, often against upper echelons' directions, and able to do so with limited resources. Proponents of this view of organisational behaviour highlight the importance of overlooked bottom-up innovation processes, as opposed to top-down processes characterised by the top leaders' initiatives discussed earlier. On this topic, Birkinshaw, Bouquet, and Barsoux (2011) argued that while bottom-up sources of innovation are evident and may initiate under the radar, such innovative behaviours can have a real impact only with the support of top management. Hence, the authors suggested that for organisations to innovate successfully, both bottom-up and top-down involvement is crucial. Finally, scholars have criticised the emphasis on individuals as the main drivers to innovation as myopic and 'one sided' and have pointed to the need to also understand individuals who resist the persuasion of such activities (see for example Zaltman et al., 1973's, pp. 85-103 discussion upon resistance).

2.4.3 Organisation level characteristics: the social dimension of innovation making

The shift from the entrepreneur (micro-level) towards the organisations (macro-level) reflected the emergence of innovation research literature in the 1950's towards organisational innovation. While Schumpeter's early work suggested that innovation is achieved by the extraordinary individual entrepreneur, he later revised this view to include organisations (large-sized) as the main sources of innovation creation (Nooteboom, 1999). This view followed the general recognition that innovation has a more social and collective dimension than individualistic perspectives suggest. Traditional economic theory has been criticised as emphasizing what people are supposed to do in order to achieve 'optimal outcomes', yet forgetting that humans are far from ideal and rational beings (Fagerberg, 2005). As discussed earlier, individualistic studies are generally criticised for implying that people are independent from external factors, such as the organisational and environmental context. Consequently, in the middle of the twentieth century a significant body of work shifted focus towards the organisational characteristics conducive to innovation.

In general, studies of innovation in organisations had an expansive effect on the individual behaviours as organisational variables acted over and above the individual members and were set at the focal point to explanations of innovative behaviours (Van de Ven &

Rogers, 1988). This perspective shifts its emphasis to the forms of organising and the social context where innovation takes place, i.e. those internal to an organisation's characteristics. For example, Saren (1987; cited in Slappendel, 1996, p. 111) postulated that "the actions of innovative individuals cannot be divorced either from the activities of other individuals or from the organization structure within which they must operate."

Along with the recognition of innovation making as a social outcome, studies in this area did not approach organisational characteristics in isolation but included the possible external environmental influences. In general, there exists a diverse range of theories and perspectives such as the structuralist perspective, the resource-based and dynamic capabilities view of the organisation, the knowledge creation and learning organisation, and more recently social network and practice-based perspectives (Lam, 2005; Nooteboom, 1999; Pettigrew & Fenton, 2000; Sears & Baba, 2011). In essence, these perspectives look one way or another at how organisations are fundamentally organised and its members communicate in order to make better use of their resources and capabilities towards innovation. However, there are various distinctive differences as well as complementarities to the theoretical enquiry of each perspective (Fagerberg et al., 2005). As it will be further evident in the following sections (2.4.4 onwards), one notable distinction is about their level of enquiry; some pay attention mostly to aspects such as functional structures and resources, whilst others to human aspects such as knowledge flows, relationships, interactions, situations, boundaries and the social practices underpinning organisational life (Lam, 2005; Lazonick, 2005). The latter perspectives (i.e. the social) offer a more contemporary, emerging and multi-level approach to understanding innovation practices in organisations. Hence, the next section provides an overview of the key concepts and ideas underpinning conventional research and highlights some of their strengths and weaknesses. Further, recent contemporary theoretical lenses to organisational innovation such as the social network perspective and practice-based approaches are discussed. In particular, the study focuses upon the practice-based approaches as they seem to offer a distinctive set of lenses for guiding research methodology and analysis of the organisational phenomena from a multi-level point of view.

2.4.4 Organising for innovation

2.4.4.1 The right-structured organisation

In the literature of innovation in organisations, research concerned with the role of organisational design and the forms of organising in relation to innovative performance has been prevalent Studies in the area have examined how organisational structures in parallel with changes in the environment may enable or inhibit the development of new products and processes (see e.g. Lam, 2005 for a review of relevant studies). Similarly, numerous prescriptive studies have encouraged organisations to change their structure, processes and management style, for example Pettigrew and Fenton (2000).

Organisational design theories have seen many changes in their theoretical enquiry mainly owing to the new forms of organisations developing during past and current economic climates (see Lam, 2005 for an in depth review of work in the area). One example of such development is the way organisations changed their design during the industrial revolution by adopting military and engineering principles that led to the view of organisations as machines of thought and action (Morgan, 1997). This in turn influenced the rise of classical organisational and management theories supporting the purely formal structures and the idea of "one best way to organize", notably found in the work of Weber's (1947) bureaucratic form and Chandler's (1962) multidivisional form (Lam, 2005). The bureaucratic design of organisations which above all envisioned optimal efficiency was, and still is to date, best represented by the so called 'organisational chart' –the precise hierarchical division of jobs and the idea of 'top-down' control. Criticism against this idealistic view of organisation still holds today, as many management scholars still approach organisations as rational systems and, hence, fail to pay attention to the people who constitute the organisation, treating them as parts placed within a mechanical entity (Morgan, 1997).

Scepticism towards the classical organisational theories led to new theoretical developments such as those from scholars who drew upon contingency theory and argued for more *idiosyncratic* approaches (Lam, 2005). In general, the structural contingency school of thought argues that the 'best structure' for an organisation is the one that can most effectively respond to the needs of its operating context, i.e. internal and external environment, market and technology. Hence, organisations may adopt a diverse

range of structures and forms in order to meet their respective needs within their own contexts. Among the most significant and influential works in this tradition are concerned with the distinction between *mechanistic* versus *organic* structures, two concepts which were originally devised by Burns and Stalker (1961). Following an in-depth study of 20 manufacturing organisations, the two authors observed that the organisations' response to a varied rate of change and complexity in their technological and market environment had immediate impact on their structure and general management of their innovation process (Lam, 2005 - the following discussion is based on his review). More precisely, the authors used two environmental classifications and their opposite ends: predictable/unpredictable and stable/unstable. They further compared these with the two extreme forms adopted by organisations (mechanistic versus organic). They found that organisations with a mechanistic form have a rigid structure and operate within a relatively stable and predictable environment. Internally, the organisation is well defined into clear functional positions and roles, whilst control, interactions, communication and authority are inherently vertical i.e. superior to subordinate. Similarly, most significant and prestigious organisational knowledge, skills and experience sits at the top of the hierarchy rather than the organisation as a whole. At the other extreme end of the same continuum sit the organic organisations. These forms are characterised by fluid arrangements, able to respond adequately to emergent changes in their environment. Internally, organisational members collectively contribute, adjust and redefine their tasks, through a network-based structure where control, authority, knowledge and skills are to be found anywhere within the system. Moreover, such organisations have a higher appreciation of external sources of expertise compared to mechanical-based organisations.

Burns and Stalker (1961)'s classification of structural types has been linked with the concept of organisational innovativeness and the superiority of organic forms over mechanistic ones in supporting creativity and innovation practices (Damanpour, 1991). On a similar logic are Mintzberg (1979)'s archetypes of structural configurations in different *situations*. While the author's 'configurational hypothesis' distinguished amongst five archetypical forms (simple structure, machine bureaucracy, professional bureaucracy, divisionalised form, and adhocracy), his main argument was identical to Burns and Stalker (1961)'s, in that bureaucratic structures are appropriate in stable environments yet for novelty and change, flexible and organic forms ('adhocracy' in Mintzberg (1979)'s terms) are by far more appropriate. Yet, in line with contingency theory, none of these two extreme forms of organisational structuring is thought to be inherently right or wrong; rather, some organisations may be better to adopt one or

the other to match their situation (e.g. their environment, see Lawrence and Lorsch, 1967; cited in Lam, 2005), whilst others may even adopt both in different parts of the same organisation. According to Lam (2005), this coexistence of structural styles highlights the contemporary interest towards hybrid organisational models, such as the "ambidextrous" organisations (Andriopoulos & Lewis, 2008) that are capable of coping and adapting to radical environmental and technological changes. Likewise, Lundvall and Nielsen (2007), the way an organisation is organising itself, both externally and internally, will have a major effect on the rate of learning that takes place and therefore on the innovation output.

In summary, structural contingency suggests that bureaucratic structures favour stability and efficiency (non-innovative) while organic forms offer the necessary flexibility and adaptability to cope with the uncertainties of innovation. However, Lam (2005) also postulated that this line of thinking lacks empirical evidence (e.g. how exactly companies manage the complex task of ambidexterity), while contingent factors fail to include key aspects such as managerial choice or the possible different interpretations of importance among organisational members. This gap was partly addressed in the area of micro-economics and strategic management, in particular in the work of Teece (1998) who linked organisational structure to the strategic choices of the top management level in relation to market opportunities and the type of (technological) innovation. One significant contribution of Teece (1998)'s framework is that he integrated multi-level variables such as the organisational boundaries, formal and informal (culture and values – discussed in section 2.4.5) structures and the external environment (networks – discussed in section 2.4.6.1) as powerful determinants to the innovation activities of an organisation. Despite this, Teece (1998)'s theoretical contribution has been criticised to lack empirical evidence and to follow a similar line of thinking found in the work of micro-economists who lack focus to the important role of the social dynamics within and outside organisations (Lam, 2005).

Indeed, structural characteristics are very useful in the attempt to investigate innovation practices within any organisational context, even in the SME context, which is characterised by fluidity and ad-hoc activities and a general absence of formal structures and systems. It is logical to suggest that all organisations possess a certain level of structure reflected on functional/departmental roles that an organisation's members occupy as well as in formal documents such as manuals, organizational charts, training programmes and job descriptions. However, formal structures represent only the tip of the iceberg of SMEs' practices; they are unlikely determinant factors that do not

sufficiently reflect how SMEs actually operate in reality, neither how innovation activities are carried out, which is a view also shared by socio-technical advocates like Macpherson and Clark (2009, p. 553) who noted that;

> *"Documented procedures provide a useful point of reference, but they cannot capture the complex unfolding nature of work and the tacit practices employees develop over time as they solve practical problems in their day-to-day employment."*

Hence, whilst structural characteristics are important variables to be taken into consideration by the study, they are not enough to provide a holistic picture to how innovation takes place within such settings. An alternative way to look at structural phenomena in the SME context is to explore the ways such organisations organise to promote the necessary permeability that may support (among others) serendipitous events to take place. That is, through planned luck and the utilisation of chance opportunities, permeability allows a flow of chances to occur. In the SMEs case especially, it is perhaps more meaningful to talk about cultural serendipity instead of planned serendipity; something that pertains to the whole organisation's DNA instead of something that is put in place by top management. The importance of organisational culture is therefore the focus of the following section.

2.4.5 A cultural approach to organisational innovation: 'The way we do things around here'

Organisational culture is all about the social (and often less visible) dynamics of the working life. In contrast to the structuralist perspective, cultural theories adopt a more relational view to the way organisations operate and its members frame their problem solving behaviours (J. M. Martin, 2006). What is most intriguing about the concept of organisational culture is that it essentially deals with phenomena that, while are very powerful to guiding and constraining organisational behaviour, they manifest under the surface of the visible organisational life (Schein, 2010). That is, as the leading organisational theorist Schein (2010) posits, while one can see the result of certain behaviours with relative ease, the underlying forces that make organisations (and its members) act in certain ways are invisible and often unconscious. The author further argued that, this reality requires researchers to develop more complex and deeper anthropological models in order to shed a light to these phenomena and sufficiently understand them (ibid, p. 14).

Similar to innovation, definitions of organisational culture vary significantly in the way they have been devised and operated by scholars (Schein, 2010). For example, J. M. Martin (2006) suggested that the concept essentially incorporates “an organisation’s shared values, symbols, behaviours and assumptions” – often described as ‘the way we do things around here’. In a similar vein, organisational culture for Nonaka and Takeuchi (1995) consists of a set of attitudes, beliefs, values, goals, and practices shared by the members of the organisation. Schein (2010, pp. 14-15) proposed a number of related concepts and phenomena that reflect organisational culture;

- *the way organisational members interact (e.g. languages, mediums, rituals etc.),*
- *the implicit values and standards that constitute working group norms,*
- *the values that are explicitly claimed to be trying to be achieve (e.g. product superiority),*
- *the formal and explicit policies that guide action towards other people (internal/external),*
- *the unwritten rules that not only dictate the behaviours of old members but must also be learned by newcomers,*
- *the climate conveyed in the day to day organisational life (hence, susceptible to changes (J. M. Martin, 2006),*
- *the skills and competencies that members possess and transferred to newcomers without being articulated in explicit written forms (e.g. craftsmanship),*
- *the habits, routines and paradigms adopted by the members and passed on to newcomers,*
- *the shared meanings which results from the interaction of members over time, and*
- *the formal rituals that members adopt to celebrate certain key events and/ or accomplishments.*

All of these concepts are held together by the concept of *sharing*, that is, they are aspects that organisational members are said to share in common. Moreover, according to Schein (2010), a key concept of organisational culture is the stability it imposes on the organisation, since they are essentially defined by it. Stability not only helps the organisation to survive the loss of some of its members (a major issue within SMEs) but also to fiercely protect the members, who value the meaning and predictability that this stability offers (and which can also lead to a resistance towards change (e.g.

Woodman et al., 1993). In other words, cultures are deeply ingrained within and across the whole of organisational *modus operandi* (i.e. the aspects of organisation practice discussed earlier). Tied together, patterns that reflect 'the way we do things around here' emerge. Schein (2010) further noted three key levels that encapsulate the aspects discussed so far as devices used to study organisational culture; artefacts, espoused beliefs and values, and underlying assumptions.

From the discussion above, it is evident that the cultural perspective pays a close attention to the human side of organisations and particularly the social interactions of the internal and external actors (Morgan, 1997). According to Morgan (1997, p. 35), the Hawthorne studies in the 1920s and 1930s particularly demonstrated the importance of social dynamics in organisations and the "coexistence of the informal organisation based on friendship groups and unplanned activities with the formal documented "blueprints" designed by the management". In a similar vein, others have contended that organisations should more appropriately be seen as 'patterns of relationships' (both internal and external) as opposed to the formal 'role of positions occupied by the people' (Handy, 1996; found in Pettigrew & Fenton, 2000). Hence, it is considered important to explore the underlying causes of organisational performance (and innovation) and this means that it is equally important to analyse tangible and intangible assets such as the quality of interactions, relationships and coordination mechanisms (Pettigrew & Fenton, 2000). This area of enquiry is particularly relevant to the *modus operandi* of SMEs as was discussed in section 2.1.2, where personal relationships and informal means of communication reflect contexts with powerful cultures. Hence, a fundamental question to be answered here is *how innovation cultures and environments emerge*?

2.4.5.1 Environments that foster innovation making; resources, capabilities and beyond

In the area of innovation research, much emphasis is put on the organisational culture as a key factor in innovation performance (Prajogo & Ahmed, 2006). While evidence has been both anecdotal and empirical, the majority of literature focuses specifically upon the components that promote a supportive organisational environment for innovation (Cobbenhagen, 2000; Prajogo & Ahmed, 2006). The key role of the innovative environment follows the logic that; if we agree that innovation is essentially the result of ideas made profitable, then an organisation's members must be supported to create

new ideas and be creative (Prajogo & Ahmed, 2006). For example, one highly acclaimed component that may enable organisational members to be innovative is the provision of a high-quality working life for the employees; this includes conditions such as skills and career development, empowerment, autonomy and involvement (Prajogo & Ahmed, 2006; Van de Ven et al., 1999). Unsurprisingly, leaders are key cultural influencers due to the powerful roles they have (e.g. Crossan & Apaydin, 2010; Morgan, 1997; Schein, 2010), a reality especially prevalent within SMEs. Putting it differently, a supportive environment for innovation is one where members are allowed and encouraged to be creative and take risks, and where experimentation and failure are tolerated (or even desired) by the top management (Van de Ven et al., 1999). For instance, in his notable cognitivist perspective on individual creativity and organisational innovation, Amabile (1988) argues that the work environment plays perhaps the most influential role in the members' intrinsic task motivation – "the difference between what an individual can do and what one will do**"** (ibid, p. 133). Therefore, *openness* to new ideas is paramount to innovation making, especially in the early stages of NPD (i.e. Initiation period (Fagerberg, 2005).

In the same logic, the way organisations make use of their resources and capabilities and the amount allocated for new developments, is another important factor for innovative cultures (J. M. Martin, 2006). Both the resource-based view and capabilities-based view of the organisation are a popular line of enquiry adopted by scholars in the area of business and strategic management (e.g. Grant, 1991; Mahoney & Pandian, 1992), which particularly stress the availability of resources and capabilities for using them as the key competitive advantage of organisations (Stevens, 2009). Influenced by the work of Edith Penrose's in the; *Theory of the growth of the firm (2009; first published in 1959)*, resource-based scholars like Barney (1991) argue that performance is closely linked to an organisation's internal and external tangible and intangible resources. The term *resources* incorporates components like the organisation's assets, capabilities, skills, processes, knowledge and so forth, that are owned and managed by the organisation and facilitate both the initial conception (i.e. initiation) as well the implementation of strategies (or a NPD can be argued here) and positively impact an organisation's performance. Hence, for an organisation to enjoy sustained competitive advantage, an implemented strategy must nurture those resources that create *value* for the organisation against competition whilst remaining *rare*, *imperfectly imitable* and *non-substitutable* by other organisations (Stevens, 2009). Nevertheless, organisations must also have a range of capabilities to allow them to make the right utilisation of these resources in order to be successful.

Much of this has to do with the concepts of knowledge creation and of the learning organisation, both of which are key components of organisational culture (Schein, 2010). A *learning organisation* (Senge, 2006) learns and develops new knowledge incrementally through trial and error ('learning by doing' (Arrow, 1962). Knowledge of successful practices accumulates during this process and is eventually transformed into organisational *routines,* which become part of the *organizational memory* (Nelson & Winter, 1982), embedded into 'the way we do things around here' (or an organisation's culture) (Bessant et al., 2005). Winter (2003, p. 991) defined *organisational capability* as;

> *"a high-level routine (or collection of routines) that, together with its implementing input flows [and] confers upon an organization's management a set of decision options for producing significant outputs of a particular type".*

While early concepts of routines emphasized the importance of entrepreneurs' and managers' skills and abilities (Nelson & Winter, 1982), hence taking an individualistic approach (Slappendel, 1996), they later broadened their scope to include "systems of shared values and beliefs" (Levitt & March, 1988; cited in Slappendel, 1996, p. 113), that reflect the wider organisational activity (Thorpe et al., 2005). Routines support coordination and management of the process through which organisational tasks are performed (e.g. the NPD process). Much learning is produced throughout the process which in turn enables its replication without the need to reinvent the wheel every time (Gittell & Weiss, 2004). Consequently, routines may work as a way to codify best practice and thus transform the individual capabilities into organisational ones, which in turn may be a potential source of an organisation's innovativeness and competitive advantage (ibid). As routines differ between organisations, so can be said is their approach and attitude towards radical and/or incremental innovation (Fagerberg, 2005). Hence, particular interest in innovation research is put upon successful routines; those routines that are learned over time and through experience and essentially reflect important innovation drivers across the NPD process, such as how projects are selected and managed, how action is coordinated and so forth (Tidd & Bessant, 2009). In other words, those activities that organisations perform better than others, termed as core capabilities / competences (Prahalad & Hamel, 1990), are said to crucially differentiate companies from competition as they are considered highly inimitable. For instance, design is often described as such a core inimitable capability that is linked with a company's success; it adds value to the company by providing high levels of customer satisfaction, commercial advantage through product differentiation and directing its offerings to a variety of markets (Moultrie et al., 2007; Stevens, 2009; Walsh, 1996).

On the other hand, routines can be said to be in conflict to innovation making; since a routine is "a behaviour that is learned, highly patterned, repetitious, or quasi-repetitious, founded in part in tacit knowledge" (Winter, 2003, p. 991) and individuals (and organisations) know more than they can tell (Kogut & Zander, 1992; Polanyi, 1967), it is logical to argue that not all sources that foster innovativeness may be codified and become organisational memory (Nelson & Winter, 1982). For instance, it has been argued that effective management of the knowledge held by the key members can support organisations to stimulate and implement new ways of practicing and problem solving (Carmichael et al., 2000; Gouvinhas & Costa, 2005). Yet, the unique characteristics of small organisations such as informal structures and communication channels make them extremely difficult to manage. This is particularly important because in times of uncertainty and rapidly changing environments, routines are constantly challenged and improvised, and such assets are said to remain often either 'invisible', or simply ignored by organisations and researchers (Nonaka & Teece, 2001; Weick & Sutcliffe, 2007). This also highlights the case with many innovation tools, analytical screening models, and over-codified processes (e.g. ISO standards[15]) recommended by experts, that often struggle to cope with the swift transformations and typical heterogeneity of small organisations, or worse, becoming a routine 'to-do' tasks, which impacts on creativity and forward thinking (Verganti, 2009). According to Nonaka & Teece (2001), studies on the way work is usually conducted in many organisations differs significantly from how it appears in job descriptions and manuals, and has both *invisible* and collective characteristics. Verganti (2009) noted that during his study of Italian manufacturing SMEs, his understanding of what was going on within the organisations was the biggest challenge he had to overcome as "the innovation process of these organisations was tacit, invisible – no methods, no tools, and no steps" (Verganti, 2009, p. 8). Similarly, I. Miles and Green (2008) in NESTA's research report introduced the notion of 'hidden innovations' that are "not recorded using traditional innovation indicators such as research and development (R&D)" (p. 6). This can be problematic for small companies who might find it very difficult to identify or even understand the sources of their advantage. SMEs are particularly vulnerable should for example key individuals whose knowledge were intuitively acquired during their immersion to everyday practices decide to leave the company (Ambrosini & Bowman, 2008). On this topic, Baumard (1999) contended that one needs to differentiate between two types of knowledge; that of the organisation's and the one that is more freely available in its environment. The former type consists

[15] International Organization for Standardization (ISO) (2014) [Online]

of technical know-how that either an organisation or a member possess and can be preserved legally. On the other hand, as Baumard (1999, p. 22) noted;

> *"…when knowledge cannot be recorded, or documented, when its tangibility is only ephemerally perceptible, when that knowledge is tacit, it becomes difficult for a firm to truly know what it is in the process of acquiring, to preserve it or use it to construct a competitive advantage".*

For instance, a great deal of an organisation's activities during NPD involves unstructured phases such as during idea generation at the Initiation period (see section 2.3.2.1) where the outcome is still uncertain, and the activities involved there are inherently non-routine (Anssi, 2010). Winter (2003) proposed the term 'ad-hoc problem solving' (essentially a *structural* dimension as discussed earlier) to describe the non-routine, non-repetitive and not highly patterned behaviours of organisations when challenged by novel and unpredictable events. He argued that ad-hoc problem solving was to be distinguished from another strand of capability-based tradition, the concept of *dynamic capabilities (Eisenhardt & Martin, 2000)*. Emerging from the learning organisation concept, dynamic capabilities put their emphasis on the ability of an organisation to continuously develop, reconfigure and readapt its internal and external competences to respond to the changes of the environment in which it operates (Teece, Pisano, & Shuen, 1997). For instance, the concept of agility has been primarily described as such a dynamic capability (Bessant et al., 2001). This view has many similarities with Schumpeter's perspective on innovation as the act of putting together existing resources into new combinations. In that sense, sustained innovation involves the reconfiguration of critical resources such as knowledge produced internally or externally to the organisation, as opposed to solely acting based on habit and experience (Thorpe et al., 2005). However, the discussions around hidden, invisible and tacit practices beg one considerable question; are they really invisible, or are they simply *obscure* in the day-to-day practices of SMEs?

It is evident from the discussion so far that much theorising in this school of thought treats knowledge and learning in organisations as a special strategic resource, most difficult to imitate. Similarly, within the innovation literature, the way knowledge is created, captured, managed and disseminated internally is considered to be critical in determining the success of an organisation's innovation efforts (Kogut & Zander, 1992; Nonaka & Takeuchi, 1995). This line of enquiry popularly referred to as the 'knowledge-based view of the firm', treats organisations as creations and applications of knowledge (Spender, 1996; Tsoukas & Vladimirou, 2001). At the heart of interest

within the knowledge-based view tradition lies the generation of strategies for managing valuable knowledge assets (Nonaka & Teece, 2001) and the measurement of their impact to the organisation's performance. Nonaka and Von Krogh (2009) also argued that this perspective complements the concept of dynamic capabilities as they both deal with explaining dynamic processes, e.g. organisational knowledge creation. Therefore, the capability of an organisation to generate new knowledge and utilise it towards the development of new products, services, or systems is likely to produce a crucial learning outcome, which in turn is key to an organisation's dynamic competitive advantage (Romijn & Albaladejo, 2002). Innovation capability therefore may be defined as "… the skills and knowledge needed to effectively absorb, master and improve existing..." practices (Romijn & Albaladejo, 2002, p. 1054). Lam (2005) defined this stream of research as "the cognitive foundations of organisational innovation" as it focuses on the micro-level processes of new idea generation in organisations and their "capacity to create and exploit new knowledge necessary for innovative activities" (p. 176).

Notwithstanding the significant contribution of the resource-based approaches (and its extensions - capabilities, competences, routines and so forth) to organisational performance (and innovation), these theories have been criticised on a number of occasions. To begin with, it is argued that these approaches lack a "perspective on why and how some organisations rather than others accumulate valuable and inimitable resources, or indeed what made these resources valuable and inimitable" (Lazonick, 2005, p. 33). In a post-reflection of his earlier work, Barney and colleagues (Barney, Wright, & Ketchen, 2001) contented that, whilst managers may assume they know which particular resources are sources of sustained competitive advantage in their organisation, in reality, such knowledge remains extremely obscure, as the link between resources is likely to be uncertain and ambiguous. Nonetheless, organisational theorists (particularly within the strategic management school), driven by what can be described as a 'liberating attitude' towards neo-classical economics, sought to explain the idiosyncrasies of the organisation by narrowing their scope on central ideas discussed within the resource-based tradition (Nonaka & Von Krogh, 2009).

Furthermore, they are based on an evolutionary perspective, which follows the logic that organisations with a greater variety of resources will also have more chances to combine them in new ways and are more likely to create more complex and more sophisticated innovations (Fagerberg, 2005). The problem with this line of thinking is that it implies that large organisations (with lots of resources) are better fit to be innovative

than their smaller counterparts (with a lot less resources). Whilst this may be partly true (e.g. where *slack resources* (Adams et al., 2006) allow large organisations to mobilise them towards innovative projects), an organisation's innovativeness is dependent on a variety of assets and capabilities that entail both tangible and intangible properties, which are not quantity-bound. For instance, Barney (1991) emphasized the role of social agency by suggesting that many 'imperfectly imitable' resources regard very complex social phenomena such as the interpersonal relations amongst the organisation's members, its culture, or the organisation's reputation in the external environment, all of which are very tricky to measure and systematically manage. Hence, whilst many organisations may possess the exact same technological resources and capabilities, their effective exploitation often depends on other intangible resources, such as social relations, the culture and traditions of each organisation. Nelson (1991) suggested a similar view through the concept of dynamic capabilities by asserting that;

> *"It is organizational differences, especially differences in abilities to generate and gain from innovation, rather than differences in command over particular technologies, that are the source of durable, not easily imitable, differences among firms. Particular technologies are much easier to understand, and imitate, than broader firm dynamic capabilities" (Nelson, 1991, p. 72).*

Amongst the most important weaknesses are the conceptualisations of knowledge within the resource-based tradition, a tradition prevalent also in the literature regarding knowledge use in SMEs. Two recent systematic reviews by Thorpe et al. (2005) and Macpherson and Holt (2007) found that the majority was influenced by Barney (1991)'s and Penrose *(2009; first published in 1959)'s* work. Thorpe et al. (2005) for example found that performance (and innovativeness) under a resource-based view is inextricably linked with the top managers' ability to utilise market knowledge for the organisation's benefit, the organisation's proximity to emerging market opportunities, recognising opportunities and exploiting them through innovation, along with the routines, norms and physical environments where activities take place. The central conclusion from both reviews was that, while factors such as human and social capital, systems, structures, and networks have been argued to play an important role in innovation performance and growth, they remain somewhat abstract concepts due to the lack of a dynamic conceptual framework that would analyse the phenomena beyond the resource-based view. The resource-based view of the organisation, associates knowledge with a tangible asset that can be taken out of context, recorded, classified, and distributed, thus evoking a close link to the cognitivist approach to knowledge (Macpherson et al., 2010).

Moreover, the majority of studies reviewed include statistical analyses using large samples and case studies. Thus, it was evident from both authors of the systemic reviews, the importance to conceptualise knowledge in different ways, with a focus on a more critical understanding of knowledge configuration within small organisations. Of paramount importance is the way practice reflects a close connection between knowledge and action. That is, knowledge has a close association to individuals' (inter) actions with others and for this reason it has been the central focus and debate amongst scholars from various disciplines, especially with the ways knowledge may be created and learned through practice (Macpherson & Clark, 2009). Often, one debate involves different schools of thought and the ways knowledge is conceptualised by different scholars (Gourlay, 2006). At one end is the Cartesian understanding of knowledge and cognition as a mental process nested in the heads of its members, for example (Simon (1991)'s concept of bounded rationality). This area has been criticised by social scientists as underpinning *methodological individualism,* an approach "which seeks explanations of social phenomena purely in terms of actor intentions and motivations" (Chia & Holt, 2006, p. 638).

Furthermore, as mentioned earlier in the chapter, much theorising around innovation has been done from a variety of perspectives and according to a particular level of analysis; so, for example, psychological theories have been applied to individual and/or group/team level, management theories to the organisational level, and economic theories to industrial, sectorial and overall societal level (Crossan & Apaydin, 2010). One issue with these approaches is that although they enable a deep understanding at each level, they also have the notion of treating each level in isolation, hence impeding useful insights about their inherently interrelations and the influence they have on each other (Gupta et al., 2007). For instance, research at the organisational and industry/ societal level (usually termed as macro-level) generally lacks the human agency when analysing various phenomena such as structures, resources, capabilities, policies etc. that affect innovation (Felin & Foss, 2005). On the other hand, research at the micro-level (individual and/or groups, teams) tends to overlook the effect that both internal (organisational) and external (environment) level contexts impose on the innovation process (Sears & Baba, 2011; Slappendel, 1996). For organisations to innovate, it is most pertinent, above all, to have the desire and energy needed to innovate in the first place. Organisations are systems made out of bundles of people and therefore it is them who determine the willingness of an organisation to innovate. Studies that adopt a single level perspective possess an important weakness in that they paint an incomplete picture of the mechanisms that influence organisational innovation practices.

Micro-level studies often examine the actions of certain key individuals (e.g. leaders) without taking into consideration either membership in its entirety (N. King, 1990) or the contextual and other environmental factors that influence their actions. Conversely, macro-level perspectives are suggested to discount the individual and relational phenomena that drive innovation practices. Hence, there have been calls for integrating the findings of both micro and macro levels to allow a more comprehensive understanding of the phenomenon of innovation in organisations. There is now a general recognition that the innovation potential of an organisation resides in both the characteristics of its people, its context (including cultures, structures and processes) and the environmental forces that impact upon it. This essentially relational perspective is the focus of the next sections.

2.4.6 A relational perspective: communities of networks and practice

A rather humanistic view of knowledge, learning and innovation is to look at them "as forms of social expertise, that is, as knowledge in action situated in the historical, social and cultural contexts in which it arises and embodied in a variety of forms and media" (Nicolini, Gherardi, & Yanow, 2003, p. 3). This latter view, adopts a relational social constructionist approach as opposed to the resource-based approach (Macpherson et al., 2010) and implies that as individuals interact, reality is constructed as social knowledge, which in turn influences their judgement, behaviour and attitude (Berger & Luckmann, 1967). Therefore, it is argued that the practices that take place within an organisation emerge socially through a process of sense-making in which individuals actively identify and resolve problems by acquiring appropriate knowledge (Lave & Wenger, 1991; Nonaka & Takeuchi, 1995; Weick et al., 2005). In a similar vein, Pettigrew and Fenton (2000, p. 5) noted that;

> *"As firms add value via relationships, and require ever greater internal and external interdependence to create, share and transfer knowledge, so the basis for organizational activity and configuration is centred on relationships and the wider social context within which firms are embedded."*

Relationality (R. Cooper, 2005) seeks to understand practice (hence, innovation making) through the relationships, interactions, communication means and actions of the organisational actors. In order to innovate, organisations need to find appropriate ways for coordinating diverse functional expertise and create shared meanings across boundaries

(Carlile, 2004). Novelty creates conflicts with existing norms which no longer have the necessary capacity to deal with it; hence, “negotiating interests and making trade-offs between actors” (Carlile, 2004, p. 559) is at a focal point for understanding environments of innovation making. For instance, Carlile (2004) particularly advanced the concept of boundary objects (or *mediating artefacts* in Engeström and Blackler (2005)’s terms) and the dynamic nature of knowledge that is transferred, translated and/or transformed depending on different types of boundaries of specialised domains within organisations. His integrative framework for managing knowledge across boundaries particularly stresses the importance of communication between actors with different levels of accumulated knowledge (skills, expertise, experience, espoused theories) and “the importance of matching the capacity of the common knowledge (common lexicon, meaning, and interests) with the type of boundary faced…” (Carlile, 2004, pp. 564-565). Carlile (2004) suggested that different boundary objects are required to meet the capacities of common knowledge at three types of boundaries; the information-processing boundary where conditions are relatively stable and knowledge is easily transferred between actors, the semantic boundary where knowledge must be translated (through participation, co-ordination etc.) to create a shared meaning, and the political boundary, which “arises when the novelty presents results in different interests among actors that have to be resolved” (ibid, p. 559) and hence knowledge needs to be transformed and negotiated through various methods and objects. Boundaries of specialised domains and objects used to span those are a particular interest to the study as they are highly relevant to the investigation of NPD activities and the communication between actors at different periods of the process.

2.4.6.1 **A social network perspective**

Contemporary research in innovation performance links knowledge management and learning to the way an organisation is organised itself (a structural dimension), both externally and internally, as a major determinant of the rate of learning that takes place and therefore innovation output (Dodgson, 2011; Lundvall & Nielsen, 2007). For instance, Lundvall and Nielsen (2007) suggested that rather than detailing the processes of knowledge creation, it may be more important for organisational knowledge management to focus on the conditions that enable internal and external actors to engage in interactive learning. Others (e.g.Fagerberg, 2005) have argued that an organisation’s capacity to innovate is co-dependent upon the organisation’s structure supporting day to day internal communication and knowledge sharing. Organising for innovation goes

hand in hand with establishing the appropriate patterns of social processes that enable the integration of people and the mobilisation of critical knowledge across boundaries to deal with novel challenges such as innovation (Dodgson, 2011; Edwards et al., 2005; Lam, 2005; Nonaka & Takeuchi, 1995). For these reasons, the social network perspective has been gaining much popularity recently (Patterson, Kerrin, & Gatto-Roissard, 2009). Some advocates in this area are concerned with the analysis of networked environments and knowledge flow i.e. the content, strength and density of both internal and external networks that influence innovation (Hakkarainen, 2004; Patterson, Kerrin, & Gatto-Roissard, 2009). Amongst the most known theories is Granovetter (1973)'s strength of weak ties, which suggests that organisations have more to gain when novel information required from networks (as many and as diverse the better) of weak strength, as opposed to the strong ties which tend to offer limited value (i.e. ties between actors who meet frequently and share similar knowledge) (Dodgson, 2011; Hakkarainen, 2004). According to this theory, weak ties offer greater diversity of knowledge resources that can be variously recombined (based on Schumpeter's innovation theory) into novel outcomes (Dodgson, 2011). On the other hand, strong ties are suggested to be particularly important for sharing complex and tacit knowledge, due to the trust built among the actors of the network. The debate about whether one is better than another when innovation is envisaged, still holds true (see for example Hakkarainen, 2004). Both strong and weak ties suffer from some notable disadvantages; the former from potential inertia and lock-in whilst the latter from their inability to effectively mobilise resources and tacit knowledge (Dodgson, 2011). Similar to the ambidexterity concept discussed in section 2.4.4.1, there is a general consensus that organisations require both strengths in different situations e.g. early stages in the NPD process benefit from weak ties (or organic structures one may argue) that support opportunity recognition (Dodgson, 2011). Yet, within the dynamic nature of the innovation process, ties may often transform from weak into strong ones (Engeström, Miettinen, & Punamaki, 1999; Hakkarainen, 2004). Weakly tied networks are said to have *structural holes* i.e. disconnections between actors and the flow of information and knowledge sharing, emerging from cross-functional boundaries (Hakkarainen, 2004). On one hand, network holes are said to blur the awareness of opportunities amongst different communities (e.g. potential collaboration between them). At the same time, they offer potential opportunities that if recognised, then novel links may be created that may in turn result in new collaborations, access to novel knowledge sources and hence increase the likelihood that these result in innovative outcomes (Hakkarainen, 2004). The focus then is directed upon the people who bridge between these holes and are so-called "brokers" or "information gatekeepers"; such as a role that; "not only spans social

worlds, but spans otherwise poorly connected worlds" (Dodgson, 2011, p. 1123). At a focal point of analysis here are the networks which are examined based on either the patterns of interactions among actors (volume and intensity) or the relationships and roles of experts and the identification of who communicates with whom (Hakkarainen, 2004; Toni & Nonino, 2010). In general, social network views of the organisation provide a useful way to visualise both formal and informal types of organisation and to identify the key individuals that act either as brokers or as information gatekeepers. Yet, it can be argued that social network traditions tend to focus on networks of information flows and routines of activity and much less on the actual content, interactions and mediating artefacts that facilitate agility and innovation making.

2.4.6.2 External networks as mediators to SMEs innovation potential

An organisation's networking practice not only has an impact on its ability to develop in-house innovations but also to potentially develop new learning about innovation practices of other organisations (Biemans, 1992). For this reason, it is argued that the way organisations' set-up their practices has an immediate effect also on their *absorptive capacity (*a cognitive explanation) (Cohen & Levinthal, 1990), to acquire and exploit new knowledge created elsewhere, that is, the external environment (Fagerberg, 2005). Maintaining strong external relationships has been argued to be a key capability for innovation (Acklin et al., 2013), especially an organisation's links with its customers, suppliers and other institutions such as educational and professional bodies, often referred to as the organisation's *social capital* (Thorpe et al., 2005). According to Edwards et al. (2005, p. 1123) "these civil and professional bodies often play an important mediating role in the innovative potential of SMEs". It follows that organisations are required not only to closely monitor what competition does but also to expand their search for new ideas, inspirations and key knowledge sources through their external networks (Fagerberg, 2005). Nowadays, firms widely recognise the importance of collaboration, to develop strong partnerships with other organisations both formally and informally, while failure to do so damages their capacity in the long term (Pittaway, Robertson, Munir, Denyer, & Neely, 2004). Nurturing good links with external sources of knowledge and learning are particularly critical and relevant to SMEs because it helps them compensate for the lack of internal resources (Bell et al., 2004). Of notable consideration is Rothwell (1991)'s study of European manufacturing SMEs that showcased exactly this reality; by creating dense networks of external partnerships with other

organisations (often larger), universities and private institutes, the organisations were able to overcome their lack of in-house expertise (Thorpe et al., 2005). Such participation in innovation networks, Freel (2005, p. 123) notes, enables small organisations to "access sophisticated technology and technical expertise, whose direct employment is precluded by internal resource limitations". This does not stop at how dense and frequent are the interactions with the external environment but also the quality of communication and relations between the two (Crossan & Apaydin, 2010; Yli-Renko, Autio, & Sapienza, 2001). This is because maintaining relationships with external actors is found to be particularly complex and difficult to manage (Pavitt, 2005; Rothwell, 1991; Thorpe et al., 2005). In their relational interpretation of the resource and capability-based view, Yli-Renko et al. (2001), found that important qualities such as trust, reciprocity and goodwill were not necessarily consistent with the companies' strong social interaction with their key customers. Pavitt (2005) particularly stressed the importance of an organisation's relationships with universities through personal and informal contacts. Informality (another structural dimension discussed earlier in section 2.4.4) has been closely linked with the simultaneous top-down and bottom-up interaction of internal and external actors, regardless of task relevant expertise. A practice that may foster new idea generation and eventually innovation (Cobbenhagen, 2000). In general, organisations benefit from employing highly trained graduates (often through other government incentives such as Knowledge Transfer Partnerships (KTP)[16] who carry with them valuable contemporary skills (e.g. design skills, new methods and techniques and so forth) and which are difficult for organisations to provide themselves. However, problems also arose in these relationships when they do not meet expectations, such as the cases where universities do not conform to the tight deadlines run by organisations or when past disappointments with inappropriate outcomes from external consultants such as designers, makes organisations reluctant to repeat collaborations (Roy & Potter, 1993). Yet, regardless of the importance of external networks to the innovation potential of SMEs, it consists of a complex activity, while "the question of how an organisation should position itself within networks, or what kinds of network configurations facilitate innovation, however, remains ambiguous" (Pittaway et al., 2004, p. 147).

[16] According to TSB (Technology Strategy Board, 2014 [Online]) "helps UK businesses to improve competitiveness, productivity and performance by accessing the knowledge, technology and skills that are available within our world-class knowledge base (universities, colleges and research organisations), through the development of collaborative partnerships which stimulate innovation and can transform the participating organisations".

2.5 *Conclusions: An Integrative and Multi-Level Framework for the Study of Agility and Innovation in Manufacturing SMEs*

This study is concerned with the question of how the innovation behaviours of manufacturing SMEs are influenced by obscure practices deployed to meet emerging challenges. This literature review has set a theoretical base from which to explore the above research question. The review of relevant theoretical and methodological literature revealed a number of key points.

More precisely, evidence suggests that to open the 'black box' and fully understand the dynamic nature of innovation practices in the unique and idiosyncratic context of SMEs require totally different empirical methods than those found in existing research. The review of the relevant literature suggested that there are not enough studies, especially in the SME context, that combine variance and process-based approaches. Consequently, there have been several calls for the need for a multi-level and integrated approach that may act as a bridge between often incompatible perspectives (Crossan & Apaydin, 2010; Sears & Baba, 2011; Slappendel, 1996; Wolfe, 1994).

In response, the study looked at the dichotomy between variance (asking 'what') and process (asking 'how') research traditions and the contemporary calls favouring their integration in order to achieve richer understandings of organisational phenomena than any one approach provides by itself. This led to an initial review of processes of innovation making and in particular the New Product Development (NPD) process, which resulted in the selection of a generic process model where the phenomena may be studied on a loose time-series and event basis (Figure 5).

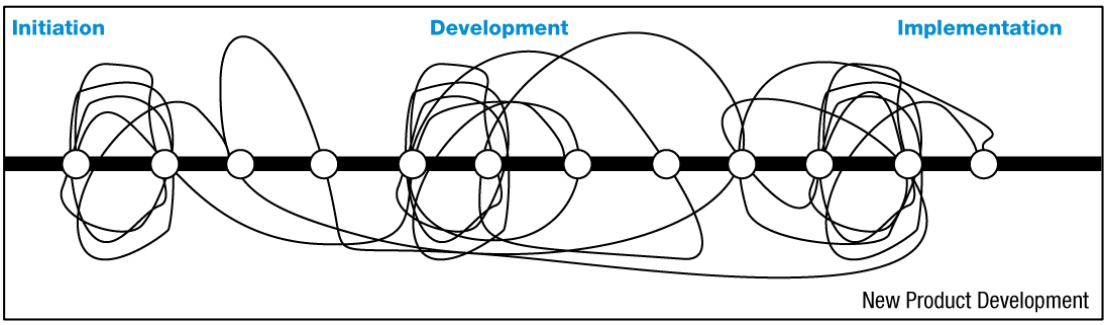


Figure 5. A general NPD model interpreted by Van de Ven et al. (1999)'s model of the innovation journey; the figure depicts the rather messy, complex and non-linear progression between the three key periods of development

Furthermore, key insights into the determinants and phenomena previously suggested to impact the innovation behaviours and potential of organisations were reviewed through a level-based approach; people's-level (micro-level), organisational-level and external-level (macro-level). In adopting a multi-level approach these key phenomena are seen from an interactive point of view, that is, the expected influence each may have on each other. Figure 6 depicts these three levels, along with a number of key phenomena involved at each level (hence not exhaustive).

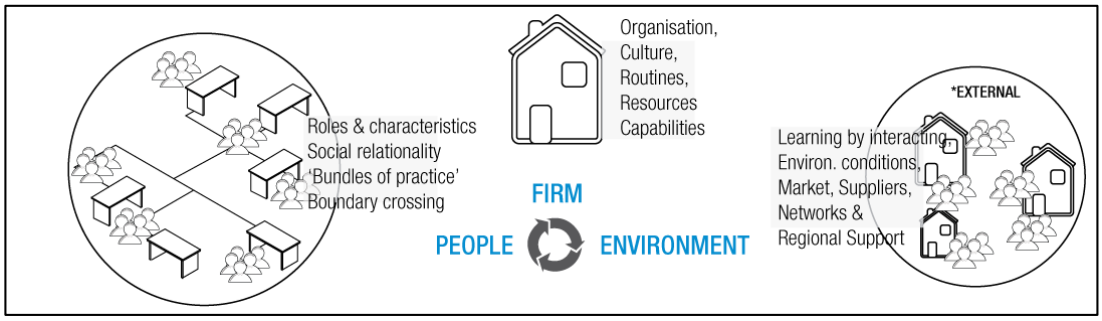


Figure 6. A multi-level framework of determinants and phenomena impacting innovation behav-iours in SMEs. The figure suggests that each level interacts and influences on others

Therefore, this integrated, multi-level approach will be used to guide the selection of appropriate research methods to undertake the inquiry set by this study, that is, to explore obscure NPD practices, as discussed in the next chapter (3).

Chapter 3.
Research Methodology

3.1 *Section 1: Development of the Research Strategy and Design*

In chapter 2, the study reviewed and presented the key ideas and issues surrounding the concept of agility and innovation in manufacturing SMEs and the reasons why it is important for research to explore these more. The chapter concluded with two key outcomes; a multi-level model depicting a consolidated view of the conceptual link between key ideas and variables that influence agile practices in SMEs.

Chapter 3 comprises of two sections: First, it introduces the design of the research methodology adopted by the study in its journey to collect meaningful and novel insights of the phenomena that drive agility and innovation in manufacturing SMEs. The chapter begins with a discussion about the epistemological approach (section 3.2), followed by the research design (section 3.3) used to drive the collection and analysis of the data from the prospective SMEs.

Following this, section 3.4 outlines a number of key challenges and insights derived from a pilot case study with a manufacturing SME, which the study needed to address with appropriate data collection research methods. This is followed by the presentation of an activity/process mapping tool devised to aid data collection. Overall, the following sections demonstrate the study's transition from questioning '*what* other people have said about the topic' (chapter 2) towards the design of a methodology devised to support the capturing of new insights about '*how* things *actually* happen' within the context of manufacturing SMEs.

3.2 *Philosophical Grounding*

Consistent with the complex nature of small business research (Curran & Blackburn, 2001), the research study is characterised by an inter and cross-disciplinary perspective as it involves theories and concepts derived from various disciplines such as; strategic management, social sciences, educational and design studies (chapter 2). Within this milieu, there are various theoretical perspectives adopted in organisational research. The review of studies (chapter 2) indicated that they are commonly grounded in one of the two main opposing philosophies of research, positivism and phenomenalism.

Positivism is concerned with the explanation of social phenomena in objective and verifiable means and usually through the use of quantitative data. According to Higgins (2009) this research philosophy is found in organisational studies that particularly focus on the behavioural and cognitive aspects (Levitt and March, 1988; Duncan and Weiss, 1979; cited in Higgins, 2009). As mentioned earlier in chapter 2, behavioural and cognitive traditions are prevailing approaches to organisational analysis and they are "strongly informed by ideas drawn from conventional cognitive psychology, itself dominantly based on information-processing view of cognition" (Marshall, 2008, p. 414). Similar views have been shared by many organisational researchers (e.g. Gherardi, 2009; Higgins, 2009), while others (Macpherson & Holt, 2007) have found that survey and statistical methods of analysis are the norm to the majority of small business research. Cognitive and behavioural perspectives in organisational analysis have attracted much criticism by many scholars (see for example Nicolini et al., 2003). For example, Marshall (2008, p. 414) argued that cognitive approaches "tend towards a rather static, functionalist and ultimately individualistic portrayal of learning as the passive acquisition of knowledge". The cognitive approach considers knowledge as something that occurs within the mental frame of the individual and therefore it is seen as detached from the actual activity in which it is embedded (Lave, 1988).

In contrast, a phenomenological approach has an interpretive orientation which suggests that both the researcher and participants are co-creators of the meaning (Robson, 2002). This logic of inquiry considers social processes as "ephemeral, fluid phenomena with no existence independent of social actors' ways of construing and describing them" (M. B. Miles & Huberman, 1994, p. 2). From a philosophical point of view, this emphasis strongly resembles the Heideggerian phenomenological perspective in which the study of the processes of the phenomena under investigation are understood in

the ways of the “actors experiencing the world through their absorption in that world” (Tsoukas & Yanow, 2009, p. 1342); a world which is often ‘hidden’ and taken for granted and is the purpose of phenomenology, which “focuses on practices to reveal what remains hidden” (ibid, p. 1342). As Nicolini et al. (2003, p. 9) put it;

> *“According to the phenomenological tradition, in everyday organizational life, such activities as work, learning, innovation, communication, negotiation, conflict over goals and their interpretation, and history are co-present in practice. They are part of human existence, of the “human life-world”.*

Higgins (2009) pointed to two main types of phenomenological approaches to organisational analysis, the socio-cultural (Lave & Wenger, 1991) and the more contemporary practice-based perspectives (Nicolini et al., 2003). These are the focus of the following discussion.

3.2.1 **Towards a practice-based approach**

As noted, recent theoretical and methodological approaches to study organisations focus on social theories that have taken a ‘practice turn’ for conceptualising agency and action (Chia & Holt, 2006). In general, the concept of ‘practice’ has been a central investigation of the social sciences and practice theorists (e.g. Schatzki, Knorr-Cetina, & Savigny, 2001), and increasingly the attention of management research (Tsoukas & Yanow, 2009). For the former, practice is seen as a social phenomenon in which “the social is…embodied, materially interwoven...[and] centrally organised around shared practical understandings” and thus “actions are embedded in practices, just as individuals are constituted within them” (Schatzki et al., 2001, p. 3). Moreover, according to Tsoukas & Yanow (2009, p. 1347) “practitioners acquire and develop their skills in the contexts of practices, such that theorising must engage practitioners acting in the context of broader activity sets, rather than merely focusing on their individual attitudes and beliefs”. Therefore, it can be asserted that as practices are socially and contextually situated within a given unit of analysis, i.e. the organisation, so are the characteristics and needs of the different organisations, dependant on their idiosyncrasies.

As mentioned earlier, this ‘relational’ turn has shifted its emphasis away from what has being coined as *methodological individualism* (Chia & Holt, 2006), which suggests that social phenomena may be best explained “in terms of actor intentions and motivations” (ibid, p. 638), towards an emphasis to “the primacy of relationships over individual entities” and suggests that “practices are social sites in which events, entities and

meaning help compose one another" (ibid, p. 640). Hence, innovation determinants such as organisational knowledge creation, sharing and learning are understood as the product of social action, interaction and habituation amongst the organisational members situated within a social system (Gherardi, 2009; Higgins, 2009; Lave & Wenger, 1991; Macpherson & Clark, 2009; Nicolini et al., 2003; Schatzki et al., 2001). In this vein, Marshall (2008, p. 414) asserted that:

> *"…practice based theories adopt a more holistic, constructionist position in which the various elements of thinking, doing, and being, and the social, cultural, historical and material settings within which they are actively situated, are conceived in relationships of co-constitution."*

Consequently, the practice-based[17] tradition offers a potential contemporary platform of addressing issues of small organisational practices and innovation "in such a way that the richness and depth of the phenomenon is given full consideration" (Nicolini et al., 2003, p. 26). In this way, the study can explore the complex dynamics of small organisations' practices from the participant's point of view, yet construed as 'bundles of practice' instead of isolated entities (Chia & Holt, 2006; Schatzki et al., 2001).

However, as Nicolini et al. (2003, p. 12) stressed "there is no such thing as a unified practice theory or practice-based approach, only a number of research traditions and scholars connected by a common historical legacy and several theoretical family resemblances". For example, Nicolini et al. (2003) provided four examples of such practice-based approaches. These adopt; a cultural interpretive framework, a symbolic interactionist perspective through the lenses of legitimate peripheral participation also known as 'communities of practice' (Lave & Wenger, 1991) , a sociology of translation also known as actor network theory (ANT) (Latour, 2005), and a social constructivist theory of the cultural and historical activity theory (CHAT - more contemporarily known as Activity Theory (AT)) (Engeström, 1987). One key resemblance of these four, otherwise unique, traditions is their contextual and culturally situated theorising of practice.

In design research in particular, there has been a wave of scholars that have adopted Activity Theory as a model to analyse activities in order to, for instance, improve the design of user interfaces (in the human computer interaction paradigm (HCI) (e.g. Kaptelinin, 2012), the design of services (e.g. Sangiorgi & Clark, 2004) and develop computer systems for aiding product design (Tuikka, 2002). Recent calls in design

[17] It is important to highlight here that practice-based theories in this study have a social science philosophical grounding rather than practice-based design research (see e.g. Sevaldson, 2010; also Yee, 2010)

research, such as from the graphic design paradigm (Tarbox, 2006) have particularly stressed the usefulness of Activity Theory as a framework for studying design practices from the contextual perspective it offers. As it will be further asserted in the following section, some of the key strengths that make Activity Theory stand out from other practice-based research methods are; first, AT does not rule out other practice-based theories (e.g. Lave & Wenger (1991)'s communities of practice - see e.g. Bjørke, 2004; also Engeström et al., 1999, p. 12), rather it provides a framework that expands on them (Tarbox, 2006). Second, AT offers a visual model (that other practice theories do not) that enables a holistic analysis of the context, the multilevel phenomena influencing the activity process (NPD) as these are experienced from the members' point of view. Consequently, it is believed that the adoption of AT as the analytical framework for the study offers a useful platform that enables the visualisation and organisation of data in such a way that rich insights of the anticipated obscure NPD practices in SMEs can be derived. With this view in mind, the focus of the next section moves its attention to the theoretical lenses of Activity theory in an attempt to draw valuable insights and inform the research approach of this study.

3.2.2 **Activity theory**

AT has its roots in Cultural Historical Activity Theory (CHAT) which has a long historical association with the works of developmental psychology Soviet scholars such as Leont'ev (and his concept of activity) and Vygotsky (and his concept of mediation) (Blackler, Crump, & McDonald, 2003). The theory's most current form can be found in particular in Engeström's work (1987). AT has attracted major interest in other areas apart from psychology such as in educational and learning studies (see a notable review of empirical studies in Daniels, Edwards, Engeström, Gallagher, & Ludvigsen, 2010), and increasingly in organisational and management research (e.g. Macpherson et al., 2010), also in human-computer interaction design studies (Kaptelinin, 2012). Due to its historical link with developmental psychology, AT draws on heavy conceptual tools and therefore this study will explicate further only those concepts that have immediate relevance to the study's analytical approach.

As part of the practice-based tradition, Activity Theory is in line with Marx's ideas that support the view that human actions are inseparable part from the social and historical context of those actions and therefore "only by considering the concrete totality of interconnected activities that engender socially productive activities can one grasp

the meaning of human action" (Nicolini et al., 2003, p. 8). The main goal of AT is to analyse development within practice through the social and contextual activities in which people develop their skills, personalities and consciousness (Sannino, Daniels, & Gutierrez, 2009). According to this theory, human activity has a structure with a number of components; first there is an active *subject* whose activity is directed towards an *object* mediated by a *tool* and *signs* while r*ules* influence the subject's relation to his *community* and *the division of labour* in the community's relation to the object (Tuikka, 2002). Mediation and relationships between these central components form an Activity System (Figure 7), which can be seen as:

> "…the subject or group of *subjects*, which through mediating *artefacts* (concrete *tools* and signs) orientate their collective activity to a specific *object*. When the mediating artefacts change *the object* can appear different. Activity is always collective, thus it is constructed by a certain community and distribution of work as well as rules (written and unwritten)." *(Engeström, 1987; cited in Kallio, 2010, p. 34)*

According to Kallio (2010) *the object of activity* can be seen as the true motive of an activity and provides a model through which the different activities can be observed "from the point of view of an individual *subject* or group as collective, object-oriented and *mediated by culturally produced artefacts*"(italics added) (Kallio, 2010, p. 33). An object can be either tangible (i.e. a product), less tangible (i.e. a drawing) or entirely intangible (i.e. a concept) (Tuikka, 2002). The culturally produced *artefacts* may include "tools, procedures, regulations, processes, concepts and accepted practices" and "represent the experiences of those who have solved problems in the past" and hence performance may only be achieved through their collective acceptance (Macpherson et al., 2010, p. 305). In other words, tools are "created and transformed by people during the development of the activity itself and carry with them a particular culture — historical remnants of that development" (Tuikka, 2002, p. 56). The relationship between subject and the tool can be inversely related as the tool can be both enabling (empowering the subject to go about a certain task) and limiting (interaction is self-restricted by the perspective that the tool allows) (Molin-Juustila, 2006). Moreover, the subjects/ individuals/ group being analysed, abide by certain *rules*, which can be formal and explicit, such as regulations or procedures and/or can be tacit such as norms, values, beliefs. Practice is seen as taking place within a *community* where other activity systems and people belong and is being shared and coordinated by some *divisions of labour*. Engeström (2001) also suggested that by exploring the *history* of the object of activity through which it has evolved, it may potentially offer a rich

understanding of the changes that have occurred within the practices of the particular activity system, as well as the tensions that led to such transformation.

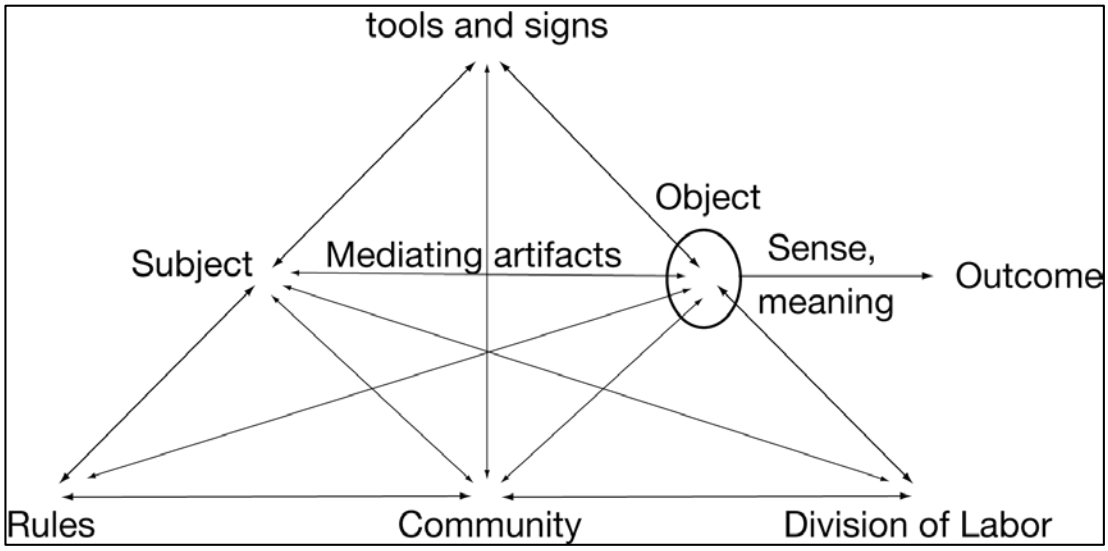


Figure 7. The structure of a human activity system (Engeström, 1987; found in Engeström, 2001, p. 135)

3.2.2.1 Structure of an Activity: Actions, operations and dynamics

From an activity-theoretical perspective, human activities are emergent and consist of social practices that are object-orientated, that is, an object is constructed by a subject in order to meet specific needs which are beyond simply meeting particular goals. In fact, Engeström (1999, p. 381) highlighted the distinction between objects and that of goals, as these are fundamentally attached to specific actions. *Actions* are at the central foci of the hierarchical structure of activity; an activity is composed of a number of *conscious* actions that are orientated towards goals (Kofod-Petersen & Cassens, 2006; Tuikka, 2002). Further down in the hierarchy, these actions are composed of *non-conscious operations*; repetition and routinisation, through practice transforms actions into operations. Putting it simply, "activities, which are driven by motives, are performed through certain actions which are directed at goals and which, in turn, are implemented through certain operations" (Tuikka, 2002, p. 57). The three-level structure of activity is schematically represented in Figure 8. Finally, an activity system is bound to a dynamic flux which highlights the importance of their historical development (Fitzpatrick, 1998); an activity may transform into actions and actions into activity i.e. when the object changes. Similarly, operations may transform into actions following a breakdown in existing conditions i.e. when a given situation cannot be satisfied by existing operations (Tuikka, 2002).

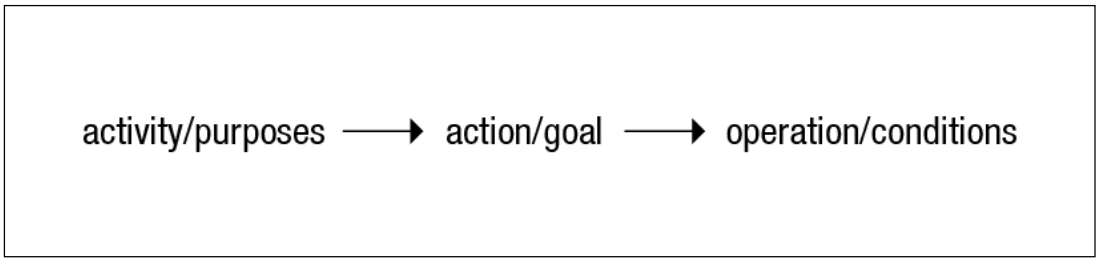


Figure 8. The hierarchical structure of an activity system

3.2.2.2 Five central AT principles to drive the analysis of NPD processes in this study

Engeström (2001, pp. 136-137) suggested that Activity Theory is bound to five central principles:

The first one is that the central unit of analysis is concerned with a collective activity system, is mediated by tools and orientated towards an object, and exists in a network of relations to other activity systems. Individual and collective actions orientated towards set goals and routine operations are treated as subordinate units of analysis, which may be understood only in relation to the entire activity system. Actions and operations are responses to the activity system's own realisation and reproduction. In a NPD setting, this principle can be seen e.g. in the activities, actions and operations of the members of the project team (see e.g. 3.2.2.3. p. 99).

The second principle of AT is that an activity system exists within multiple voices, that is, a community with a variety of point of views, traditions and interests. While the division of labour places individuals into different positions within the activity, so do the individuals exhibit diverse personalities, skills and histories. The activity system itself encapsulates layers and strands of histories in its rules, tools and conventions. Such multi-voiced-ness, which expands further within networks of interacting activity systems, is both a source of trouble as well as of innovation. In a NPD setting, the members of a project team interact and relate with other internal and external peers who possess different roles, motives and characteristics (see e.g. 3.2.2.3. pp. 99-100).

A third principle is that activity systems have a historicity as they form and transform over lengthy periods of time and consequently any problems and/or potentials can only be understood by studying their own history. For example, the way the NPD process is managed and executed may be the result of particular organisational changes on

a strategic level or simply due to good/bad experiences of the project team members in previous projects.

Fourth, contradictions (different from conflicts and problems) are seen as sources of change and development. More precisely, “contradictions are historically accumulating structural tensions within and between activity systems”. For example, contradictions may be created between old and new i.e. following the adoption of a new element such as a new technology or when individuals perceive a situation differently or un-expected difficulties arise in managing daily tasks (Blackler et al., 2003). In turn, such contradictions may generate both disturbances and conflicts but also innovation in the attempt to change the activity. In a NPD setting, such phenomena may be found in the practices of members from different functional teams who possess diverse expertise and boundaries (see e.g. 3.2.2.3. p. 100).

Finally, the fifth principle suggests that activity systems may experience expansive qualitative transformations through their life cycles. Previously described contradictions may turn individual participants to question and challenge the established norms and in some cases this leads to the conceptualisation and collective efforts towards change. An expansive transformation is taking place when the object (motive) of the activity is modified in order to embrace a radical alternative spectrum of possibilities compared to the previously existing activity (see e.g. 3.2.2.3. p. 100). AT’s main principles and approach to the study of practices are nicely summarised by Blackler et al. (2003, p. 130) and presented in Table 4.

Based on the above review, it can be argued that the structure of an activity based on the five central principles that compose AT, provides a useful analytical tool to study the NPD process and its activities as an inclusive unit of analysis. Therefore, the analysis of the NPD process will be based on these five key principles; below, section 3.2.2.3 presents an example of how AT’s model and its five key principles can drive the analysis of practices in a representative NPD setting, and therefore how it will be used to drive analysis by this study.

Table 4. A summary of Activity Theory's approach to the study of practices found in Blackler et al. (2003, p. 130)

An activity-theory approach to research:	**(a) What are people doing?**	**(b) How and with whom are they doing it?**	**(c) What is the nature of collective learning?**
(i) Study the detail of practices	The "object of activity" is fundamental to activity-theoretical analysis of practices. Objects of activity are partly given and partly anticipated. They are intimately related to the mediating factors through which they are constructed	Activities are culturally situated and linguistically and technologically mediated. They are enacted in communities and involve a division of labour. Such factors and their interactions are described as "activity systems". This is the unit of analysis used in activity theoretical research.	Activity systems are tension-producing systems. Disturbances within and between activity systems provide the driving force for their development.
(ii) Study practices in the context of their historical development.	Actions are discrete, have clear beginnings and endings, and exist over short time scales. They are goal oriented. "Activities" on the other hand are complex patterns of practice that endure over long time periods. Activities suggest goals and provide motives.	Activities develop over time. As a general trend, activity systems in work organisations appear to be becoming more complex and interdependent, and objects of activity more abstract and emergent.	When activity systems become more improvised and fluid, established priorities and relationships are loosened and may be reformed.
(d) How can people shape the contexts that shape their practices?			
(iii) Support the development of the practices that are being studied	Research can help people become aware of the object of their activity and of the process of object construction.	Research can explore the nature and dynamics of particular activity systems and the trajectory of their development.	Research can trigger discussions about disturbances within and between activity systems and these are, and might be, responded to.

3.2.2.3 **AT's relevance to this study: A multilevel approach**

There are a number of observations that suggest AT as an appropriate analytical model for this study. First, the analytical model of AT takes into account "one of these pervasive and persistent issues is the relationship between the micro and macro levels of analysis" (Engeström et al., 1999, p. 8). As it has already been discussed in earlier sections, a multilevel approach (individual, group, organisational, external) to organisational innovation is a focus of this study. Similar to the AT approach, this study has set to explore innovation activities by looking at both the detail of the practices in question, including what people do, how they do it and with whom, as well as the context in which these practices take place, including both internal and external elements.

The concept of '*object-orientated*' activity in particular seems to provide a very useful tool for the analysis of the activities of the key practitioners involved in the NPD process of the small manufacturing organisation. As an example, let us consider a new product development setting where a small organisation is devising a new design for a client. As noted in section 2.3.2, the ultimate goal for the NPD is to produce a new artefact based on given requirements devised internally (proactive) or externally (client). In most typical cases, these requirements relate to the particular market needs that the organisation aims its products.

The members of the project team are all subjects in the development process and together they form a community both internally and externally with the client. Each member has his/her own personal characteristics i.e. experience, skills and so forth. For example, Tuikka (2002, p. 66) outlined the role of the designer as subject in their participation during concept design process.

> *"The subjects who participate in the design sessions contribute with their knowledge and personal background. These are individual resources, which are brought into the design situation. Thus, the subjects' knowledge is composed of personal understanding of the domain, which has been accumulated during their individual history. […] The designer reflects on this knowledge and transforms the vision of the design object according to their own reflection on the goals of the design group"*

Every member of the project team interacts with members not only from their own functions but also with other organisational functions in a division of labour. Initially, the object at hand is an unfinished prototypical idea, which needs to be transformed in order to be ready to be handed over to the client. In NPD an object can be seen as

the actual motive that drives a new idea while being transformed into its final outcome and in this example, the overall motive is the client satisfaction. The relationship between object construction and final outcome may be found in the concepts, visions and images of the new products that organisational members collectively construct through their practice. In this sense, the object ultimately refers to the possibilities and courses of action of the relevant activity collectively transformed through the development process. In the different stages of NPD, the subjects carry out different kinds of actions in order to transform the object into the outcome. Because the activity system of these practices is ambiguous and dynamic, tensions and conflicts are often evident between diverse expertise and boundaries of the various functional groups, distributed practices and competing objectives inevitably affect the way practices co-orient and re-establish (Macpherson & Holt, 2007). Along the process, the project team makes use of a number of tangible and intangible tools, from early ideas and strategic planning to design specifications, drawings, prototyping, testing and, finally, to a fully functional product. At the same time, these different tasks are driven by certain rules, some explicit (e.g. safety standards) and some implicit (e.g. organisational culture). As Engeström (1999, p. 381) pointed out that “this situation-specific construction and instantiation of the object of an activity system often takes the form of problem finding and problem definition”. For instance, according to AT’s approach, the early phases where an organisation searches and recognises an opportunity for innovation, is conceptualised as a process of sense-making i.e. of uncertain and ambiguous events (Macpherson et al., 2010; Weick et al., 2005). At these early stages, the organisation does not only need to construct a new product, but the object/motive of the whole new activity system needs to be designed, including elements such as strategic vision and the business plan that will guarantee (to a certain extent) sufficient profitable prospects for that new activity to exist in the first place (Molin-Juustila, 2006). Putting it simply, the activity system during the NPD process begins as an emerging state only to slowly transform into a more stable new activity system in the later development stages (Molin-Juustila, 2006).

3.2.3 A three layered framework to phenomenological research

Following the discussion above, analysis of the organisational phenomena underpinned by a practice-based approach and through the Activity Theory model, it was determined that this combination of research approach and theoretical model would enable the study to conceptualise agility and innovation making from a social relational, situational and contextual perspective. Consequently, the integration of the AT model and its five central principles discussed in section 3.2.2.2, along with the multilevel and NPD frameworks devised in Chapter 2, form a 'three-layered' framework for filtering and analysing data (Figure 9) to be adopted for the research strategy discussed in chapters 3 to 7.

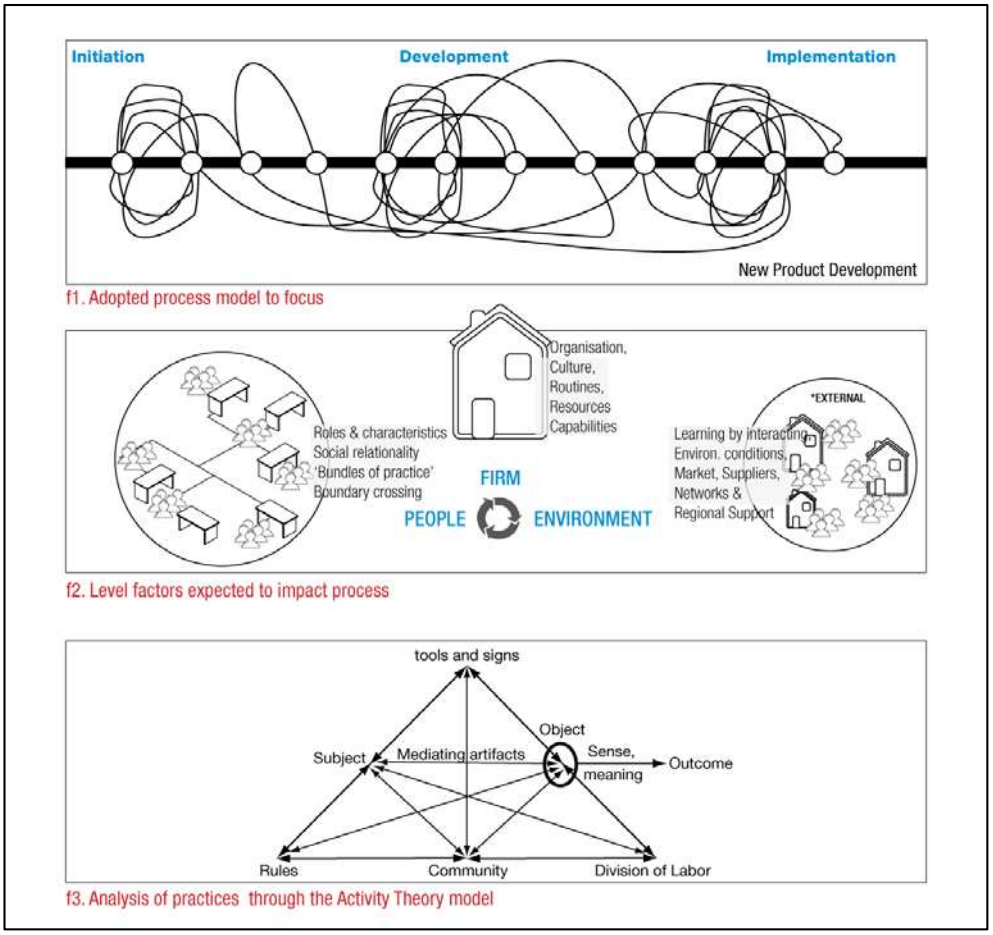


Figure 9. A conceptual '3-layered' framework to guide data collection and analysis

3.2.4 **Qualitative**

As with other empirical studies of business contexts (e.g. Stevens, 2009), this study seeks to gather insights about the practices of small businesses during the New Product Development process – a process where activities are complex, socially embedded and highly dependent to both the *situation/context* and the individuals involved. During a NPD process, members engage in a social *activity* where *relationships* and *communication* within a *network* with internal and external actors play an important role in organisational practice. By acting as members of a community integrated within practical work, practitioners from similar and different areas of expertise interact and exchange knowledge and stories in order to develop a collective bricolage of shared meanings and identity, create new knowledge and learn from their engagement with practice (J. S. Brown & Duguid, 1999; Gherardi, 2009). To this end, the emphasis this study sought to explore is the 'reality' as it is experienced by the individuals from a social perspective as opposed to one's *thinking* towards 'objects' – a sole product of reason or cognition. Therefore, this study is grounded in a qualitative research approach as it is thought to be the most appropriate method for exploring phenomena that are socially situated, "contextual and unsystematic as in reality things happen in an unplanned way" (Bjork & Ottosson, 2007, p. 199). This view is consistent with practice in small business environments (Curran & Blackburn, 2001) as well as with a growing trend towards qualitative methods in business environments (Bell et al., 2004). For this reason, the positivist approach and the use of quantitative techniques is believed to be ineffective to this study because, while they are thought to be particularly useful to systematic enquiries they are at odds with the context and complexity of this research topic, its focus and its aims. Bjork and Ottosson (2007, p. 197) suggest that this is a key issue with past research in the area:

> *"One explanation may be that the research methods used are often poorly related to the context and complexity of product development processes. Calculations and simulations also only represent simplifications of stable/ideal situations, which is why predictions do not take the important unpredictable and chaotic aspects of innovative development projects into account".*

Yet, it may be sensible to highlight that this research is not biased towards the usefulness of one approach over the other. Rather, it is suggested that the choice of the approach should be according to the enquiry set by the researcher (Creswell, 2012).

3.2.5 Alternative Qualitative Research Methodologies

Several methodologies grounded in the phenomenological tradition were considered during the early stages of this study. These spanned from ethnographic studies such as Action Research methodology (Swann, 2002), Grounded Theory methodology (Glaser & Strauss, 2009) and Case Study methodology (Yin, 2003). All these options were kept open as potential methods, however as the study progressed the former two were deemed as inappropriate to this study.

Action Research (AR) methodology is characterised by an actively participatory observational approach which aim is to bring about an improvement in practice (Evans, 2009) (e.g. organisational practices) while conducting research and by acting as part of a community of practice. An AR approach has been highly endeavoured in both product development studies (Bjork & Ottosson, 2007) and design and learning studies adopting the theoretical lenses of Activity Theory (e.g. Sangiorgi & Clark, 2004; Toiviainen, 2007). For this reason, an AR method was considered during the early research phases as the 'ideal' approach for data collection. However, AR is concerned with the implementation of the change and the successful and proven improvement of the given initial problem (Bjork & Ottosson, 2007). Whilst helping to improve a business was generally seen as a desirable outcome, there was limited time available for this study to make AR an efficient method. Moreover, the impracticalities attributed to the methodology such as the difficulty of being fully immersed in the organisations invited to participate over a significant time period (Moultrie, Stevens), proved difficult to overcome. Eventually these issues led to the decision to look for alternatives. One of these was Grounded Theory, a methodology concerned with the development of new theory through interviews and observations (see for example Corbin & Strauss, 2008). Data collected through this approach seeks to conceive a new theory that explains the phenomena studied. However, this study sought to *explore* and *describe* practices and phenomena rather than *explain* them, hence creating a new theory was out of scope.

Eventually and among the various qualitative methods (see for example Creswell, 2012), Case Study method (Yin, 2003) was chosen as the preferred method of data collection for this study. The rationale behind this choice is based on Yin's (2003, p. 1) suggestion that "case studies are the preferred strategy when 'how' or 'why' questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context". In this study,

the phenomena under investigation manifests within an organisational context (SMEs) and around a key organisational process – NPD. Therefore, their forms may vary in both different contexts and during the different phases, while they exist within different levels (internal or external) of the organisation.

Because some of the phenomena in question may not be explicitly identified by the participants (habitual and taken-for-granted), data collection techniques such as surveys and questionnaires were regarded as inappropriate to capture the richness of data required in the study (Bell et al., 2004). Ultimately, semi – structured interviews were the chosen technique to collect data from the participants due to its ability to be flexible, provide an open-ended approach and opportunity to gather rich data that can be analysed in different ways. While for Eden and Ackermann (1998, p. 90) “the most common way of collecting experience and wisdom is through a series of interviews with members of the executive team […]”, this study sought to collect data from a wider variety of SMEs’ members than solely upper management echelons (a problematic practice as discussed earlier in chapter 2). To this end, this endeavour raised one important question to answer: given the fact that typical options were either a) one-to-one interviews, and/or b) group interviews, what method would most suitably allow the researcher to conduct research within the sensitive small business environment? For instance, in-depth interviews of a significant number of participants would require far more time than may be available. The specific research challenges identified were discussed in section 2.1.2. They formed the basis through which the study responded with the development of a customised interview technique, which is described in detail in section 3.6.

3.3 *Research Design*

Ultimately, the study's research design adopted Robson's (2002) suggestion for a flexible design which dictates that the researcher considers five key themes, each with an immediate effect on the others (Figure 10). Therefore, the study's purpose and its theoretical underpinnings should inform the research question while the methods and sampling strategy are appropriate to the question (Stevens, 2009);

- The ***purpose*** *of the research: To understand how 'obscure practice' impacts on SMEs agility and innovation potential.*

- The driving ***theory****: Theoretical and empirical literature on Strategy, Management, Practice, NPD, Design and Organisational studies, supported by a derived conceptual, multilevel, integrated framework and Activity theory model to drive the analysis of 'obscure practice' data.*

- The *research* ***question****: How New Product Development (NPD) practices in small and medium-sized manufacturing enterprises (SMEs) are influenced by obscure practices, deployed to meet emerging challenges that enable SMEs to remain relevant to their markets?*

- The ***methods****: Collection of data on obscure practices in NPD in SMEs using exploratory semi-structured interviews and multiple case studies.*

- The ***sampling*** *strategy: Key members of manufacturing SMEs of varied organisational roles.*

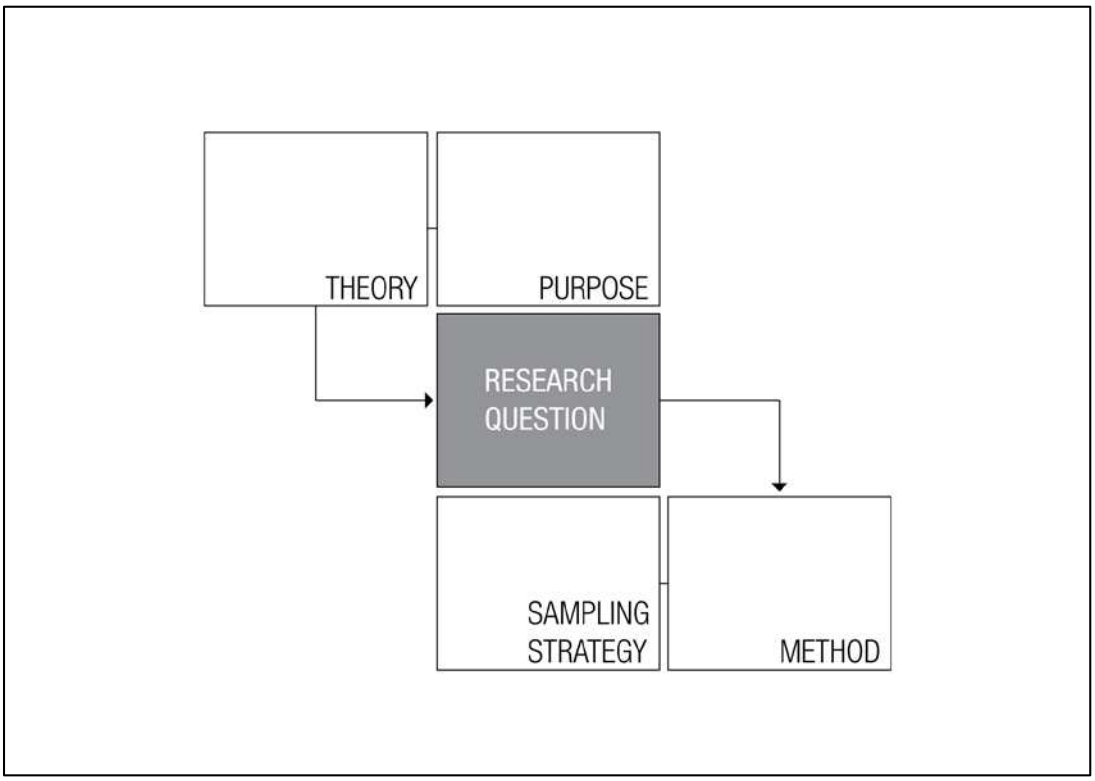


Figure 10. Illustrated framework for research design based on Robson (2002)

Next, section 3.4 presents preliminary findings from a pilot case study conducted at a manufacturing SME and their implications that led the study to the refined of the study's data collection methods.

3.4 *Section 2: Refinement of the Data Collection Methods*

This section presents the key insights and challenges derived from an exploratory pilot case study, which involved a small manufacturing organisation, Mobility Ltd[18], through semi-structured interviews of the key members of staff. Essentially, the insights gained from the actual data collected as well as the researcher's reflection upon the technique employed, triggered the development of a new interviewing tool; Pytheas (discussed in more detail in section 3.6.1) that was also trialled in Mobility (Appendix 3), and subsequently guided data collection from multiple case studies presented in Chapter 4.

3.4.1 Summary of pilot case study findings

In general, the pilot case study provided an important platform that influenced the development of a new research technique that was employed throughout the data collection during case study research. Before this, the standard interview identified a number of insights that are relevant to those the study sought to explore.

For instance, there were notable multi-level influences at each period of the NPD process from internal and external level variables. These ranged from an individuals' sense-making and opportunity recognition through to their interaction with end-users during the Initiation period, the importance of the availability of external networks (e.g. local authorities and councils) that provide end-users that influence both the Initiation (need recognition) and Development (design evaluation) period, the role of limited resources to design and manufacturing expertise (Development and Implementation periods) and so forth.

Most notably, however, was the impression that Mobility was a company made in its owner's image. Much of the critical practice involving opportunity recognition, idea generation, development and implementation was primarily driven (at least it looked so from the outset) by a single person, that is, the owner-manager Calvin. One powerful practice Calvin brought with him along to his multi-tasking roles was a high-level of

[18] The pilot case study is reported in brief in Appendix 1 and the interview questionnaire employed to collect the data in Appendix 2.

empathy towards the end-users and his constant effort to spend time to really understand their needs to offer the most appropriate solutions. However, this practice seemed to be done in isolation from the rest of the organisation's members; while Calvin did mention his liaison with the management team, one could reasonably interpret this as something with relatively limited importance. In other words, internal participation to problem solving and decision-making (apart from its strict technical nature) did not seem to be valued nor follow an empowering and integrated process that brings together creative practice. Indeed, project management was described as a central problem for Mobility. Mobility provided an example of a manufacturing SME who, although able to find available business support from regional and national bodies, struggled with much of the implementation of received advice to their practices. Tools such as; Stage-Gate, were perceived by Calvin as bureaucratic mechanisms that may work fine in large organisations but they would stifle the company's existing flexibility. Another typical example was their inability to make better use of product design – a practice perceived as the least important task in the Development period, it was also mostly done externally.

Moreover, Calvin's discussion about Mobility's products pointed to another notion of a company not recognising innovation as such; there was a general impression that innovation is strictly accompanied by in-house technological breakthroughs. The fact that Mobility was applying existing technology to their products made them believe (at least by owner Calvin) that this was not innovation but merely 'a different application'. Of course, this is a fallacy as incremental improvements and the application of existing technologies with the goal to better fit the needs of specific end-users are considered important types of innovation (see e.g. Tidd & Bessant, 2009, discussed in section 2.2.1). In turn, the lack of this recognition can be argued that could undermine the company's value and its strategic positioning to the mature market operated in.

Although these preliminary findings provided some interesting insights about practices in a small manufacturing organisation, it was felt that the standard interview technique had left much unexplored such as the views of other key members in the organisation and the surfacing of anticipated 'obscure practices' that impact SMEs agility and innovation potential. The rationale of the need for a new research technique for data collection appropriate for meeting the needs of the research strategy presented in Chapter 3 are discussed hereafter in the following sections.

3.5 *Requirements for Data Collection Methods*

The research study has been predominantly concerned with the identification of appropriate qualitative research techniques to drive the data collection process through case studies. Similar to a design task, the choice of techniques used to collect data was thought to be critical as it is widely recognised that developing solutions contrived on the basis of inappropriate investigative strategies and techniques can be weak and ineffective (Dewsbury, Rouncefield, Sommerville, Onditi, & Bagnall, 2007). In the following sections, a number of requirements considered for the design of a new research technique are discussed.

3.5.1 Innovation, New Product Development and the SMEs case

To begin with, the study was set to explore agility and innovation as a phenomenon that may be reflected on the ways an organisation and its members ultimately organise their practices to promote it (Lundvall & Nielsen, 2007). Such organisation of practice is seen through the social, relational and contextual phenomena involved, hence supporting the view that innovations are outcomes of a journey driven by multilevel and multifaceted phenomena. The main activity platform through which organisational practices are under scrutiny is the New Product Development (NPD) process. As already discussed in previous chapters, the rationale for exploring the NPD process is its ability to reflect innovativeness either in its process or its final outcomes, which in turn may help organisations to generate growth and economic viability (agility). Furthermore, NPD often involves every single member of the organisation, one way or another (Bruce & Biemans, 1995). The pilot study at Mobility revealed that this multifaceted process was not reflected on in sufficient detail by one interviewee. Therefore, the new technique needed to allow the researcher to investigate the involvement and relationships of an organisation's members across the various activities taking place during the NPD process. This means engaging and inviting participation of an organisation's members across different levels and positions (as long as they are involved in the NPD process). This is borne out by the pitfall within existing research, that is, the notion of developing insights by focusing solely upon the leader or management 'guru' of an organisation (e.g. Jassawalla & Sashittal, 2002; Laforet & Tann, 2006; Lipparini, 1994; Oke et al., 2007; Prajogo & Ahmed, 2006; Varis & Littunen, 2010; Yap, Chai, & Lemaire, 2005).

However, this endeavour posed several implications that needed to be addressed by the research technique:

First, an increased participation in numbers requires sufficient time available for each individual, something which was not expected to be offered by the organisations. For the same reason, it was expected that the research would likely require more than one visit to the potential participating companies in order to interview different members. In sensitive contexts such as SMEs, time is a critical commodity, very hard to sacrifice on anything else other than 'profitable' activities. This meant that, despite the interest a certain company might have to the overall goals of the research, the study was faced with a company responding to an invitation to participate with a type of attitude similar to 'this sounds good, but what's in it for me?'. In addition, time constraints set by organisations would also pose a threat to the research study and its attempt to capture deep qualitative data.

Research Method Review Requirement (1): An effective research technique should, a) allow rich data to be gathered in a relatively short period of time and, b) provide a valuable outcome, i.e. in the form of a report, that would allow both the transferability of research findings back to the industry (Bjork & Ottosson, 2007) as well a sense of investing time in a useful purpose.

Arguably, a major obstacle that studies of this nature face is in gaining enough access to the organisational settings that are under scrutiny (Curran & Blackburn, 2001). For instance, many companies may feel threatened and would avoid exposing themselves to outsiders hence provide limited insights about them. Organisations may also be very reluctant to share any information that they may consider commercially sensitive and would refuse to have it published.

Research Method Review Requirement (2): The chosen method must not be perceived as threatening or interrogative but to provide enough stimuli for the participants to mindfully engage and share their deeper thoughts.

As outlined in chapter 2, innovation activities in the SME context were expected to be found within an informal, ad-hoc and spontaneous culture. Hence, reliance on the explicit data found in various organisational documents, formal charts and other readily available information was thought to only look at the 'peak of the iceberg', while miss-

ing far richer insights that may exist under the surface. In many instances such documentation does not even exist (Bell et al., 2004) or is simply not available to an outsider (Curran & Blackburn, 2001). Krackhardt and Hanson (1993, p. 104) highlighted the importance of activities that remain 'hidden' from any formal documentation by asserting that "if the formal organisation is the skeleton of a company, the informal is the central nervous system driving the collective thought processes, actions, and reactions of its business units".

Yet, entering an organisation at a time where organisational members undergo their respective working routines places a difficult challenge on how to align their thought processing away from their work and in line with the study. Capturing the phenomena involved there requires a platform that may allow the participants to explicate their subjective realities and uncover their 'taken-for-granted' world. One way to achieve this is by creating a 'playful' atmosphere, where participants are removed from their 'espoused theories' and reflect upon their own perspectives (Eden & Spender, 1998).

Research Method Review Requirement (3): The hypothetical 'obscurity' of the practices in question imply that the adoption of a qualitative structured interview / questionnaire would be inadequate for the purpose of this study, as individuals could not be expected to be able to readily articulate their knowledge (Ambrosini & Bowman, 2008).

Research Method Review Requirement (4): The method should be able to stimulate the participants' thinking by incorporating elements of playfulness and engagement in order to capture their interest, without requiring any unnecessary effort from the participants' point of view.

3.6 *In Response: A Mapping Technique to Facilitate and Structure Data Collection*

The various requirements described in section 3.5 led to a new literature review of design research techniques. To a great extent, design research techniques consist of revised or readapted methodologies originally derived by disciplines such as cognitive/ behavioural and other social sciences and include a variety of traditional qualitative approaches. In particular, the focus was put upon the growing trend around strategy making (e.g. Eden & Ackermann, 1998), service design (e.g. Diana, Pacenti, & Tassi, 2009) and social network analysis (e.g. Marin & Wellman, 2011) and the methodologies adopted to visualise spaces, processes and relationships.

In the area of strategy and service design, a good deal of qualitative research techniques is based on a process mapping approach (see for example Eden & Spender, 1998; Goldstein, Johnston, Duffy, & Rao, 2002). According to Eden and Spender (1998, p. 125) “a mapping methodology aims to uncover important features of a person’s internal representations and to externalize them”. Although based in a cognitivist tradition, mapping techniques in psychology have traditionally been used to represent mental models that simplify a complex problem so it can be understood. Ultimately, these mapping techniques aim to capture phenomena by probing participants to reflect on their own experience. Furthermore, the development of the research technique was further informed by another contemporary organisational strand, social network analysis (SNA) (Toni & Nonino, 2010). As discussed in section 2.4.6.1, this network based approach is concerned with how “networks of relationships that employees form across functions or divisions, are used to accomplish tasks fast” (Krackhardt & Hanson, 1993, p. 104).However, it was also argued that SNA approaches are specifically concerned with generating visual network portrayals, rather than with the content analysis of the network of activity systems offered by the Activity Theory model. Alternative analytical tools and techniques are discussed in more depth in section 3.6.4.

During the early development stages of the research tool, a number of brainstorming sessions took place between the researcher, his supervision team and other design colleagues from the School of Design, Northumbria University. These were driven primarily by concepts such as playfulness, engagement, and adaptiveness to different contexts and individuals, and effective time management. During that period, much work within the strategic design tradition adopted techniques from the social and cognitive

sciences. Prominent inspirational tools at the time were Design Council's 'MatchBox' as well as Pei, Campbell, and Evans (2011)'s 'iD cards' both of which consisted of card-based tools (although with very different purposes – see section 3.6.4). A trial use of the 'MatchBox' card tool that University's School of Design possessed resulted in the realisation that such a medium (cards) could fulfil all of the requirements set at section 3.5. This realisation coupled with concepts of playfulness and engagement, led the researcher to design and develop a card-based process-mapping tool. The tool's purpose was to act as an assisting tool to facilitate the researcher during the interviews with participants and to provide a semi-structured platform through which data can be gathered systematically.

The development of the tool began with a number of early design sketches where the researcher and his supervision team explored strategies with regards to the tool's form and function. For example, the cards' design evolved from square, to oval and finally to a hexagonal shape (see e.g. Appendix 4). The rationale behind the final choice for a hexagonal shape was inspired by the shape's ability to construct linkages between the cards when placed next to each other. In this way, it enabled the creation of a 'network map' that visualises connections between different areas of expertise. Along with the cards' shape, the study considered also the type of paper where they would be printed. For instance, the study considered the use of magnetic paper in order to allow the use of the cards on white boards, in a similar manner that post-it notes are traditionally used during brainstorming. However, various technical obstacles and the high related costs were the main reasons for abandoning this format.

In line with the study's research strategy and its aim to explore the relational, situational and contextual aspects of the practices related to the NPD process through AT's five central principles, the function of the card tool was decided to be; a) around personal roles (functional positions) where participants would relate with, b) their possible multi-tasking roles (a typical characteristic in SMEs – see section 2.1.3), and c) the people who constituted their communities of practice and whom they interacted with. Therefore, the tool was divided into three main categories – own position, multi-tasking roles, and people/roles interacted with. Because it was important to collect data relating to the 'content' involved in the activities and interactions between different organisational members, it was thought that one effective way to achieve this was to look at how frequent and how 'satisfactory' the quality of interactions was between the organisational members. First, a set of arrow-shaped cards were developed to visualise the direction of interactions. Moreover, the arrows were made distinctive by

four gradient colours (from yellow to deep red), used to visualise frequency and quality of communication based on a scale 1 (yellow) to 4 (deep red). Finally, a set of cards printed with numbers were designed in order to get a clear idea of how many people consisted each and different functions within the organisation. This latter element was also thought to be useful in allowing participants to identify and relate with specific individuals from different teams/functions.

In general, the decisions made about the particular three categories, the cards' shape and particular colours were addressed following a series of iterations and pilot tests with the invaluable help of a number of design, business and social experts from the Centre for Design Research at the School of Design, the Business School and the School of Psychology of Northumbria University (2009/10) (see Appendix 4-6). Insights derived from the tool's first real case study application during the pilot case discussed in section 3.4.1 (see also sections 3.7 and 3.8), led to a number of revisions with regards to the process of using it (but not to its overall design).

Finally, it is worth mentioning that the study hoped that the systematised approach of data collection the tool offered, would allow a higher number of case studies to be considered by inviting the University's postgraduate design students to carry out additional case studies. While this possibility was an early stage aspiration, it was eventually decided that the tool required the researcher to control the process. The next sections describe the tool in more detail.

3.6.1 Description of a process mapping tool: Pytheas

The card-based process mapping tool, named 'Pytheas' (derived from the homonymous Greek BC explorer), is a set of cards through which participants construct a schematic representation of their roles and activities during New Product Development. The design of the cards emerged following two important requirements for data collection; a) the collection of information relating to the various product development activities (Moultrie et al., 2007), and b) the collection of information relating to the interactions and communication amongst the key members of the organisation during NPD (Biemans, 1992). The former defined the context into which research was to be undertaken and therefore informed the central content of the cards. A literature review of relevant studies in organisational research (e.g.Bruce & Biemans, 1995; Saint, 1990) assisted with the identification and selection of typical organisational functions/

departments that are usually found within the product development process in small manufacturing organisations. More precisely, twenty-one (21) typical organisational functions were chosen to form the basis of the content to be printed on the cards (Table 5). Each card represents a single organisational function/position. The central idea was to allow participants to identify and articulate their individual experience in the NPD process through their self-involvement and in relation to their interactions with members of other functions/positions.

Table 5. Organisational positions printed on each card

CEO	Product Development	Management	Maintenance	Tech	Human Resources	Planning
Sales	Manufacture	Manufacturing Supervision	Procurement	Finance	Personal assistant	Marketing
Admin	Shopfloor Manufacture	Administration Supervision	Dispatch & Logistics	Designer	Progress chaser	Engineering

The cards are divided into three main activity categories (Biemans, 1992; Toni & Nonino, 2010);

a) own *role*s/function in the organisation*,*
b) parallel, multi-tasking *activities, and*
c) Other people/functions *whom they interacted with during product development.*

Each category is assigned to a different colour (a – grey, b – green/lime, c – blue), made distinct in order to serve as a separate stage of the mapping process. The printed positions were identical in every category. A number of blank cards were provided for the participants to edit and/or create a role that may have been absent from the printed cards.

Finally, the set of cards was completed with two extra assisting elements;

d) A set of small-sized cards of numbers (1 to 12) to help the participant highlight the number of people he/she interacts with in every function.

e) *The second assisting element is a set of arrow-shaped cards that purposefully attempt to highlight the direction (e1), frequency (e2), and quality (e3) of interactions between the different people/functions.*

Both these two assisting elements were drawn from SNA techniques of analysis such as degrees of proximity and density of interactions (Toni & Nonino, 2010) and revised for the purposes of the study. The arrows provided the participant with a choice of assessing on a scale one to four (4) the different strengths (1 – 'weakest' and 4 – 'strongest') of the different *values* (frequency (e2) and quality (e3)) that exist when involved with different activities/people. The values of frequency and quality are indicated during separate stages. Again, the arrows were distinct from each other through different colour cues (1 – light yellow to 4 – dark red). Figure 11 describes the different cards and their purpose.

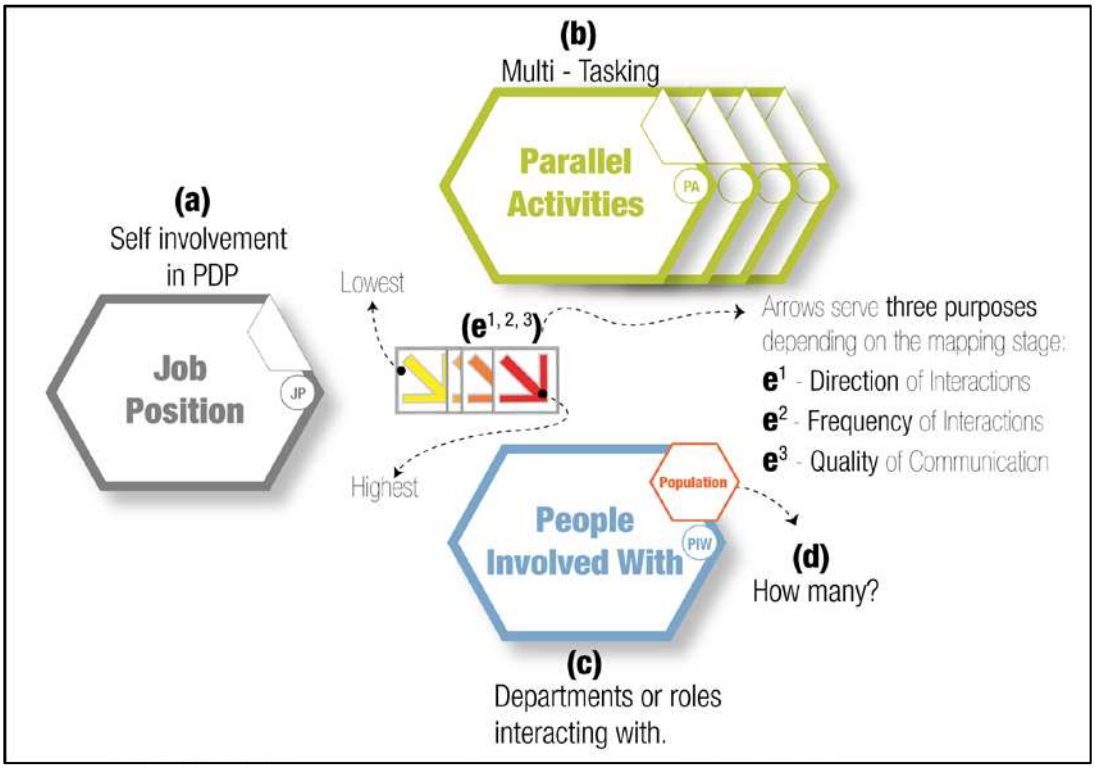


Figure 11. Description of the Pytheas cards

3.6.2 **Using Pytheas**

The card tool provided a relatively fast way of pulling complex and rich data into a system of interacting issues, allowing both participants and the researcher to focus upon key organisational activities associated with NPD. The tool allowed for an in-depth understanding of a situation and helped unravel practice as it happens instead of what the formal description of the role would suggest. As the duration of the interviews was thought to be essential for the participants, the use of the cards was designed in such a way that would allow data to be extracted within a relatively short amount of time (less than an hour). Each card-mapping session was with one person at a time. The reason for keeping it strictly individualistic was to provide a more comfortable zone and influence higher trust amongst the participant and the researcher, as opposed to a group setting. According to Baumard (1999, p. 85), a group setting could increase the risk of generating data that is not representative of the phenomena in question;

> *"Interviewing several actors can result in data that is not representative of a phenomenon, but rather of a collective fear of expressing a felt reality. Each of us is socially linked to a particular environment: 'We tacitly encourage one another's lies by virtue of an unwritten social code that says we will see only what we are supposed to see; the unseeable stays out of the frame' (Goleman, 1985:20)".*

By interviewing one respondent at a time, it allows future comparisons of the different views of the respondents thus to reveal possible contradictions and different realities. The data collection process is described hereafter.

3.6.3 **The Data Collection Process**

Initially, the research process was concerned with the invitation of the potential organisation. The first contact was done either over the phone and/or subsequent emails[19] in order to provide general information of the study and the interview technique. In order to adhere to the ethical guidelines of the University[20] with respect to the rights of the participants, the attached information also included a copy of informed consent form which informed the respondents of their ability to withdraw at any time as well as the anonymity and confidentiality of the data provided (see Appendix 9). As mentioned earlier, Pytheas was intentionally designed in such a way as to be able to capture rich

[19] A sample of the email send to the prospective companies is attached in Appendix 7
[20] A copy of Ethical Approval Form can be found in Appendix 8.

insights but in a much shorter time than the typical interview procedures. It was very important to communicate this to the potential companies and explain that the research process was not going to require lengthy amounts of time. Moreover, Pytheas (in its simplest application) allowed the visualisation of schematic representations of networks (among other things) and these visuals were also approached as outcomes reported back to the companies. This was offered by the study in order to reassure the potential companies that their participation would result in a useful outcome worthwhile to their time invested in the study[21]. This information was sent in the form of a graphical flyer (Figure 12). The main purpose was to help the participants to get to grips with the value of the study and familiarise themselves with the process, hence to allow the researcher to make effective use of the available time during the visit to the organisation.

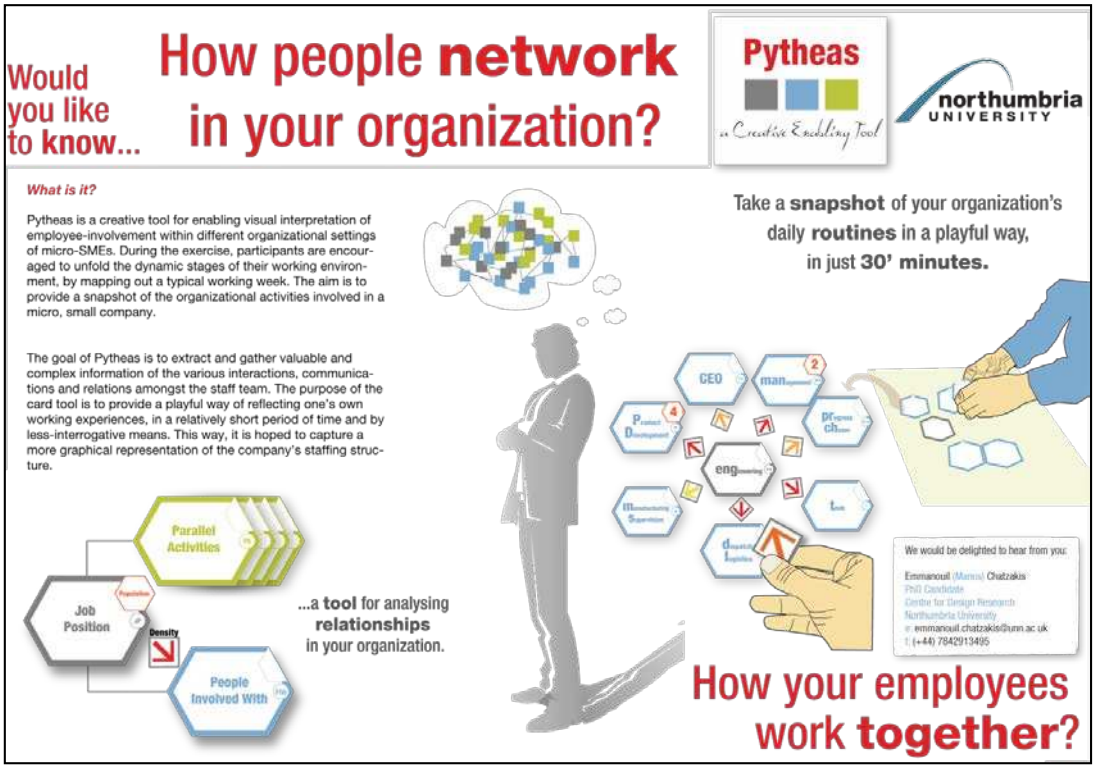


Figure 12. Flyer disseminated to company owners/managers prior to the first visit

[21] Along with the reported schematics, participants were given a feedback form where they could express their experience with the interview procedure. An example of a returned feedback form is provided in Appendix 10.

The first visit to each company (Figure 13) involved meeting with a key individual of the organisation, usually the CEO, or another experienced manager. The importance of the first visit was highlighted by Eden and Ackermann (1998, p. 372) who commented that "… the first meetings with the client can be significant for both client and facilitator. Initial meetings demonstrate professionalism, set expectations, and build trust and credibility". The discussion involved at this initial meeting provided the researcher with a general overview of the organisation and the organisation with the information of the study and the card-mapping exercise. That is, during the first visit the researcher provided the participant with information on the researcher's background and skills, introduced the goals of the study and attempted to familiarise with the organisational context, before moving onto exploring the phenomena surrounding the innovation activities of the organisation.

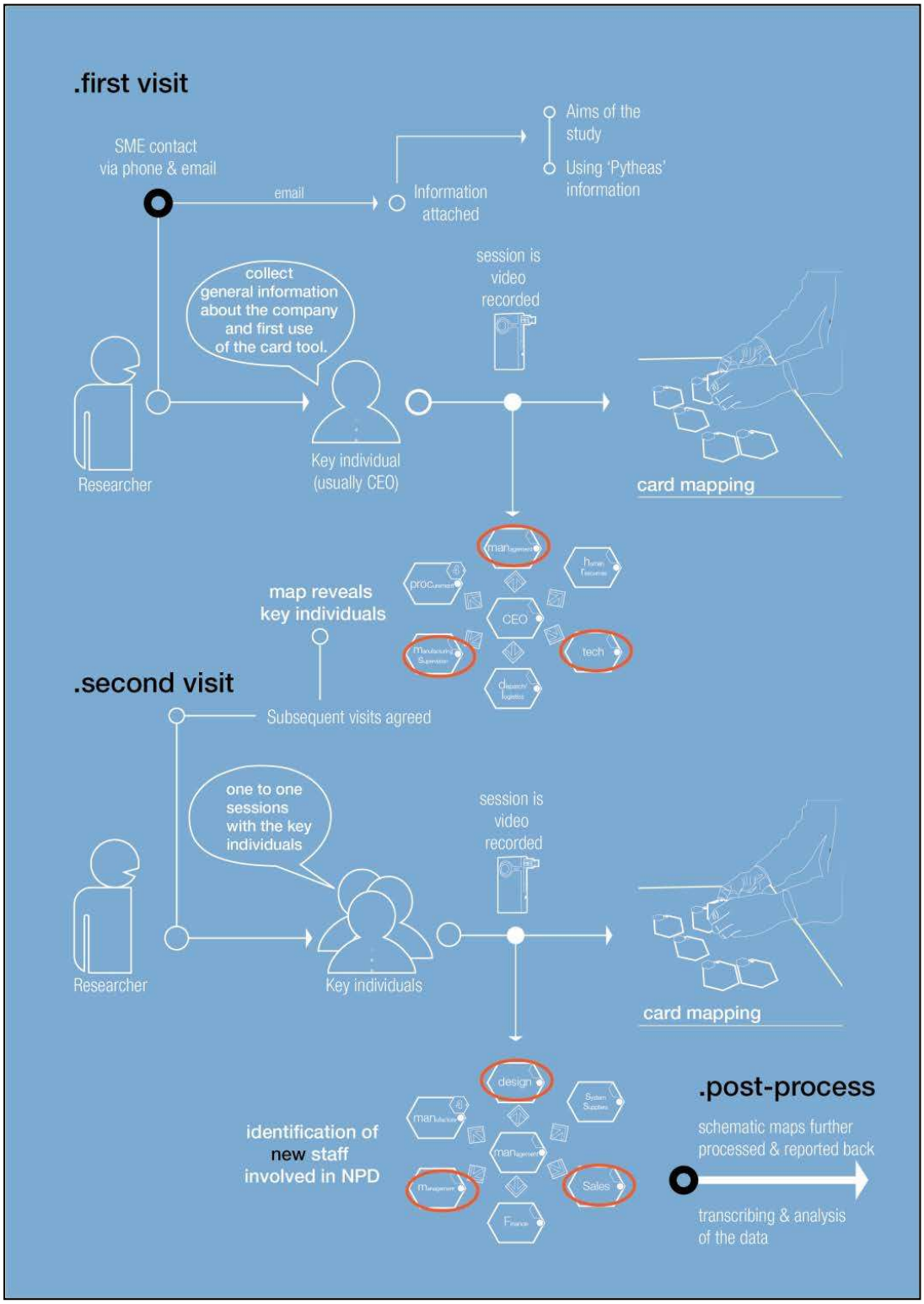


Figure 13. The data collection process

The familiarisation takes place during the first visit to the company where it uses an open-ended interview procedure; it begins with questions of a general nature with a scope on the individual's background, position, and years working in the organisation.

Then, the interview is followed by questions around the overall organisational practices. There were specific questions that were repeatedly asked at every company including questions about the history of the company, market segmentation, number of employers, management structure, market and customer approach, external support, Intellectual Property (IP) issues, and general views on innovation. However, these questions were not necessarily asked in this order. This process helped both the researcher and the participant to 'break the ice' and get to know better; 'who we are' and 'what we are involved with' and general characteristics of the organisation. Up to that point, the card tool was not yet utilised. Only after enough information about the organisation was revealed, were the participants finally invited by the researcher to reflect on their self-involvement in the NPD activities through the card tool.

At the beginning of the card-mapping session each participant was invited to find from the '(a)-grey' category cards his/her personal position within the company (Step 1; Figure 14). The card was placed at the centre of the designated area (A1 sized). The reflective process was triggered right after the researcher asked the participant to indicate what other parallel activities / positions / responsibilities he or she is involved with, by navigating through the '(b)-green' category cards (step 2;Figure 14). At this point the participant started explaining his/her own role in the organisation along with possible multi-tasking cross-boundary responsibilities that he/she may be involved with. This stage also served as a mental warming up activity, before proceeding to the more complex steps (3 and 4) of the interactions and communication with others. Following the completion of step 2, the selected '(b) – green' cards are removed from the designated area in order to avoid clutter and prepare for step 3 (Figure 15), the '(c) – blue' interactive category cards.

Similarly with previous stages, the participants were probed to flip through the 'c' category cards and identify the people/functions that they interacted with in their daily routine. The reason for using the 'daily routine' term instead of the NPD was to highlight the differences between everyday practice and how it changed during New Product Development. The benefit of asking the participant to initially reflect on everyday practice, thus his/her daily routine, is that it allowed the researcher to collect useful insights about how things evolve/change when switching from a standard to a new product development process. The selection of the 'c' category cards activated the participant's reflective process. With the '(a)-grey' card (own position) still at the centre of the designated space, the '(c)-blue' cards were placed by the participant around their role in a circular way similar to a mind-mapping (Buzan & Abbott, 2005). During the selection and placement of the cards, the

participant was invited by the researcher to ‘think aloud’ and share his/her thoughts on what is involved during each interaction with the different functions.

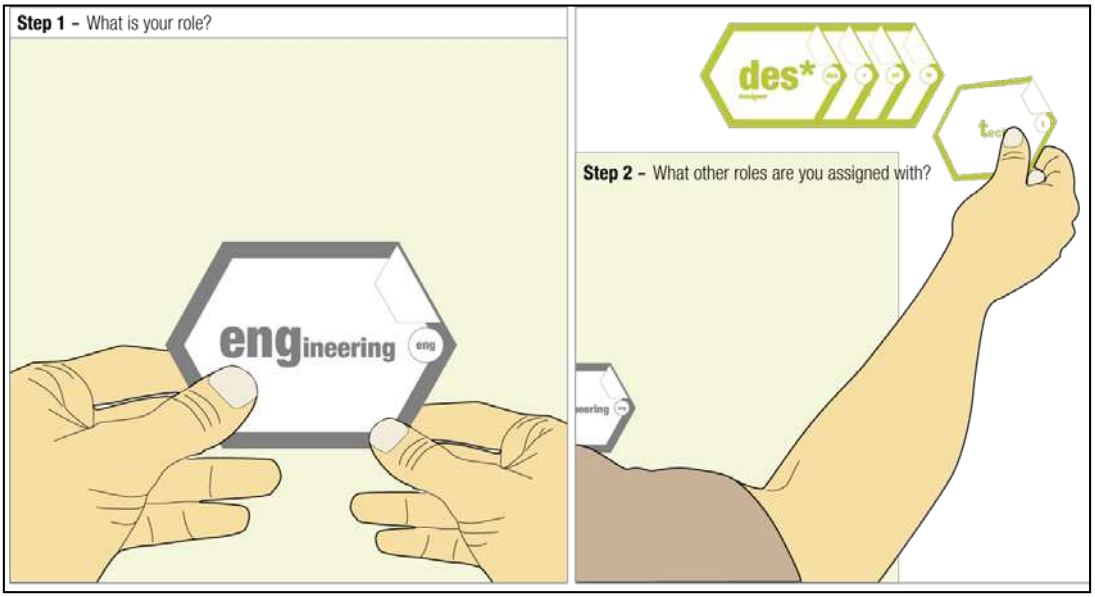


Figure 14. Illustration of the beginning of the card-mapping session through ‘Pytheas’. Here the participant is concerned with his/her own position and other own roles that he/she may be in-volved with

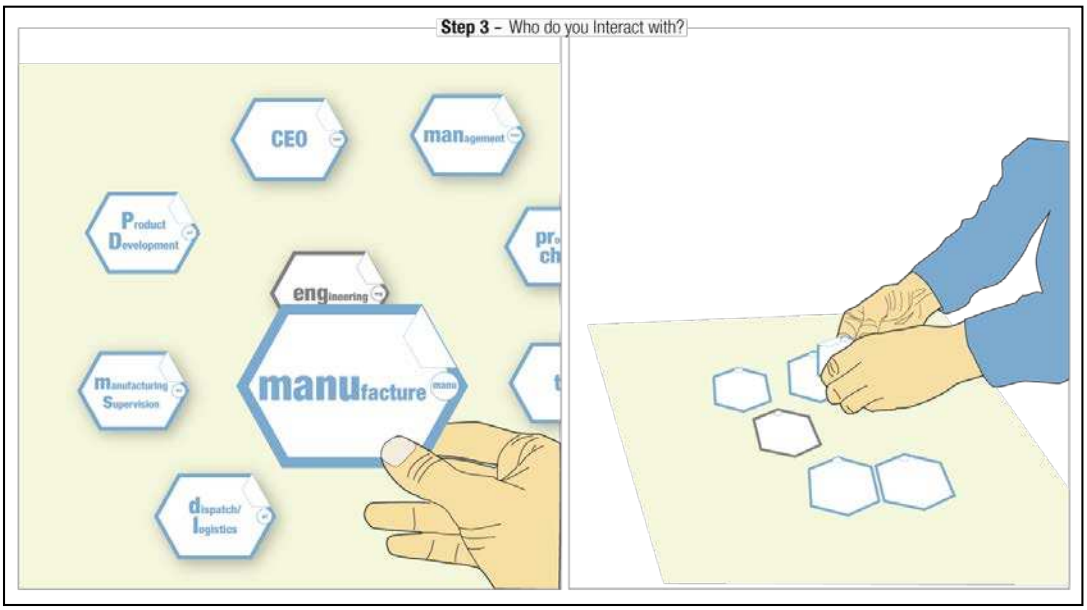


Figure 15. Illustration of the main stage of the card-mapping session through ‘Pytheas’. The participant reflects on own practices through the identification of the activities, tasks, and people that he/she is involved with

At the completion of step 3 the participant was then asked to identify how many people (‘(d)-population’ cards) were in each of the cards/positions (step 4; Figure 16). During this task, the participant was able to identify the individuals that were involved in more than one position at different periods of the product development process. This task

allowed the participant to group those positions that were undertaken by the same people and therefore to reduce the visual complexity of the overall map.

The reflective process continued with step 5 (Figure 16), in which the participant chose the frequency of interactions with the other people that were involved. At this step, the participant was asked to explain why some interactions are more frequent than others. The participant was specifically asked to reflect on how the frequencies may change according to whether undergoing a standard or a new product development process. Regular questions posed to the participant referred to the; when, what, why and how he/she is involved during the interactions with his/her colleagues.

At the end of step 5, the arrows were temporarily removed from the designated area in order to move to the next step 6. There, the participant was asked to select the relevant arrows that represented the quality of communication between the participant and his/her colleagues (step 6; Figure 16). At this final step, the participant was made clear that the aim of step 6 was not to be interrogative or 'intrusive' to personal relations, but instead to help identify possible weak and strong links within the company's practices. In this sense, the term 'quality' referred to the overall participant's experience of communicating with the various departments / teams / individuals and to question the levels of satisfaction and effectiveness of their social practice. Again, typical questions here revolved around the 'when', 'what', 'why' and 'how' (e.g. when communication is effective? Why is it not? How is it being affected and/or resolved?). The result was a reflection on existing issues such as various conflicts between departments, lack of adequate communication channels, information/knowledge sharing between teams, as well as possible strategies employed in tackling these issues. Following the completion of the first card-mapping exercise the researcher was then able to identify other key organisational members to interview at a following visit to the company. Within each organisation, participants were recruited using a 'snowballing method' (Andriopoulos & Lewis, 2008; Curran & Blackburn, 2001; Hanneman & Riddle, 2005; Hutchinson & Quintas, 2008) until the additional card-mapping exercises reached theoretical saturation (Gummesson, 2000), meaning that they did not dispute existing information or stopped revealing new insights.

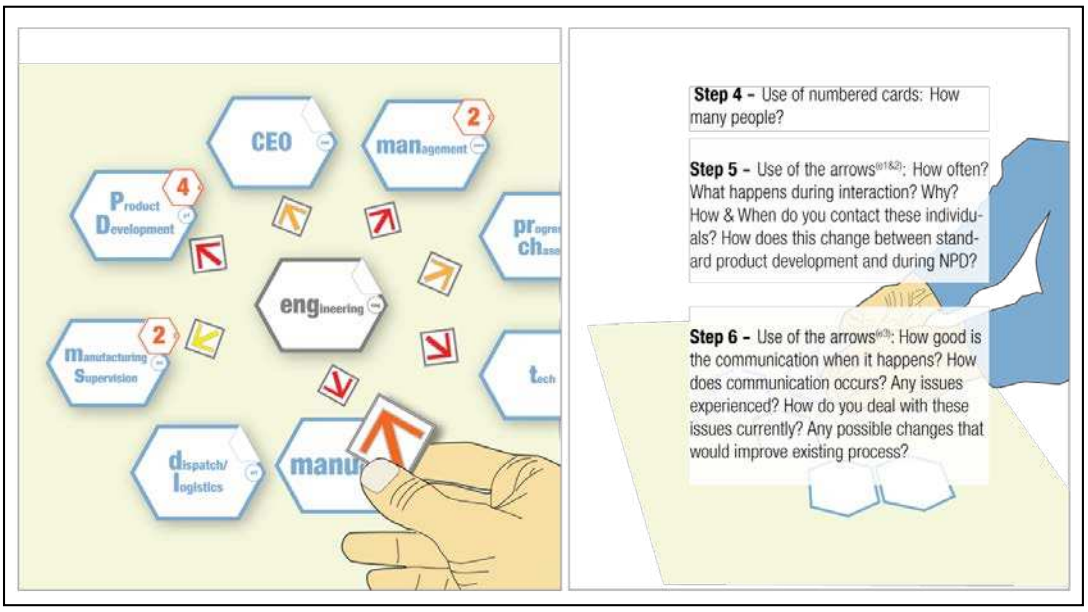


Figure 16. The final stage of 'Pytheas' mapping exercise; the participant indicates the number of people involved in the interactions, the frequency of them according to different periods in Product Development and their irrespective quality

3.6.4 **Other analytical tools Pytheas resonates with**

Because Pytheas is, in its generic use, a mapping tool it is important to acknowledge that it closely resonates with other mapping techniques from other various disciplines. These techniques often serve a particular purpose and are mainly informed by the research tradition through which they derive from. For instance, one of the most traditional mapping techniques has been developed and employed by the cognitive and behavioural sciences, that is, the cognitive mapping methodologies (Eden & Spender, 1998; Nicolini, 1999). Again, within the cognitive methodologies used for organisational analysis belong a multitude of techniques, the most popular being the causal maps. In particular, causal maps may be seen as having the closest resemblance to Pytheas, as they involve a similar approach to interaction and reflection of personal constructs. However, there exist several differences between the two both in their execution and, most importantly, their theoretical lenses for analysis of the collected data. Causal maps' purpose are to explore organisational phenomena entirely based on eliciting cognitive processes and therefore are used with a predefined concept (e.g. 'success' - see Ambrosini and Bowman (2008)) through which the mapping process initiates and which the participants are reflecting upon. In contrast, Pytheas does not employ any particular concept/idea to probe reflection rather it attempts to elicit deep knowledge through representations of the participants' activities through reflection of

their practice. That is, Pytheas focuses on exploring the organisational phenomena by generating knowledge as opposed to a hypothesis proving approach. This view also highlights the different theoretical lenses through which analysis is done following the development of the maps.

Along with causal maps, other cognitive-based methodologies include the mind maps (Buzan & Abbott, 2005) - generally used as a means to identify factors in a given problem and to boost creativity and reflection, future wheels (Glenn, 2003) and laddering (Bourne & Jenkins, 2005) – methods which work on a 'future prediction' model. Mind maps for instance and future wheels are used to show the interaction effects between variables. Laddering, a technique typically used in conjunction with Repertory Grid Analysis (Kelly, 2003), is "a method for eliciting the higher level abstractions of the constructs that people use to organise their world" (Bourne & Jenkins, 2005, p. 412) and is concerned with hierarchical constructs and evaluative judgements.

Apart from the cognitive tradition that such techniques are bound to, a great number of them are widely used and make sense only when used on a group setting. Strictly group techniques, presented in the seminal work of (Eden & Ackermann, 1998) include the Oval Mapping Technique (OMT) (Eden & Ackermann, 1998), the 'Snow-card' approach (Spencer, 1989), a group technique for developing a list of strengths, weaknesses, opportunities and challenges (SWOC Analysis) (Bryson, 2004, p. 140) , 'Post-its' as a substitute to ovals and the 'Hexagon' toolkit (i.e. (Hodgson, 1992). The two authors went as far as to argue on the form the cards of these techniques and the effect it has on the participants' mind-set. In particular, the authors, clearly in favour of the oval shape as opposed to the hexagon (as in Pytheas case), suggested that "the use of 'post-its' suffers from 'rectangular thinking' where structures are inclined to rows and columns, and the use of hexagons encourages 'six-sided thinking'. Neither are effective for generating free form cause map structures" (Eden & Ackermann, 1998, p. 304). Whilst this study has no intention to disagree with the principle behind this assertion, it is important to highlight that such an effect is likely to occur within the particular cognitive techniques. Although Pytheas cards have a hexagon form, it would be unreasonable to assert that it encourages 'six-sided thinking' as its use and purpose are dramatically different from the cognitive technique; that is, the cards do not offer any 'connection points' through its 'six-sides' , rather their shape purpose is to provide an aesthetically pleasing and coherent structure for the constructed maps.

In addition to the traditional cognitive-based mapping techniques, a more recent work derives from the design research tradition, although with strong connotations to the cognitive approach. A good example to this is the ‘Matchbox’, a card tool developed for the Designing Demand programme by the Design Council, UK, which is a method that focuses on helping both designers and business owners to find new ideas and ways of improving their practices and decision making through one-day workshops (http://www.designingdemand.org.uk/How_Does_it_Work, no date). More recently, Pei et al. (2011) developed a card tool, named ‘the iD cards’, for the facilitation of communication between design and engineering practices in the NPD process. As opposed to Pytheas, both the latter tools are meant for designers to facilitate the design process and not tools for SMEs to help in their awareness of how they, as an organisation, operate to support innovation practice for agile business.

Last but not least, the categories into which Pytheas was structured (interactions, communication, frequency, quality and number of people involved) were influenced to a certain extent by techniques derived from Social Network Analysis (SNA) and relate to Network Theory (e.g. Krackhardt & Hanson, 1993). Yet, as noted in section 2.4.6.1, significant differences exist in both the methodological and theoretical analytical approach of this study, in particular with the notion of SNA techniques to focus on ‘networks’ at the expense of the ‘content’ involved within the network. Moreover, traditional tools used by SNA proponents often involve the use of computer software programmes for the generation of networking diagrams.

In conclusion, all of these tools and techniques presented above help in disentangling the context, relationships and the workings of a situation in one way or another. The majority of them seem to serve their purpose effectively as well. Yet, as explained earlier, these tools and techniques share many differences from the Pytheas card tool in both their data collection process as well the theoretical lenses for analysing the complex phenomena that exist in the activities around the NPD process.

3.7 *Back to Mobility: First Trial of Pytheas Process-Mapping Tool*

As the first draft version of Pytheas card tool had been developed, the research moved to the second phase of its pilot study with Mobility to apply the new tool's interviewing technique. Prior to revisiting Mobility, the tool had undergone a series of informal trials with various professional peers at the University (see Appendix 6). Its application to a real case study had never been attempted before. Ultimately, Pytheas card tool was meant to be used as a non-intrusive way of collecting visual data of the ways people network within the organisation. Keeping its session strictly to a very short amount of time was a priority for the study and therefore probing questions remained minimal during the mapping sessions. However, this proved to have a negative impact on the richness of the data collected from the participants and did not reveal any insights other than simple schematic representations of daily interactions. While the visual maps were enough to identify patterns of relations, interactions and communication flows, they failed to capture the content and phenomena in play during these interactions.

The mapping exercise started once again with Mobility's owner, Calvin, as it was important to familiarise him with the process and the data that was about to be collected during the second visit. First, Calvin described the multi-tasking roles that he was responsible for in his business: apart from being the Managing Director, he identified his other roles as being in Sales, Marketing, Finance and Planning. Furthermore, he described himself as a central actor in the Product Development team, as the people responsible with developing a new product included him and the Development Manager.

When faced with selecting the people that he interacts with on a daily basis according to frequency and therefore importance, Calvin identified his management team; Kevin (DM), John (OP) and Finance Manager, and Breen (TS) and Human Resources (a role operated by the Finance manager) as the most vital. These functions were inextricably linked with core activities in the product development process and generally the organisation. Moreover, Calvin noted that he was generally satisfied by the quality of communication with his staff, yet he also suggested that issues were experienced when trying to get hold of his off-site Sales agents.

The second mapping session involved John (OP) who selected the Manager card as his prime position. John's reflection on his position and the multi-tasking roles he was responsible for revealed that the position he was employed for ended up being only a part of what he was actually doing. That is, John was initially employed by Mobility to do Procurement, yet his role eventually evolved first from a Procurement to Purchasing Manager and finally to Operations Manager, a role which incorporated all of his previous roles at Mobility. Hence, his activities spanned from managing purchase orders and chasing their progress to a more central role of overseeing, planning the manufacturing process and supervising the shop-floor team.

Finally, the next two consequent and final mapping sessions, one with Kevin (DM) and another with Breen (TS), did not reveal more than simple representations of interactions and networking. The two participants did not share any deep insights about their practice for two reasons; a) the way 'Pytheas' was applied at the time was still experimental and b) a notable lack of interest from the participants to deeply reflect on their practice on their own.

3.8 *Pytheas: Refinement of the Tool for Data Collection*

In the first application of Pytheas a number of issues were identified as explanations to the relatively low engagement and richness of the collected data. The main culprit was found to be in the probing techniques employed by the researcher. More precisely, the initial application of Pytheas revealed the level of engagement by the participants, with as little probing questions as possible. In the subsequent visits to Mobility, Pytheas was used as a self-probing technique; there were no questions of the what, when, how and why nature asked. Instead, because one key requirement was to meet the anticipated time the session should last (30 minutes), the mapping process proceeded solely with the four stages (the participant's own role, multitasking, interactions and quality of communication), using all the cards but without 'thinking aloud'. This resulted in visual maps of networks but not with any meaningful insights of the content involved at each interaction. While this outcome may have been satisfactory in some other cases (e.g. in a social network analysis tradition), it was deemed as inappropriate to the purposes of this study, that is, to reveal the 'obscure' dynamics of the practices in question.

Mobility's pilot study allowed the identification of the challenges not only of researching the small business context but also the issues of applying a novel interviewing technique such as Pytheas. During the invitation of a number of companies to participate in the study (see Table 6 in section 4.1), the researcher was able to improve the probing techniques and redefine the Pytheas card tool steps during data collection. Case study research during Phase 2 was conducted after the changes were trialled and implemented.

Chapter 4 concerns the actual data collection of this research study. It initially presents the study's selected sample criteria, followed by a discussion of Pytheas process-mapping tool usefulness as a design-led interviewing tool. The chapter ends with the introduction of the four manufacturing SMEs from which data was collected.

Chapter 4.
Data Collection Case Studies: Case Vignettes of Manufacturing SMEs

4.1 *Sample Criteria and Definition*

The study set to conduct research into the various internal and external relationships and activities that are taking place in manufacturing SMEs during the NPD process. Defining what is to be considered as 'small' is thought to be a difficult and complex task due to the extreme range of forms small organisations take. Also, various definitions adopted by studies in the area have received various debates and criticisms (see for example the notable work of Curran & Blackburn, 2001). According to these authors because "there is no established, widely accepted definition, official or otherwise, of the small firm" (Curran & Blackburn, 2001, p. 9), it creates major problems to research. Notwithstanding the difficulties, the basic selection criteria adopted by this study were that organisations should:

- Be actively involved with the creation of new products, services, or systems.
- Employ less than 250 staff (consistent with the EU[22] and UK definitions of SMEs and supported by extant small firm literature (Bell et al., 2004; Storey, 1994).
- Be indigenous (located in the North East of UK) and autonomous (owner or family based – no subsidiaries[23] of larger organisations).
- Be mature (no start-ups as these are expected to possess substantially different characteristics and would therefore require a different approach to research.

Although the EU/UK definition of Small and Medium-sized Enterprises (SMEs) also integrates their financial turnover, such a criterion has not been adopted by this study for the case selection. There are several reasons behind this (see Curran and Blackburn, 2001), with the bigger problem and a direct effect to this study being the difficulty in finding out reliable numbers for a small organisation's turnover, either shared by the owner or available in regional/national published databases[24].

[22] European Commission (2003)

[23] One exceptional case study (see table 1) was officially defined as part of a same size organisation. The two organisations merged into one 5 years ago and currently have two sites of operation, one based in the North East and another in the South of the UK. However, from the first visit at the North East site, it was evident that the two sites were operating autonomously, with their own management and decision-makers in place, hence it was thought to pose limited implications to viability and comparability of the data.

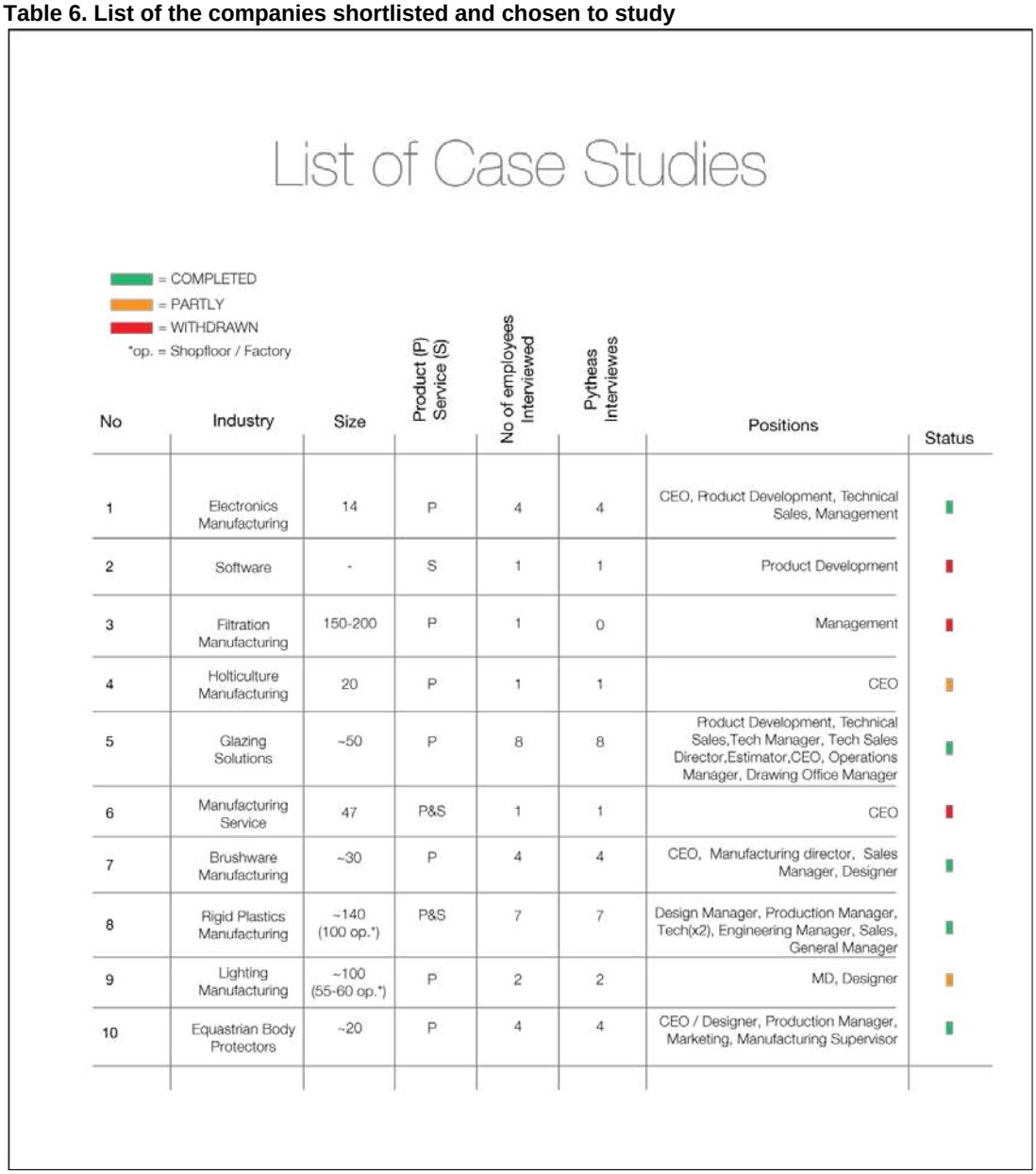
[24] The study uses the FAME (Financial Analysis Made Easy) business database to collect and confirm information relating to employment size and financial turnover of the cases selected. However, financial turnover was available only to a handful of the businesses.

The decision of this study to research manufacturing SMEs was mainly based on the rationale that these companies were less likely to possess a systematised process for developing tangible products. At the very early phases of case study research, the study approached a software-based company where it questioned whether it would have a systematised NPD process. However, on applying the study's process-mapping method, it was found that the company was operating on a client led project basis and therefore it fell out from the purpose of the study.

One criterion for selection of the organisations also related to their past participation in projects conducted by the University. The rationale behind this related to the expected reticence of SMEs to take part in the study. It was hoped that pre-existing relationships with the University would increase the study's ability to recruit the much needed companies. A list of potential companies was provided by contacts within the University's School of Design and Business School. An email was sent to all SMEs (about 20) that were found to align with the criteria for this study (discussed earlier in section 4.1). As mentioned earlier in section 3.6, the study initially considered the use of postgraduate students to help with data collection in order to approach a higher number of SMEs, however this option was abandoned as it was important for the researcher to control the data collection process and maintain a consistency of approach.

In total, ten companies expressed a positive initial response to participate in the study. This number was considered to be appropriate at the time as it was expected that not all ten companies who expressed an early positive response would be willing to fully engage with the study. In other words, the study's goal was to end up with a satisfactory number of manufacturing SMEs that would be willing to fully engage with the study and therefore enable it to derive rich data. Eventually, four of the SMEs visited were selected due to their expressed level of engagement with the study and therefore these four were used as the basis for qualitative observations by the study. Table 6 provides a snapshot of the SMEs that were approached by this study.

Table 6. List of the companies shortlisted and chosen to study



List of Case Studies

= COMPLETED
= PARTLY
= WITHDRAWN
*op. = Shopfloor / Factory

No	Industry	Size	Product (P) Service (S)	No of employees Interviewed	Pytheas Interviewes	Positions	Status
1	Electronics Manufacturing	14	P	4	4	CEO, Product Development, Technical Sales, Management	
2	Software	-	S	1	1	Product Development	
3	Filtration Manufacturing	150-200	P	1	0	Management	
4	Holticulture Manufacturing	20	P	1	1	CEO	
5	Glazing Solutions	~50	P	8	8	Product Development, Technical Sales,Tech Manager, Tech Sales Director,Estimator,CEO, Operations Manager, Drawing Office Manager	
6	Manufacturing Service	47	P&S	1	1	CEO	
7	Brushware Manufacturing	~30	P	4	4	CEO, Manufacturing director, Sales Manager, Designer	
8	Rigid Plastics Manufacturing	~140 (100 op.*)	P&S	7	7	Design Manager, Production Manager, Tech(x2), Engineering Manager, Sales, General Manager	
9	Lighting Manufacturing	~100 (55-60 op.*)	P	2	2	MD, Designer	
10	Equastrian Body Protectors	~20	P	4	4	CEO / Designer, Production Manager, Marketing, Manufacturing Supervisor	

4.2 *Pytheas Interviewing Technique: How it Helped Surface Obscure Practices*

The interviewing process through Pytheas facilitated the exposure of the participant's 'taken-for-granted' world because it involved continuously asking the respondents to reflect on their own activities, perceptions and experiences (Schön, 1983) in relation to others. Throughout the mapping exercise participants were asked to explain when, what, why and how (Yin, 2003) they go about doing what they do and in that process they revealed to themselves aspects of practices that up to that point may have not been previously articulated. Throughout the reflective process, participants were asked to provide examples and tell stories of their activities as it has been argued that such methods are able to assist the articulation of previously 'obscure' activities (Hansen & Kahnweiler, 1993). As issues emerged, it also helped to surface memories, events and feelings that they may have been otherwise unable to recall. A great benefit of the Pytheas card-tool was that it did not require any advanced education or training prior to its use by the participant (though it is necessary for the facilitator). Ultimately, Pytheas as an activity process-mapping tool attempted to make individuals shift their minds into a more collective relational thinking frame. For example, it is argued by Glenn (2003), author of the 'Futures Wheels' – a type of structured mapping brainstorming method, that such mapping methods facilitate a change "from linear, hierarchical, and simplistic thinking to more network-oriented, organic, and complex thinking" (2003, p. 9). Pytheas helped to translate one's stance towards his/her own activities into a relatively clear and simple visual map of the complex interactions and relationships involved during the New Product Development Process.

Because of the tensions and conflicts Pytheas was found to reveal, it is best when used by a single individual per session and facilitated by the researcher in order to ensure confidentiality and a sense of security. Each interview through the use of Pytheas generated a visual map that belonged to the participating practitioner. As described in section 3.6.1, each visual map indicated the individual's salient construct accompanied with density of interactions and quality of relationships between the organisational members. Individual maps were then compared between all the participating members of an organisation in order to ensure that they were a reasonable representation of personal experiences of 'the way things we do things here'. Each mapping session was video recorded and transcribed using QSR International's

NVivo 9 software[25]. Each individual map was post-processed into more analytical visual schemes through design software tools such as Adobe Illustration, printed and reported back confidentially to each individual participant (Figure 17 and Figure 18). Further analysis of the individual maps and the interpretation of the interviewing data produced distinctive integrated visual schemes of the organisation's informal structure (Figure 19) and a departmental and activity – based model of the NPD process (Figure 20). As opposed to the individual maps, the organisational maps were disseminated to every participant across the organisation as they did not reveal sensitive information.

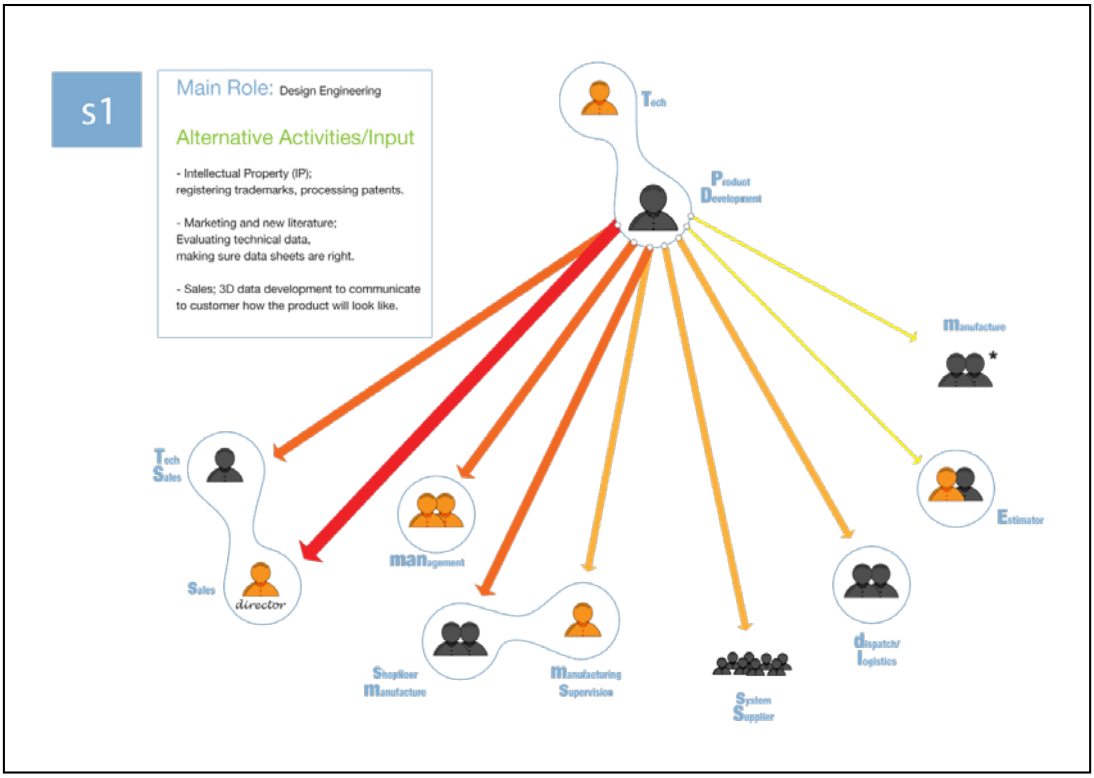


Figure 17: Example of a post-processed map into more visual schematics reported back to the participants

[25] NVivo qualitative data analysis software; QSR International Pty Ltd. Version 9, 2010

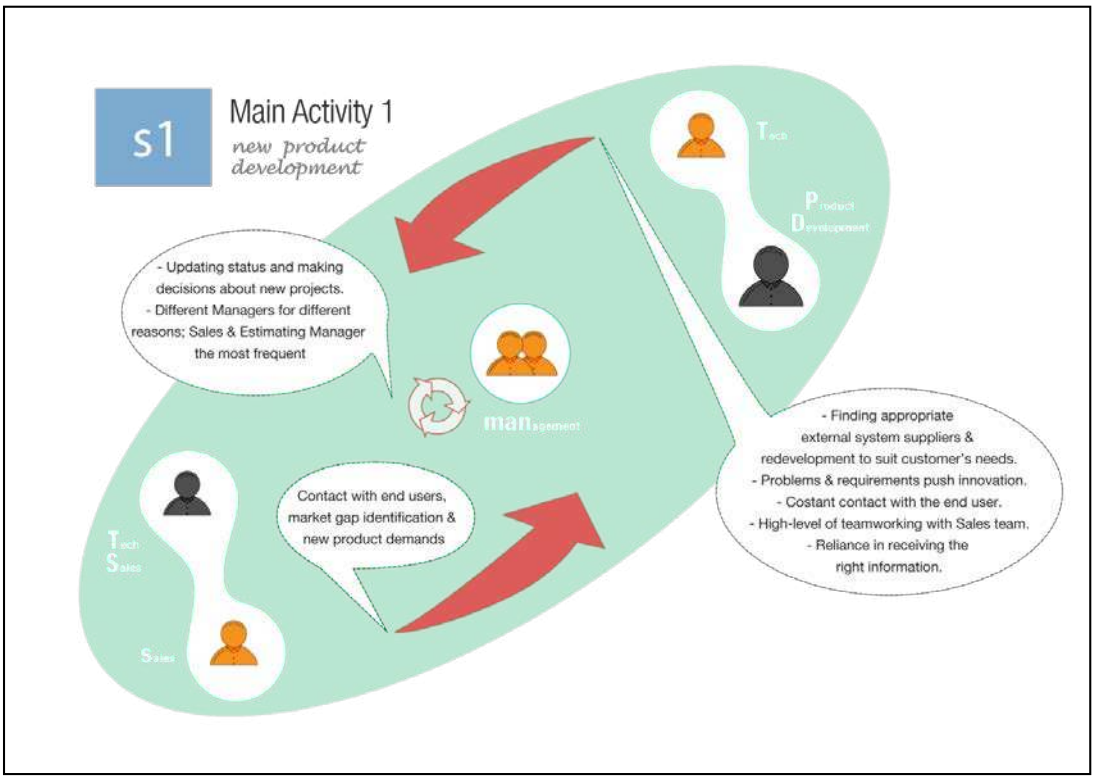


Figure 18. Example of a post-processed map into more visual schematics reported back to the participants

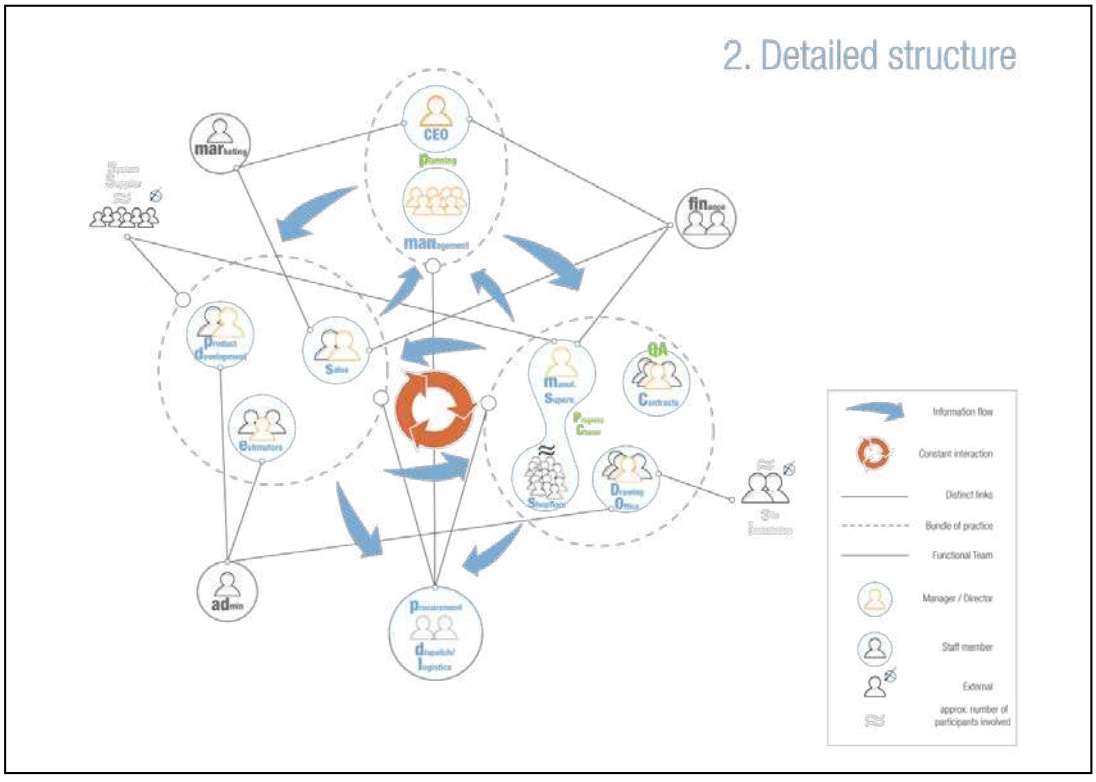


Figure 19. An example of a schematic representation of the organisation's actual informal struc-ture

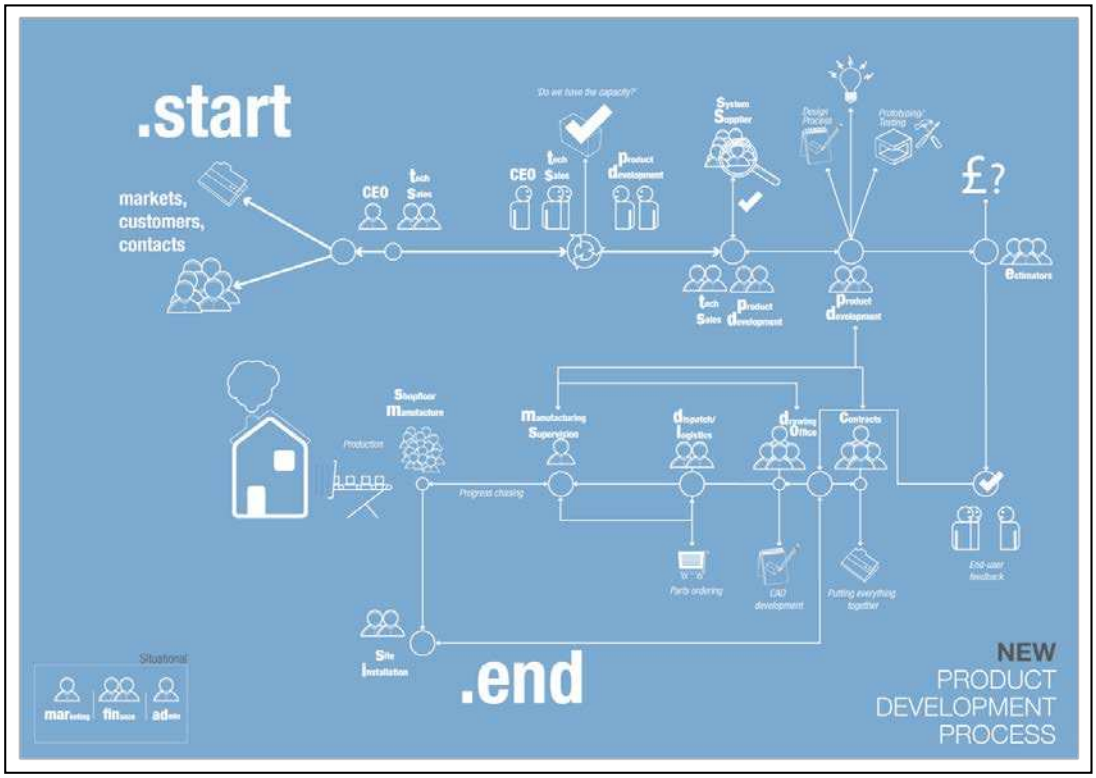


Figure 20. Example of a schematic representation of the Product Development process revealed through the analysis of the data

The visual reports were sent to the participants as a means to satisfy two requirements:

- *First, it allowed data to be validated by those involved in the study.*
- *Second, it helped with a continuous co-operation between the researcher and the participants by providing them with an end product that justified their time invested in the study (Curran & Blackburn, 2001).*

4.3 *Introduction to the Companies Studied*

This part of the thesis is designed to help readers gain a feel about the organisations that were studied. To this end, the following sections will serve for the purpose of introducing the companies based upon three central topics;

- The ‘general information about the company’ provides a general overview of the organisation.
- In the ‘Getting to Know the company’ are descriptions of the particular conditions by which the company provided access to its settings in parallel to the standardised strategy (see section 3.6.3). Moreover, the section includes facts and events, which were found to highlight the idiosyncratic characteristics of the organisations.
- ‘The way we are organised’ provides a general overview of the internal organisational structure, including department divisions and basic networking between the different communities.

Furthermore, the readers are invited to develop their first intimate understanding of the companies and its constituent parts such as the owner, key staff member and/or other participants. The vignettes also describe cases of relatively successful stories. Samples of the interviews conducted in the four SMEs can be found in the Appendix (11-18).

It is important to note that each introduction is part of the same company’s vignette that follows in Chapter 5 where they are analysed based on the Activity Theory model. Therefore, the descriptions also include facts and events that have been partly interpreted from the researcher’s own perspective during the analysis of the interviews – yet they have all been ratified by the participants. Moreover, some of the information presented here has been acquired from official organisational documentation, including things like the official number of employed staff as well as the names of the various organisational departments. All figures and schematic representations presented along with the text have been based on interpretations made by the researcher following the post-processing phase of the information shared by the participants. All the stories presented here involved the researcher as a facilitator through the employment of the Pytheas activity mapping tool (Appendix 19).

Finally, it is important to note that some of the ‘juicy’ bits relating to sensitive issues (e.g. personal dissatisfaction or accusation of fellow members) are excluded from the description since they cannot be published without creating discomfort to the participating companies. Many important (and often sensitive) issues captured are still illustrated throughout the vignettes by using pseudonyms for the participants and the organisations and by treating details in such a way as to protect them, in keeping with the Northumbria University ethics in research policy. Nonetheless, the essential features of the stories remain intact.

4.3.1 CASE 2: Glazing Ltd.

Interviewees (8):

- Nick – Owner Managing Director (OMD)
- Laura - Design Engineer (DE)
- Paul -Technical Manager (TM)
- James - Technical Sales Director (TSD)
- Peter - Technical Sales (TS)
- John - Estimating Director(ED)
- George - Operations Manager (OM)
- Keith - Drawing Office Manager (DOM)

4.3.1.1 About Glazing

Glazing ltd was a small manufacturing organisation consisting of 50 members, whose traditional practice had been the design and development of fire glazing systems in which the company dominated for the last 15 years. Since 2003, the company had also successfully entered the security glazing market. The good relations between Glazing and Northumbria University offered a good opportunity to invite the company to participate in the study. In particular, the familiarity and mutual appreciation gained from past collaborations meant that Glazing was relatively comfortable to allow an out-sider to investigate their practices and to offer an accessible context for the research. In addition, this had a positive effect to the overall attitude of the participants, as the majority of them were very keen to engage with the research study and provide their views about their practice.

4.3.1.2 Getting to know Glazing

At the time of the first contact, the research process and technique had been further refined, after various iterations based on several trials and some incomplete case studies. As a result, the Pytheas card tool was employed from the very start and with each and every participant. In two instances, the data collection also included in-depth interviews with key individuals, which provided general information about the company.

In both cases, the process was aided through the Pytheas mapping exercise. The first in-depth interview was conducted during the first visit to the company's offices and involved a key member of the Product Development team, Design Engineer, Laura. The discussions with Laura provided the researcher with in depth insights on the NPD process as well as a general overview of the key organisational members. Moreover, a second in-depth interview was conducted during a follow-up visit to the company and involved Nick, the owner and Managing Director of Glazing Ltd. The discussion with Nick explored the strategic side of the company as well as historical events that shaped its most current practice.

More precisely, Nick described how Glazing had fundamentally changed its strategy and overall practices in the last 8 years. The changes were heavily influenced by him, who, at the time, was newly appointed as the Managing Director of Glazing by its previous directors. Nick had brought with him a very different personal philosophy to that which was in place at the time. As mentioned earlier, the organisation had been the leader in the fire glazing market for many years, yet according to Nick, its past directors were short-sighted about the opportunities that could have been found in other market places. At the time, the directors of the company were primarily concerned with maintaining the status-quo and the comfort zone of 'doing what we know the best'. Their visions of the organisation were in conflict with those of Nick's, who had a completely different view of the organisation's capabilities and future. For example, the directors suggested to him that his main job responsibility was to spend most of his time internally with the various departments in order to get to know the organisation better. Nevertheless, Nick explicitly disagreed with these suggestions. According to him, the organisation would have a lot more to benefit if he was spending most of the time in the marketplace, meeting with customers and getting to know better what is going on there. His argument was that meeting with the internal departments should require from him no more than a day a week. This, he argued, would allow him to spend meaningful time meeting with existing or new customers and other market experts in order to get a deeper understanding of the current state of the market, its potentials as well as its risks. By doing so, Nick eventually concluded that their dominance in the fire glazing market was counterbalanced by their inability to increase their market share.

> *"We had a very big fish in a very small pond…and the worst was that the pond was getting smaller…and we couldn't do anything about it".*

This was accompanied with a very negative forecast in which he predicted a 66% drop of the organisation's turn over in the following years. Therefore, Nick suggested that the best strategy to deal with this would be to move into new markets. As he explained at the time, this did not mean that the company should move out from one market and enter another one. Instead, he proposed that the existing rich experience the company had acquired with the steel-based products and fire proof fire glass systems, be further advanced in a market that shared similar needs, i.e. **"**strong as steel**"** and "being preventive**"** such as in security glazing. This realisation was received with much scepticism and criticism by the company's former directors as it contradicted their views of what the company ought to keep doing. In a sense, the directors seemed to have no trust in the organisation's rich capabilities and feared to take the risk of 'navigating into unknown waters'. Nick was surprised to hear that in the past, the company had done a one-off project for a particular client in the security market, however they did not think of further exploiting that particular market.

Eventually, in 2003 the organisation slowly began extending from solely the fire glazing market to security glazing as well. However, according to Nick, moving into a new market was not without serious challenges. Two years later, in 2005, the factory had to go through inevitable changes in both machinery and expertise following the replacement of heavy and expensive steel that the company traditionally used, into the cheaper and lighter aluminium. This change had an immediate effect on the company, as the use of aluminium attracted new customers who demanded both new and different products. Meanwhile, working with aluminium had to push the company to bring in some new equipment, which required a reduction in human resources compared to that demanded for steel work. These issues raised further conflicts between the existing directors who were unwilling to take the risk of investment. As a result, a few years later, Nick took the risk himself and led a management buyout of the company from its former shareholders who were not convinced of the potential of Nick's ideas.

Subsequently, Nick noted that they turned over more on aluminium than steel while they still had the fire-glazing market. Moreover, what Nick had predicted 8 years ago proved to be true as Nick argued that they would be lucky to generate as much as 33% of previous turnover. This meant that if they had not taken the necessary actions and risk to move into a new market, the company would have been struggling to survive today. That little pot of history had a lasting impact to Glazing's practices and influenced the way the company was developing new products through a market and customer-driven approach.

4.3.1.3 The way we are organised: General structure of Glazing

Nick had structured Glazing into well-defined departments with a senior manager placed in each of them (Figure 21). In particular, he described the people who constitute it and the overall structure of the company as “the way the pyramid works”; a senior management team that directly reports to him, a secondary management team and then the rest of the company. More precisely, under Nick were; a) a Sales/Technical Sales department which consisted of Director, James (TSD) who was responsible for Peter, Technical Sales (TS) as well as the Technical/ Design team with; Paul, Manager (TM) and Laura, Product Design Engineer (PDE), b) an Estimating department, where John, the Director, was overseeing a team of other 2 other Estimators, c) a Drawing Office department which consisted of Keith, Manager of 3 colleagues, d) a Contracts department consisting of one Director and 3 regular members, e) a Logistics team of 2, f) an Accounts team of 3, g) 1 receptionist, and finally h) 30 people in the Factory, where George, Operations Manager (OM) and one Steel Production Manager were overseeing the shop-floor blue-collar workers. More recently, Nick had created a new Marketing function by separating it from the Sales/Technical Sales function where it was in the past.

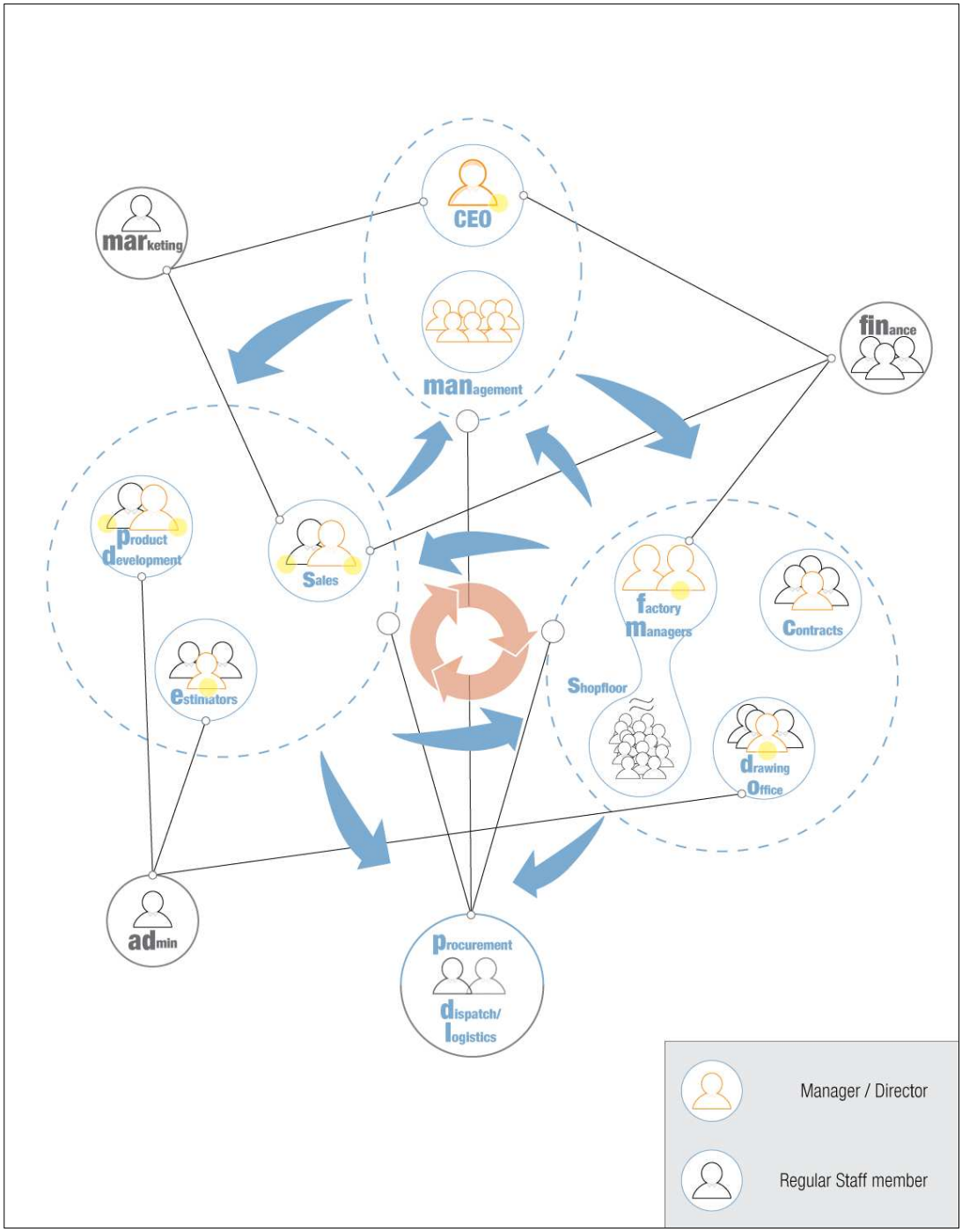


Figure 21. A visual representation of Glazing's general structure – yellow dots highlight the mem-bers interviewed

4.3.2 CASE 3: Brushware Ltd.

Interviewees (4):

- Chris - Managing Director (MD) (In-depth &'Pytheas'),
- Sam – Manufacturing Director (MND) ('Pytheas'),
- Emma –Sales Manager (SM) ('Pytheas'),
- Tom – Designer (DES) ('Pytheas')

4.3.2.1 About Brushware

Brushware Ltd was a small family-owned business involved with the design and development of brushes. The company employed thirty (30) individuals and was originally founded more than a century ago, whilst at the time of the case study it was being run by the 6th generation of the founder's family. The company had been operating in a number of different industries and markets, a practice that had significantly changed since its foundation years. In particular, the company had to adapt to changes and competition posed from emerging economies e.g. China, that led to a decline in market share where the company had been operating traditionally, such as ship building and the oil industry. The long history and notable agility of this small family business are indicative of the adaptation and learning that had been fundamental ingredients to its survival and prosperity and made Brushware an ideal candidate to be studied.

4.3.2.2 Getting to know Brushware

The process of meeting Brushware at first involved the researcher contacting the company by e-mail and a follow-up conversation by phone with Chris, the company's Managing Director (MD). Initially, an email was sent which included an invitation for participation to the project as well as a short description about it. A few days later, the researcher with the assistance of the supervision team, contacted Chris by phone and further discussed details around the project's aims and goals and what would be required by them if agreed to participate. An invitation was sent to the researcher and the member of the supervision team to travel to Brushware's offices at a later date.

The purpose of the meeting was, first, to get to know the company better by interviewing Chris, and, second, to generate enough interest towards the participation of the company in the project. In this regard, the process adopted in this first interview was relatively un-structured and questions were posed along with the unfolding pace of the storytelling. However, the general scope of the questions was kept around the company's history, its strategy, innovation, intellectual property, and the product development process.

As mentioned earlier, Brushware Ltd has been owned by the same family through its entire existence. Chris, who is the current MD of the company, is also one of the shareholders and had replaced his father in the MD position, effectively representing the 6th generation of his family running the business (remarkably, in the company's board of directors, three generations are represented).

Generally, Brushware's practice could be divided into two major halves, one of which can be further divided into two subparts (Figure 22). More precisely, one half involved in the 'traditional' part of the business, and the other half the 'specialised', which essentially consisted of two parts, industry specific and non-specific. Chris (MD) noted that "although we run it as one, we think of ourselves as three", emphasising in this way the organisation's orientation to the world across these three central areas.

Half of the business – The 'traditional'

i. The "**cleaning and painting business**": Consisting of the biggest part of the business, this side essentially reflects the company's long-standing traditional practice and is the precursor of its identity. Here, the company develops a large range of different products such as sweeping and paint brushes, generally used by professionals (i.e. janitorial purposes) who have acquired them. The brushes reach the end users through a network of key distributors that the company has been in cooperation with. They are usually grouped with other products (often sourced by other suppliers) before hitting a particular client or market. This is effectively the area nearer Brushware's traditional legacy, with one difference (from its past) being that it was now operating within much smaller industries as opposed to the heavy industries that flourished in the past.

Other half of the business – The 'specialised'

ii. **Pipeline maintenance industry** (25%): This part of the business is involved with the development of technical products specifically tailored for the needs of the pipeline maintenance industry, that is, the cleaning and inspection of gas pipelines. Although technically it can be seen as part of the "cleaning and painting" business, it was separated because of its large size. Moreover, in this area the company is a member of the traders association and has close links with international trade associations in the pipeline industry.

iii. **All other specialists** – non-industry specific (25%): Finally, Brushware develops specialised products that are custom-tailored for the needs of a large range of markets, including automobile, agricultural and marine processes. According to Chris, this area of the business is also the most fragmented because of the multiple markets and the different purposes that their products are used for.

Balancing the two halves

At the time of the interview, Chris' (MD) central activity was focusing on strategically changing and improving the existing business both internally ("*how we do things here*") and externally ("*how we stretch ourselves*"). In support of this activity, he was working on a new 3-year strategic plan, the "Business Growth Plan" (BGP). The plan was in development for about 9 months and was being implemented during the company's visit. Chris (MD) was undertaking this activity in close collaboration was his senior team, Sam (MND), Emma (SM) and (to a lesser extent) his father, Financial Director (FD). Together, they were "*trying to improve the business, trying to develop things or getting involved with new customers, new processes and trying to pick up problems that are in the existing business*" (Chris, MD). The BGP plan generally reflected Brushware's efforts in changing the organisation by; a) finding the right balance between 'traditional' and 'specialised' markets and, b) implementing cultural changes with great care and "*along the lines of realigning our business with the needs of our markets and the needs of our customers without damaging anything we've got at the moment*" (Chris, MD).

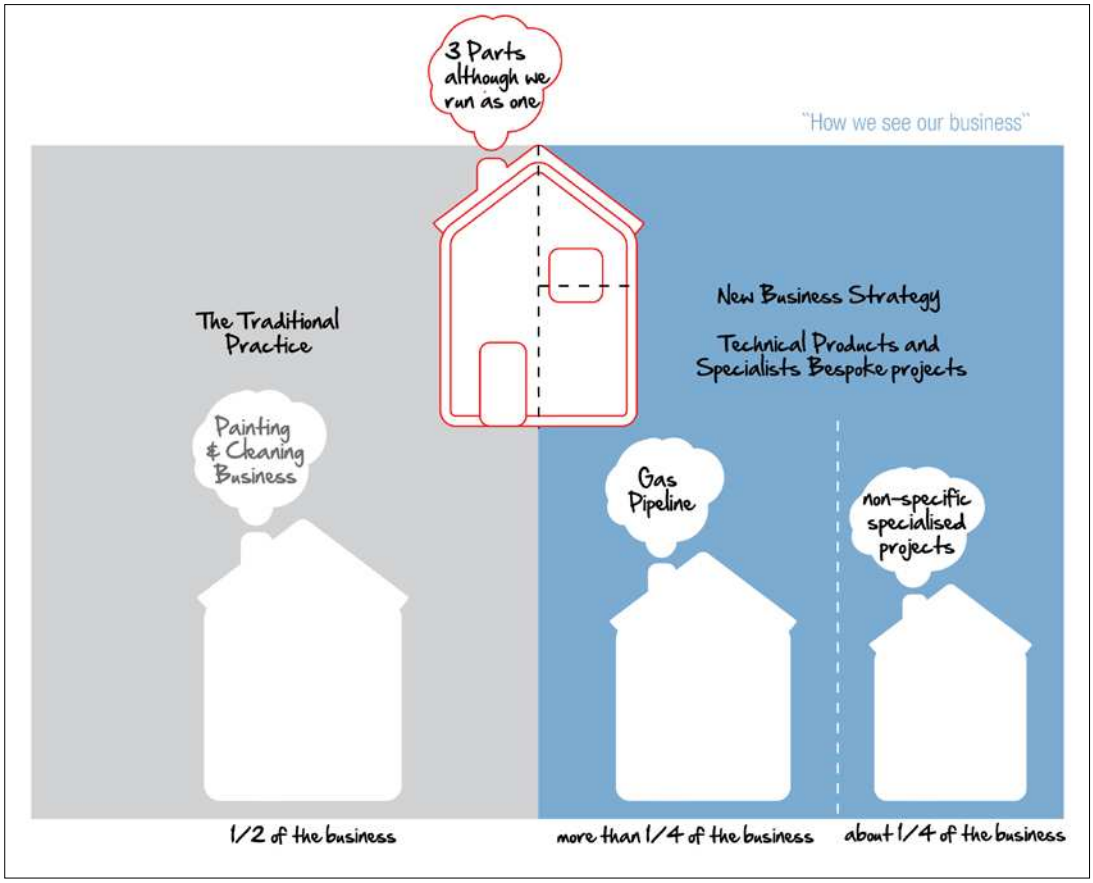


Figure 22. Brushware's market orientation

4.3.2.3 The way we are organised: General structure of Brushware

Below Chris, Brushware Ltd. consisted of two main teams, the Sales and the Production. Each team falls under the control of one Manager, Emma (SM) and Sam (MND). Together with the Finance director (Chris' father and 5th generation MD), they comprised the senior management team and the main decision and strategy-makers of the organisation. The rest of the functions fulfilled the operational part of the business, with one Manufacturing Supervisor linking the shop floor with the management team. Operational functions were primarily responsible with the traditional part of the business (cleaning and painting) and the everyday management of enquires from the stock (although still involved in the NPD). At the time of the visit, and as part of the BGP activities which included finding new talented staff to join the company, it had hired a Product Designer, Tom (DES), who had been subcontracted for almost a year by the company particularly for his support in the development of new specialised products (other half of the business). Finally, the company commissioned an external

Sales agent, which although was not technically employed by Brushware, he was effectively treated as part of it (Figure 23).

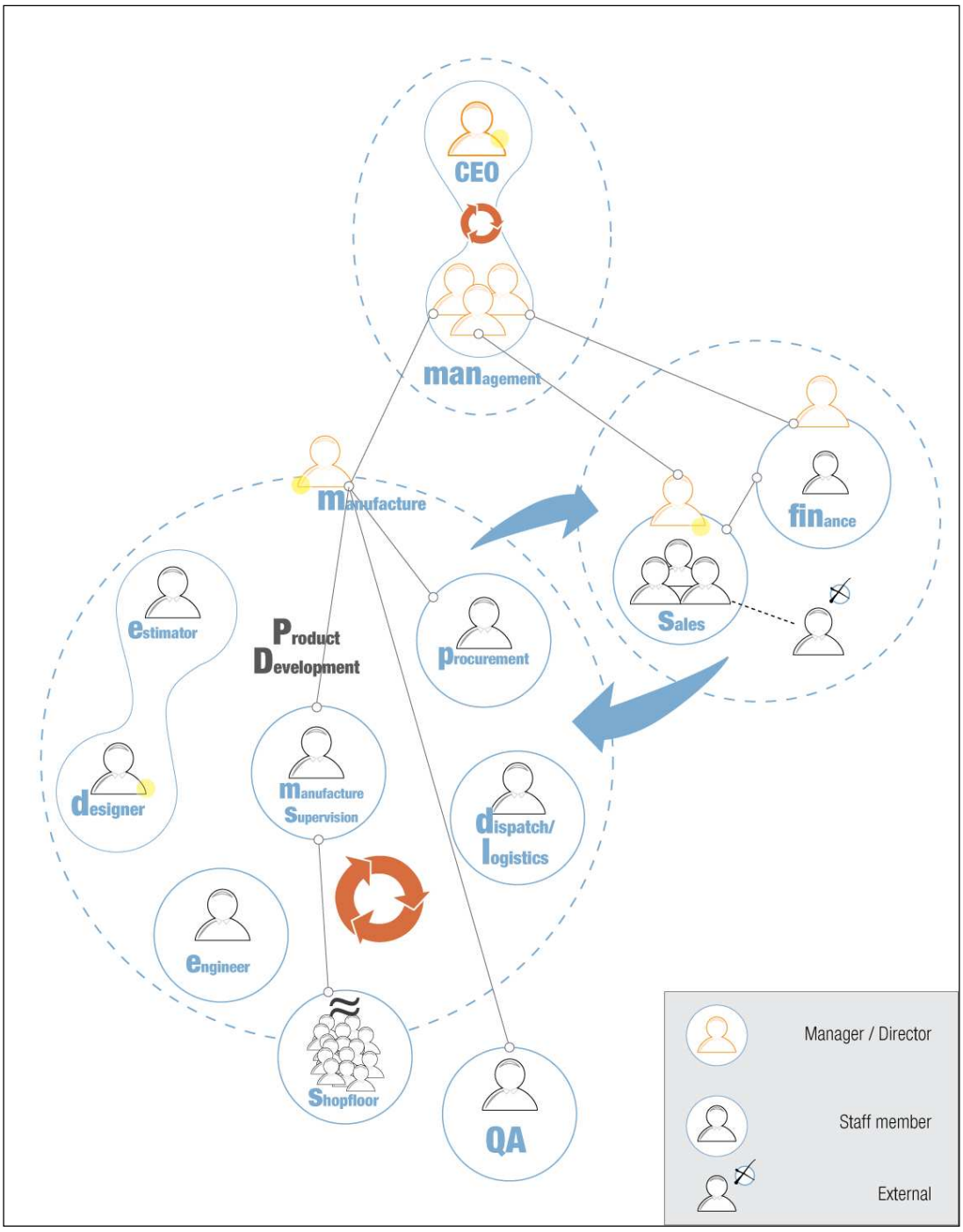


Figure 23. A visual representation of Brushware's general structure – yellow dots highlight the members interviewed

4.3.3 CASE 4: Pharma Ltd.

Interviewees (7):

- Alan – Design Manager (DM),
- Ben – Site Manager (SM),
- Sam – Engineer Manager (EM),
- Tim – Operations Production Manager (OPM),
- Steve – Technical (TECH),
- Andrew – Senior Extrusion Blow Moulding Technician (TECHN),
- Brenda – Sales (S).

4.3.3.1 About Pharma

Pharma Ltd. was an SME that employed around 140 individuals making it effectively the largest amongst the cases studied. The company was specialised in the design and development of rigid plastic packaging (containers) specifically aimed at the pharmaceutical industry. Pharma had been operating independently for more than 30 years in the same industry until two years prior to the date the case study commenced, when Pharma ltd. was taken-over by another company operating in the south of England (which from now on will be referred to as the 'SE' site) and specialises in a different segment of the same industry (healthcare). In spite of a number of operations which were centrally controlled by the SE site, Pharma operated relatively autonomously. These facts coupled with the intricacies of the particular organisational model were some of the most important reasons for inviting Pharma Ltd. to participate in the study.

4.3.3.2 Getting to know Pharma

Most of the general information around Pharma's history, traditional practice and recent organisational changes, was collected during the first visit to the company and the interview with the Design Manager, Alan (DM). Because Alan had been with Pharma since it was independent, he therefore had a very good inside knowledge of how things were in the past and the kind of changes the new operation had brought

to the organisation. In addition to the interview with Alan, important relevant information was further recorded during the interview with Ben, Pharma's newly hired Site Manager, who joined the company after it had been merged with SE.

For many years, Pharma used to dominate the pharmaceutical packaging market. Prior to being acquired by a company in the southeast of the UK (SE), Pharma's main competitor in its segment was also SE. Although SE specialised particularly in the healthcare market, the two companies still had been competing on both price and design and had frequently copied each other. Alan (DM) illustrated this situation based on his personal experience at Pharma;

> *"…the fact that a lot of the packs we and SE were doing, were the same to the point that it made sense that were copied most of them… but the clients were asking, you know, we have this pack from Pharma, is not protected any way, we want it cheaper so SE would do that… and we [would do] the same, we took a lot of work from them too."* Alan, DM

Things changed dramatically in 2008 when Pharma could not cope with the economic conditions and had to go into administration. Pharma's newly hired site manager, Ben, argued that it was only a matter of time for one of the two UK competitors to 'go bump' and Pharma was the first. SE saw this as an opportunity and took over Pharma and as Ben noted "effectively you have the two biggest UK competitors merged into one...but they are remarkably similar in many ways."

Because the two companies shared many similarities in terms of technical competence and expertise, it "has been a very good fit" according to Alan as it was made possible for them to streamline the production and at the same time to retain their long years of reputable experience and expertise. For instance, after years of fierce competition the members of the two organisations had to jointly find out who has the best manufacturing production tools and how these could be shared. Eventually, some of Pharma's tools were relocated to the SE site because, as Alan argued, "our tools were better!". Merging with SE also meant that Pharma's main competitor was no longer a reason to retain its price-based competition strategy. More importantly, the two sites were able to remain quite autonomous in the development of new products. This was possible because each site had exactly the same production facilities and capabilities, yet each site had a different primary focus. As mentioned earlier, Pharma was a specialist in the pharmaceutical/medical market, whilst SE mostly specialized in the health market (Figure 24). Alan asserted that Pharma had consciously decided

to set up their market focus based on the company's technical facilities such as the 'clean room', an important facility for manufacturing products for the pharmaceutical/ medical industry. Moreover, Pharma's facilities offered "a one stop shop" for its customers as it also included appropriate printing tools such as dry offset and screen-printing machines for labelling its packages (except the filling of the actual consumable product). Last but not least, as Ben noted, the two sites produced about the same high turnover as each other (£12 million).

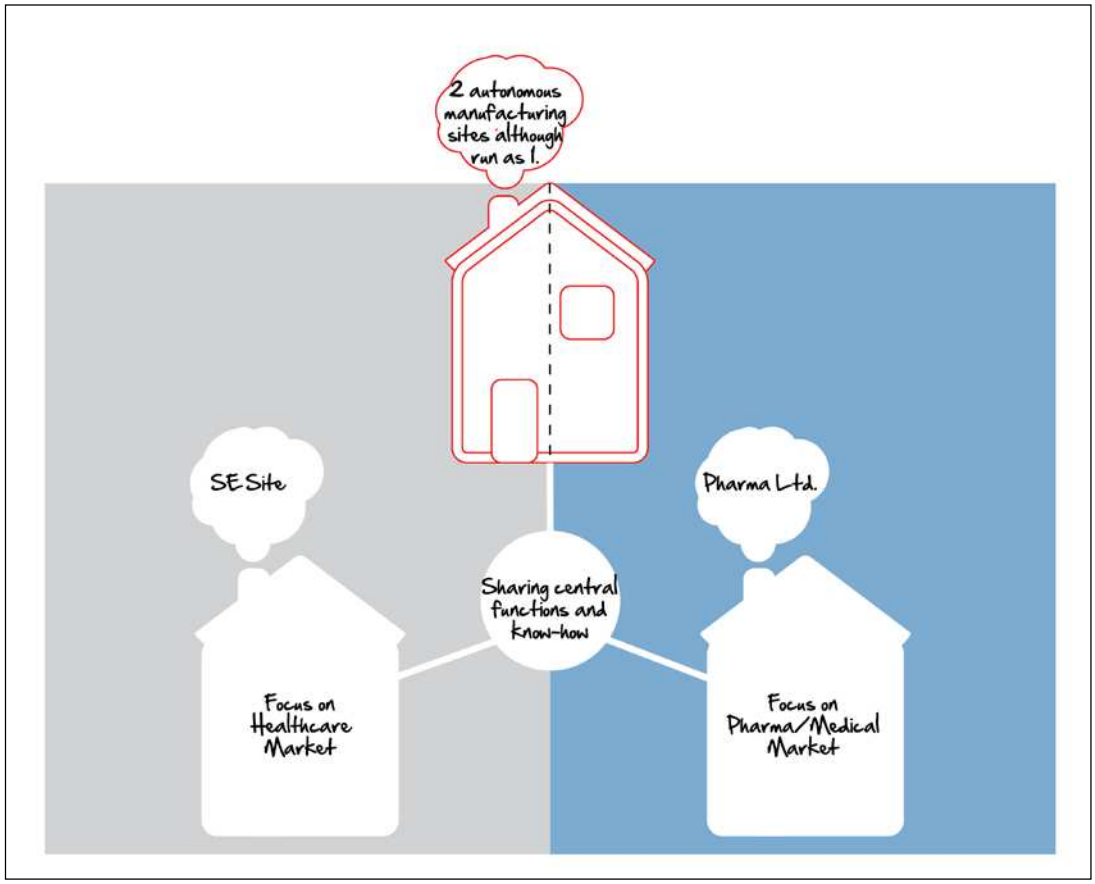


Figure 24. The division between Pharma and SE site

4.3.3.3 The way we are organised: General structure of Pharma Ltd.

As mentioned earlier, the two sites had their own manufacturing facilities, each with very similar capabilities and customer portfolios. Yet, the acquisition of Pharma by SE had an immediate impact in the way the company was structured, as staff became redundant and many functions' central administration was relocated to the SE site. First, the board of management, which consisted of the 5 co-owners of SE and Pharma were all based at the SE site. Moreover, each site has a general site manager. One of the co-owners, Peter, Pharma's past Technical Director and a key player in the Design department, moved to the SE site and while he retained his key role, he expanded to include Technical Sales too (he is referred as 'Peter' or TS throughout the case study). The Sales department's control also moved to SE, although each site had a dedicated team. Pharma had three full time Sales personnel, including Brenda, and a 4th as part-time, all of which had to report to the Sales and Tech Sales directors who were based at SE.

Certain changes occurred also in the NPD team of Pharma. Alan noted that the Design department used to be quite big with 4 designers working in Pharma alone in the past, whilst now it was only him based at the Pharma site and Peter at the SE site. While Ben highlighted that officially the SE centrally controlled the Design department due to Peter's position there, Alan was still the leader of the design work at Pharma. In particular, Alan's role was aligned towards the design and development of new products, as opposed to the majority of the work of SE's technical team who are primarily concerned with the improvement of existing products and processes. To assist him at the design office was a Technical person, Steve (TECH). The Technical and Product Development team further consisted of the Engineering team of five, managed by Sam (EM), and Tim, the Operations Production Manager (OPM), who was responsible for the manufacturing and production personnel.

There were also various changes in the Production facility following the merger of the two companies. For example, Andrew, senior technician for extrusion blow moulding (TECHN), was one of the five senior technicians who was initially going to be made redundant, yet he was asked to stay because the managers at the SE site appreciated his personal skills during his involvement with the moving and setting up of specialised

machinery from Pharma to SE. In his new position, Andrew, along with four shift managers, was supervising the technicians who were organised based on their expertise and according to the four different types of plastic moulding technologies the company has. Finally, other functions included a QA team, a Procurement team, one Planning staff member, and the newly generated one; Continuous Improvement (CI), which consisted of two Change Agents, one permanent and one in the periphery (Figure 25).

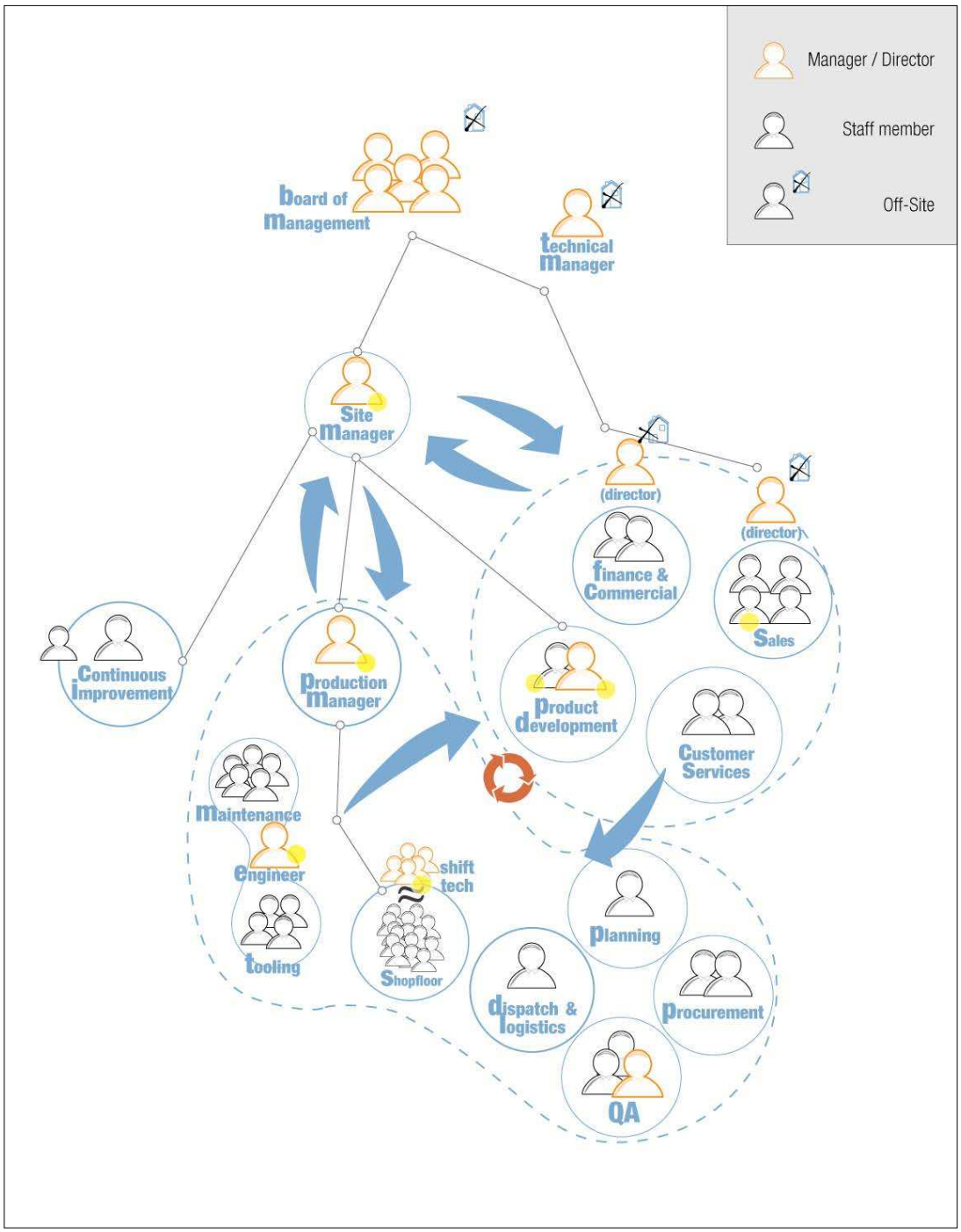


Figure 25. A visual representation of Pharma's general structure – yellow dots highlight the members interviewed

4.3.4 CASE 5: Body Protectors (BoPro) Ltd.

Interviewees (4):

- Nadia – CEO/Designer (DM),
- John – Production Manager (PM)
- Kat – Manufacturing Supervisor (MS)
- Louise – Marketing (M)

4.3.4.1 About BoPro

BoPro Ltd. was a small manufacturing company that employed 23 individuals specialised in the design and development of body protectors for the equestrian safety market. In addition, the company was also a distributor of riding helmets and high visibility clothing. BoPro had been successfully operating in the equestrian industry for more than two decades and was turning over around £2m per annum.

4.3.4.2 Getting to know BoPro

Learning about BoPro's practices was achieved during a meeting and interview with the company's owner-manager and designer, Nadia. The first visit at BoPro offices was partly initiated by Nadia herself, as she had been recently in discussions with the university about a potential project collaboration. Information about the study was distributed via email and telephone and led to an invitation to jointly meet Nadia at BoPro's premises along with the university's project representative.

"It's not all about pretty cad…"

According to Nadia, BoPro was a leading brand in the area of equestrian body protectors. The products that BoPro was designing and developing were a mixture of "niche product design with an interest in fashion". Contrary to other companies who would be at the low value end, BoPro's focus was upon innovation, style and design fit. The latter in particular was a vital selling point according to Nadia who highlighted

the fact that BoPro had a wide range of stock sizes while being “good at making garments that fit people”, in other words, products that were made to fit all sizes. This was very different for instance from other companies at the low value end whose sizes may only cover a part of the population. Even if the stocks did not cover someone’s particular size then the company offered to customise “a bespoke fit if somebody falls absolutely outsized”. The fitting quality in BoPro’s products was not only a strategy to be persuasive to the customer but equally for swaying retailers to promote BoPro to their customers. However, style and fitting was not the only competence and challenge that BoPro was good at delivering. In addition, the company was an expert at developing products that not only were a good fit but also met the Safety Standards imposed in the particular market (a practice that according to Nadia is easy to do separately, but very difficult to achieve both for the same product).

Moreover, for BoPro, the development of technical products, such as body protectors in line with high safety standards, was not about simply “drawing pretty pictures on CAD” or dealing only with the specifications and how it is made. Rather, Nadia argued that while these things were important, so were the creative efforts needed to;

> *“[…] understand the product, the body, how do you measure the internal parameter, how you work out how the market [operates], so you can have your adjustments… [and therefore] you do not want to be handing these [on] to somebody else”.*

Competition

Getting the product right was not enough for BoPro to survive in this business. As Nadia noted, the company was finding it hard to persuade retailers in a market which was, a) brand driven and b) dominated by large organisations who offered complete ranges of products;

> *“Going into a retailer, first question was 'why should I buy from you? I've got an excellent product...why should I buy from you... why should I open another supplier account for a niche product when I can get it [from other companies] and I can get a good range and I can buy everything together...and you know I [have] a lot of unique selling points but not sufficiently dynamically different to sway enough, in enough volume, to follow everywhere...”* Nadia, DM

For Nadia, these difficulties were inextricably linked to the size of the organisation (lack of resources), as she added “*I was too small to play, I was being eaten, I was a little... I had the product right but…*”. In response to that, BoPro had to reduce its diversification

in the products and the markets that it could be involved with, a strategy that Nadia would be willing to change only if the right marketing and distribution were in place.

In general, BoPro exported many of its products in many countries worldwide while it was still looking at expanding in many more. In some instances, BoPro would sell its products unbranded as an alternative strategy to compete with its large counterparts. Strategically the company had been considering opportunities to enter in other markets as well, although Nadia highlighted the fact that being small and having a shortage of resources had been detrimental in doing so in the past.

4.3.4.3 The way we are organised: General structure of BoPro

The way BoPro was organised was fundamentally linked to the intricacies found in a small company like BoPro. More precisely, Nadia contended that long-term employment was one of the biggest challenges for the company because “if you bring somebody in with calibre, they will inevitably use you as a stepping stone to move on”. She further argued that when hiring someone for a senior-manager position, the chances would be that this person would eventually move to a large organisation where he/she could make more impact, whilst if he/she was to stay, then it would be probably because he/she would lack the calibre to go somewhere else. Consequently, Nadia noted that many of the company’s functions were staffed on a temporary basis. For instance, along with her CEO role in the company, Nadia was the head Designer as well. Normally, however, the Design department would have at least another Product Designer to work with Nadia in the design and development of new products. At the time of the study, that position was open and Nadia was reluctant about hiring a new one because of a previously bad experience. Nadia had hired a graduate Product Designer who had been training for the job for one year, only to find that person left the job for another company;

> *“I did not get any return as far as I am concerned and I am still angry with her...that's bad return on investment for me, waste of time […] because I've done the training, she only got just [to] the point where she was useful and [then] she's gone”.* Nadia, DM

According to Nadia, part of this could be explained by the mentality of people nowadays such as not expecting to stay in the same job for a long time. Consequently, she

argued that the company had no expectations in retaining its staff for any length of time either.

In parallel to Nadia's Design function was the rest of the Product Development team. John's official role was that of the Operations Manager (OPM), which consisted of Production and Procurement functions. Next to him was Kat, the Manufacturing Supervisor (MS), who was also one of the oldest staff members of the company. Under Kat's direct supervision were two Sample Sewing Machinists. Furthermore, in the Marketing (M) side of the business was Louise, whose official role was that of Equestrian Brand Manager. The latter three individuals, along with Nadia, consisted of BoPro's Management team and where located at what the company called the 'back office'. The manufacturing side of the business further consisted of one warehouse supervisor and twelve Shop-floor blue-collar workers. In addition, the company had also three individuals at the 'front office' where the Customer Care, Administration (Admin) and internal Accounts Manager (Finance) sat. Finally, BoPro had six external UK and International Sales agents, as well as an external Accounts Manager (Finance) (Figure 26).

Figure 26. A visual representation of BoPro's general structure – yellow dots highlight the members interviewed

The data collected from the four manufacturing SMEs presented in this chapter is analysed hereafter (Chapter 5) using the AT's practice-based theoretical model.

Chapter 5.
Data Analysis through the Activity Theory Model

5.1 *Conceptualising the Organisation as a Network of Activity Systems*

This chapter is concerned with the application of the theoretical frameworks developed in Chapter 2, in order to analyse and explicate the phenomena that characterise agility and innovativeness in manufacturing SMEs. Moreover, the following analysis brings together the research approaches devised to guide the study and which were presented earlier in the thesis (Chapters 3 and 4). More precisely, the generic NPD process model (section 2.3.2.1), the conceptual, integrated, multilevel framework (section 2.5), the AT's theoretical lenses to data analysis (section 3.2.2) and the Pytheas process-mapping card tool (section 3.6). Figure 27 provides an illustration of the different research steps that filtered the case study analysis presented hereafter.

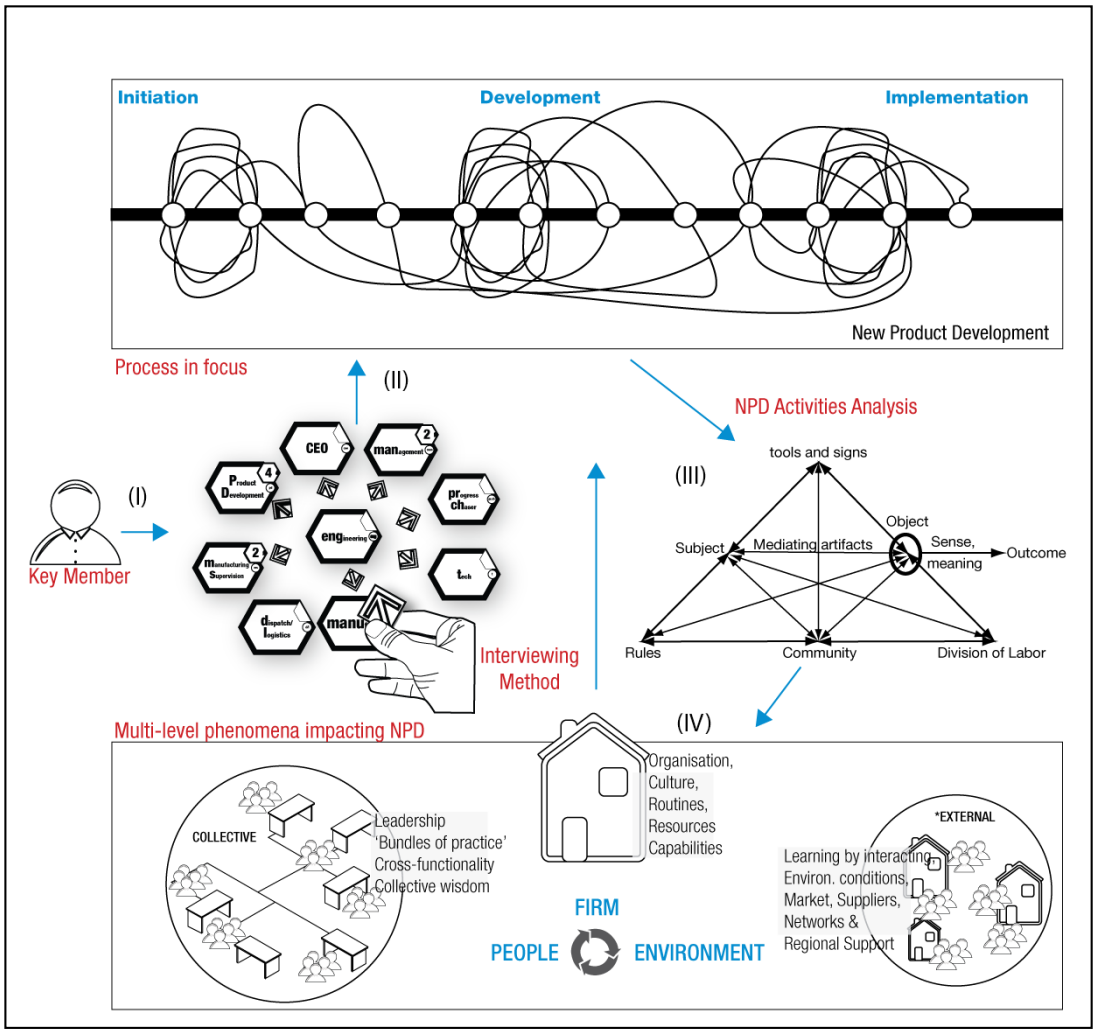


Figure 27. An overview of the data collection process and data analysis

Initially, data was collected from individual key members of manufacturing SMEs through the Pytheas interviewing tool (step I in Figure 27). The resulting visual maps provided valuable insights about frequency and quality of interaction between each individual. Each visual map was compared to others in order to identify recurring patterns or differences. Interviews were transcribed, analysed and organised visually into the three key periods of the NPD process (Initiation, Development, and Implementation) devised in section 2.3.2.1 (step II in Figure 27). Practices found at each period were then filtered based on the AT's theoretical model (step III in Figure 27, see also Figure 7, p.94) driven by its five central principles discussed in section 3.2.2. In line with the AT model, each interview was analysed in order to identify the respondents' *object of activity* (potential outcomes), their roles (*subject*), their membership, relationship and *rules* of *divisions of labour* and/or other *communities,* any *tools and signs* adopted in their practices as well as key *mediating artefacts* involved in the NPD process (first AT principle). In order to satisfy the second AT principle, individual interviews were compared by looking at specific NPD periods and tasks in order to triangulate and identify differing points of view, traditions and interests. Discussions regarding changes to either; organisational or individual practices and approaches were seen as potential historical transformations (third AT principle). Further, data analysis focused also on contradictions, conflicts and any other 'disturbances', which either caused problems or led to innovative responses and expansive transformations, to either the organisation's or the individuals' practices (fourth and fifth AT principle). Finally, the analysis presented in this chapter aims to enable the study to make cross-case observations and identify possible obscure multi-level phenomena that impact the NPD process and, therefore, SMEs' agility and innovativeness (step IV in Figure 27, discussed in Chapter 6).

5.1.1 How to read the following sections

Following are a number of useful guidelines for the reader to keep in mind while going through each case analysis thereafter.

- *The practices of every company studied are organised based on the three key periods (Initiation, Development and Implementation) of the NPD process adopted from Van de Ven et al. (1999) and presented in section 2.3.2.1. The three phases are used as simple themes to help both the researcher and the reader to create a context where a number of phenomena are investigated. However, it is*

important to note that as the process is highly complex and non-linear, these three phases are not necessarily clear-cut in most instances and often overlap.

- *As part of the interviewing process through the Pytheas card tool, the respondents were asked to reflect about both the standard (existing orders) and the new product development process. This was done in order to capture any significant changes involved in practice when moving from highly routine work (production of existing portfolios) to the uncertainties and complexities involved in new product development. The difference between standard product development process versus NPD process is highlighted only in cases that were found to reveal useful insights.*
- *The focus of the analysis is based on the specific actions of the organisational functions/teams involved at each phase as these were reflected by the key organisational members interviewed. However, not all roles and practices discussed thereafter were derived from reflections of the members who possessed them but from the people who interacted with them.*
- *Each activity begins first with a description of the background and key roles of the interviewee, the function/team members he/she is part of (bundles of practices) as well as any other relationships with other communities of practice (internal or external).*
- *Schematic representations (figures) adopting the Activity Theory model accompany each central activity reported.*
- *Real examples of new projects and the detailed actions taking place during them are provided whenever these are available from the collected data.*
- *Personal opinions that reflect certain attitudes and behaviours, regardless of not being part of the NPD process, are still considered important and therefore are reported by carefully introducing them within the NPD phases that seemed to most likely impact.*
- *The respondents generally referred to in the text by their names (pseudonyms) represent those organisational members that were interviewed. On the other hand, members and functions not personally interviewed but appeared in the interviewees stories are only referred to by the function/role name they belong to.*
- *Finally, each case report ends with an integrated visual process map representing the company's NPD process.*

5.2 *Glazing*

5.2.1 Initiation period

The object of activity at the Initiation period is represented by actions that are found within internal and external levels of the organisation. In some instances, the object involves both levels simultaneously, i.e. managing the team internally in order to work effectively externally.

Generating new business

The first priority for Glazing is with its external environment. In this sense, the general object of activity is concerned with all those efforts that may ultimately "*generate new business*" or "*bring new jobs in*" and translate into the initiation of a New Product Development (NPD) process. In general, Glazing is involved in both the re-development of its existing range of products and the development of novel or incrementally different ones (NPD). The main people responsible with the Initiation are the company's owner and Managing Director, Nick (OMD), and the two members of the Technical Sales team, James (TSD) and Peter (TS) (referred to as the front-end team herein). On some occasions, members of the Estimating department also receive new enquiries from the company's clients (e.g. architects or main contractors) but it would normally regard solutions and orders drawn from the existing portfolio (requiring little level of modifications to adapt to a new customer's needs).

At the initiation period, the front-end team share, largely, identical objects of activities. Their number one priority is to spend a great deal of their time externally at the front-end of the business. While there, Nick (OMD) would try to identify potential opportunities for new product development. Nick does this by meeting with market experts/advisors and other personal contacts which help him to better understand the marketplace, its size, status, what do the customers say about it and so forth. These insights in turn influence his decisions about a) what they would have to do as a company to tap into that market and, b) the kind of products that Glazing should be offering. Nick employs several personal *tools* to aid his actions. First, his personal culture and worldview cultivated through several years of practical experience as a Managing Director in large organisations, where he had taught the importance of his role in relation to the front-end of the business. Conceptual tools employed to support the transformation of the object into

an outcome are *heuristics* such as '*demand creation'*, '*looking out of the window*' and '*front-end of the business*', referring to actions described as – first to "*look at the market and then look at the customers…it is the market first, customers second and this is what I do in this company*" (Nick, OMD). These early actions enable Nick to strategically think about potential market directions and to coordinate, internally, the focus of the Technical Sales team accordingly.

> *"Part of my job then is to take the Sales and Tech Sales Director and say 'you are focusing on healthcare, so, off you go...and he focuses there and chases all the projects in healthcare and looks at other markets like the police cells etc."* Nick, OMD

Like Nick, the Technical Sales team's actions are primarily positioned towards the external environment, or as they put it, to "go out there and speak to potential customers" (James, TSD) and "try to generate new business" (Peter, TS). There were several tactics through which new projects are identified by the Sales team, all of which are significantly supported by their *experience tool*: both James and Peter have been at Glazing for many years (22 and 13 years respectively) and they both have a technical background and have been previously members of the Drawing Office (a function mainly involved during the Development period). As a result, when James and Peter meet certain professional end-users such as architects, their technical knowledge of Glazing's products enables them to cross-boundaries between the two parties because, as James put it;

> *"…architects […] are quite demanding and they like to see... they do not necessarily like to see a Salesman, what they like to see is someone who tells them technically about the project. They don't want to speak to a salesman who is then going to pass it to somebody else and so forth. They want somebody who can tell them technically about what the whole thing is…"* James, TSD

Interactions with architects are frequent for James (TSD) and Peter (TS) for other reasons too, such as to give seminars around security and fire glazing issues and solutions. In other times, the team represents the company at various exhibitions and professional events (e.g. health-care events). There, they get to meet with new and potential end-users (e.g. NHS), demonstrate Glazing's product capabilities and listen to their problems and needs. This is an important practice as Peter and James often discover gaps in the market that the company could potentially explore/exploit (hence generate new business).

Market/ Customer-driven attitude

James and Peter's technical competency enables them to draft early designs (boundary objects) and offer them to the potential customers (Peter, TS). The team's customer-driven approach was expressed through *heuristics* such as "how to satisfy the customer" (Peter,TS) and "trying to make customers happy" (James, TSD). Consequently, the difficulties of attaining the team's object of activity (generate new business) at each new project varies according to the complexities inherited of the specific market/customer involved each time. At the Initiation period, this translates as the degree of complexity within the *network of contacts* that Nick (OMD), James (TSD) and Peter (TS) need to interact. A great example can be found in NPD projects for the healthcare market where Peter and James had to deal with the uncertainty of offering a particular type of security glazing suitable for a hospital , while communicating with the client (a public organisation such as the National Health Service (NHS)) indirectly through hired contractors;

> *"…because at the minute the big thing is sliding windows, and a year ago we had not done any sliding windows before, but because NHS said 'we would like sliding windows' we started doing it […] might be something as a security hospital […] If we take a hospital for example, your customer in the end of the day is NHS […] They would hire a contractor to get all the work done…"* Laura, DE

Object of Activity: shift from external to internal.

When a new enquiry is received, both Nick's and the Tech. Sales team's object of activity would shift towards the internal level. As mentioned earlier, after understanding market demand, Nick (OMD) is concerned with the management of the business internally. All new enquiries received by James (TSD) and Peter (TS) are disseminated internally and together with Nick they have a first informal meeting and discussion around them (Figure 28). The next individuals that are called in vary according to the type of new project and whether it is about re-developing an existing solution or an entirely new product.

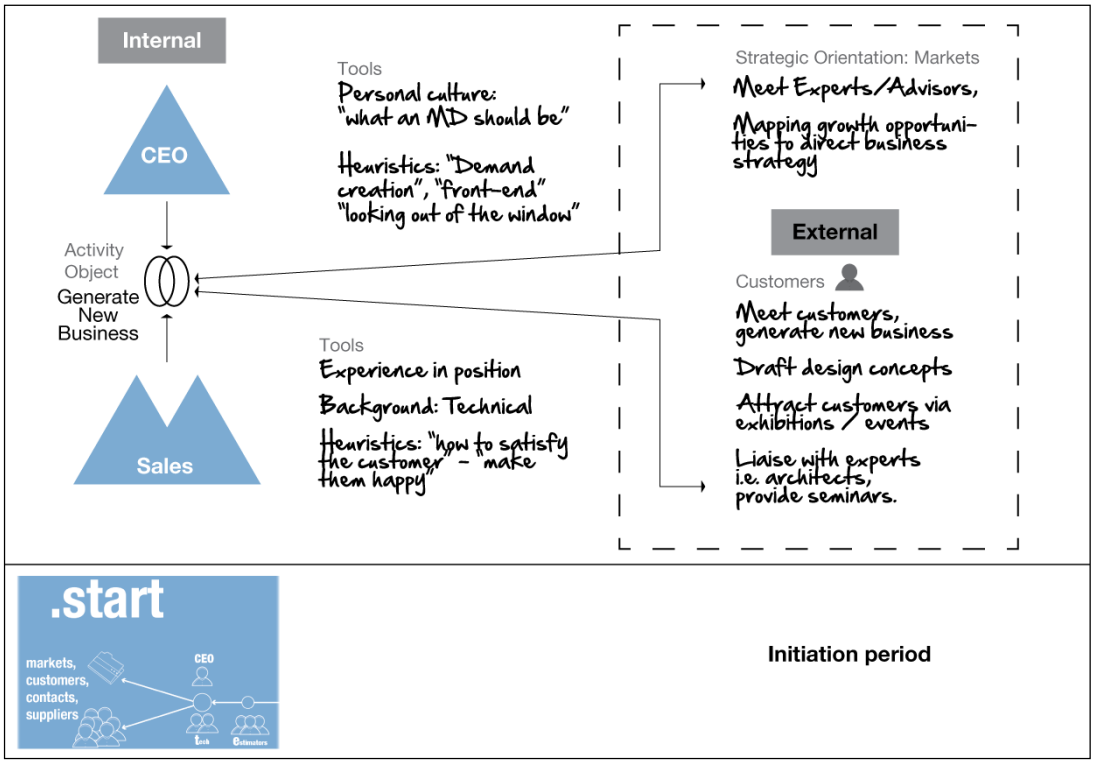


Figure 28. Market and customer-focused activities at the Initiation period

Re-development - 90% of projects

In the first instance, where the new project regards an existing solution, the process follows a relatively straight forward direction as it mostly involves incremental changes.

On the external level, Peter (TS) and James (TSD) (with input from the Design team – see analysis of the Development period) are in contact with the system suppliers from which he searches for the most appropriate system to meet the needs of the specific project. System suppliers provide Glazing also with the relevant technical information needed for the Development period. Moreover, system suppliers occasionally go to Glazing to ask for the manufacturing of a system for their customers.

Internally, the next individuals to be immediately called would be any of the three members of the Estimating department. The Estimators' object of activity is the generation of a pricing quote regarding all new enquiries. More precisely, they would "*collect all the details about the project, pull together all the information and put together a quotation and a price, what will it cost for that job*" (Laura, DE). There are three members in the Estimating department, one of which is John (ED), the Director of the team who has been with Glazing for 17 years. The team internally is organised according to the material that is used in each project, hence one might be responsible for aluminium

and another for steel-based products. John described the team's involvement as 70% technical and 30% procurement, separating the two in terms of priority and amount of work;

> *"…everything has a technical aspect about what we do, product selection, advising, it is a sort of dynamic enquiry...you start on one path and then you follow another...so I would think that it is probably 60-70% technical - 30% procurement, because you have to sort the technical aspect before you go on and find about the prices… in terms of Estimating we do procurement all the time...so we go out in the market for prices and materials."* John, ED

The members of the Estimating team have a good technical understanding about Glazing's products because of their experience through their daily involvement with every single project that enters the company (Paul, TM). In many instances, this experience tool allows them to act as Sales persons and receive new project enquiries coming straight from clients such as main contractors and/or architects, although it involves re-developing solutions from the existing portfolio.

In all scenarios, whether the new enquiry comes first from the Technical Sales team before it reaches the Estimators, or the Estimators leading it from the beginning, any technical issues relating to the feasibility of the specific project are dealt with by the Design team (discussed in more detail in the following paragraphs) and the Production side of the business (Figure 29). Finally, after dealing with any design and technical issues, the procurement, final cost of the new enquiry and the customer's willingness to make the final order, the process then moves to the Development period.

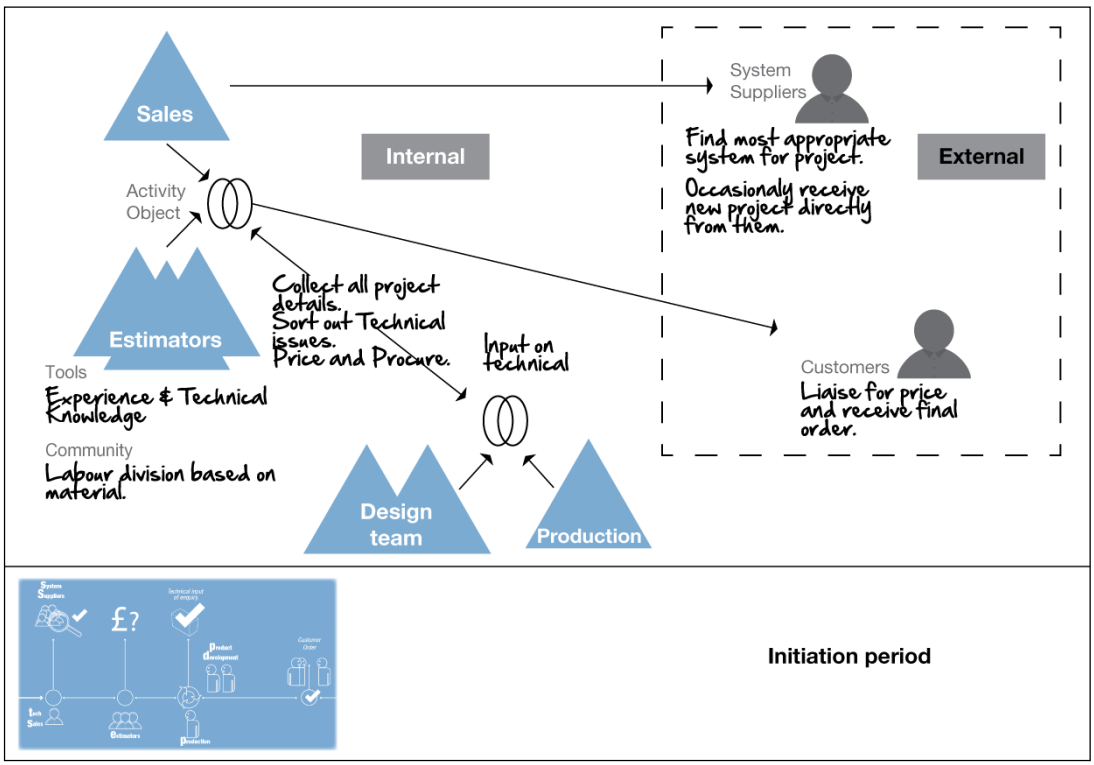


Figure 29. Re-developing from existing portfolio

New Product Development – 10% of cases

New enquiries that are "a little bit different, a little bit out of ordinary that needs to suit the customer's needs" are only led by the front-end team. Contrary to the re-development process, a potential NPD would require a different approach by them. As Nick (OMD) noted, the team waits until they have enough knowledge of what "*is the size of the market, this is what we have to do and now here are the products we need*". A vital question for Nick (OMD), James (TSD) and Peter (TS) then is to find out whether the company has the technical capacity to supply products to that market in the first place. To do so, James and Peter work very closely in particular with Paul (TM) and Laura (DE) from the Technical (Design) team.

As mentioned earlier, the Design team consists of Paul, Technical Manager (TM from now on), and Laura, Product Design Engineer (DE from now on). Both of them were relatively new members of staff at Glazing as they have been there for less than three years (at the time of the interviews)**.** Paul (TM) is an experienced fabricator previously employed in a number of manufacturing companies. His focus of activity is primarily the design and development of new products. In addition, Paul is responsible for a number of information managing activities such as keeping up-to-date with Quality

Assurance (QA) issues and British Safety Standards, building regulations, product manuals, publication manuals, etc.

Concerning NPD, Paul shares his role and object of activity with Laura (DE). Although new in the organisation, Laura had helped the company to create a more coherent Design Process. More precisely, Laura was studying an MA in Design programme at University where she was employed by Glazing through a Knowledge Transfer Partnership (KTP) scheme the company ran with the University. Through her activities there, she had developed a NPD tool (boundary tool) that had "*put a little bit of structure in place so that NPD and designs could have something to follow*". With the support from the University, Laura managed to implement a process tool that allowed Glazing to document every stage where every member is in relation to that stage. Moreover, Laura's lack of experience in the company (compared to her colleagues) was counterbalanced by her skills in the visualisation and communication of designs through software tools such as 3D CAD.

On a daily basis, the Design team spend most of their time with either the design and development of new products and/or liaising with the Shop-floor's blue-collar workers about manufacturing issues and potential improvements to existing solutions. The team is effectively run by James (TSD), however their interactions mostly occur when a new project requires their input (i.e. NPD). Their role at the Initiation period sits at the core of the process, as the team's object of activity is to work out new design solutions and draft ideas and concepts. These actions would very often take place in close collaboration with James (TSD) and Peter (TS) (and often with input from Nick (OMD)). On the other hand, at the external level and during the concept generation, the Design team would keep in close touch with the potential customers either directly or through the Tech. Sales team (Figure 30).

> *"We try to get a better understanding of what the end user will be using the [product] for… to make sure what we're developing is not only what we want but it's something they are going to want when we go out there."* Paul, TM

In many instances, the new product idea would come after noticing the needs of the end-users who have expressed a 'problem' with existing solutions in the market, yet without knowing what the alternative could be;

"An example was when we came up with a new window system called a [clean vent] which is a sliding security window, which gives you access to clean the glass that's situated behind the security mesh - we didn't have that product a year ago but it was something that our clients were asking for regularly…so to give the clients what they needed, we had a meeting, we sketched down ideas, and over the course of about 2 to 3 months we came eventually with this solution that we thought it would work" Peter, TS

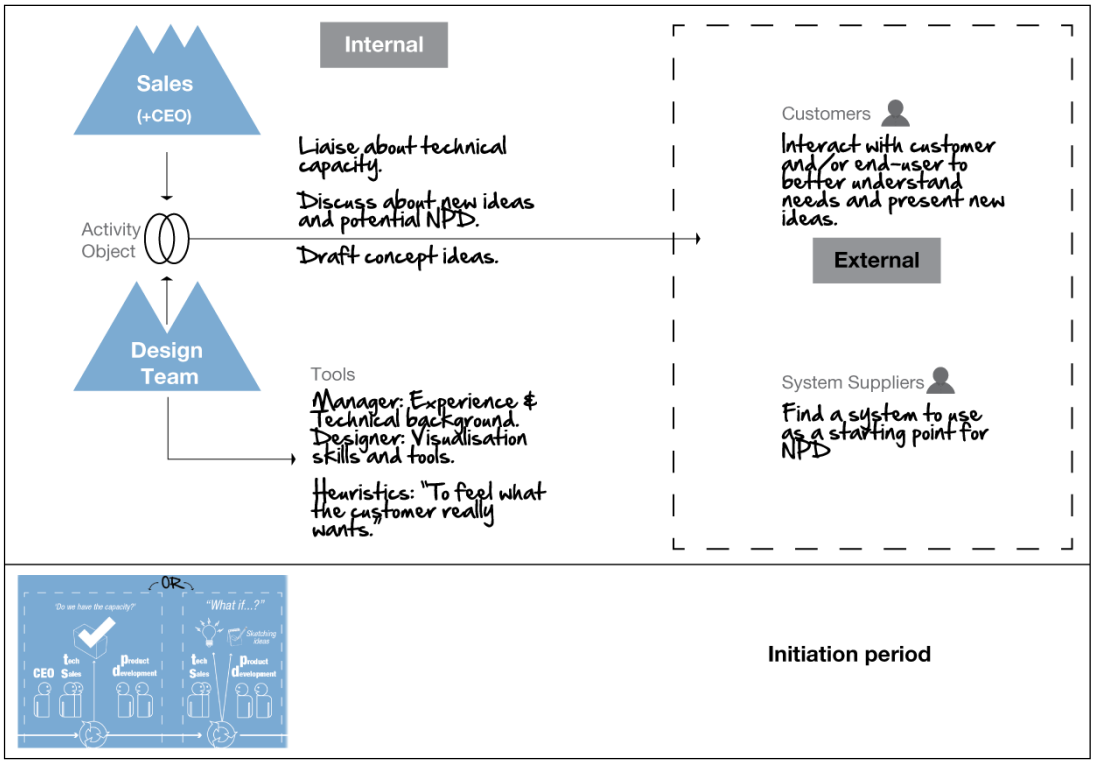


Figure 30. Conceptualising and drafting initial ideas during the Initiation period

Pre-Development period: Managing the business

Before the transition to the Development period there is a phase where Nick's (OMD) object of activity transforms into an internal activity; that is, the object becomes the "*management of the new business*". More precisely, Nick would conduct a first formal senior management meeting where each manager of the different internal functions would be informed about the new project (Figure 31). One part of the discussions there would be about analytical future projections of the product's longevity, its expected sales and potential return. Another deals with the planning and working out a plan in relation to the existing workload.

For Paul (TM) and Laura (DE), a priority is with the engineering side of the project as it is crucial to figure out soon (often with input from Operations Manager, George (OM)) the technical aspects of the new product;

> *"…how we can make things work, any processes that we need to look at - not only for us in the Technical Department but also for Production, so we are looking at any tooling they might need , any engineering skills they might need to manufacture the potential product driven by R&D [referring to the market research]"* Paul, TM

Very often, it is during this management meeting that crucial decision-making is made about whether or not to move forwards with a specific project. Yet, as Nick (OMD) highlighted, the informal interactions and feedback between the management team on a daily basis were a lot more frequent than formal meetings "*because we cannot wait for them to happen in order to work*". Finally, having decided to accept the job, the next period to follow is the actual Development.

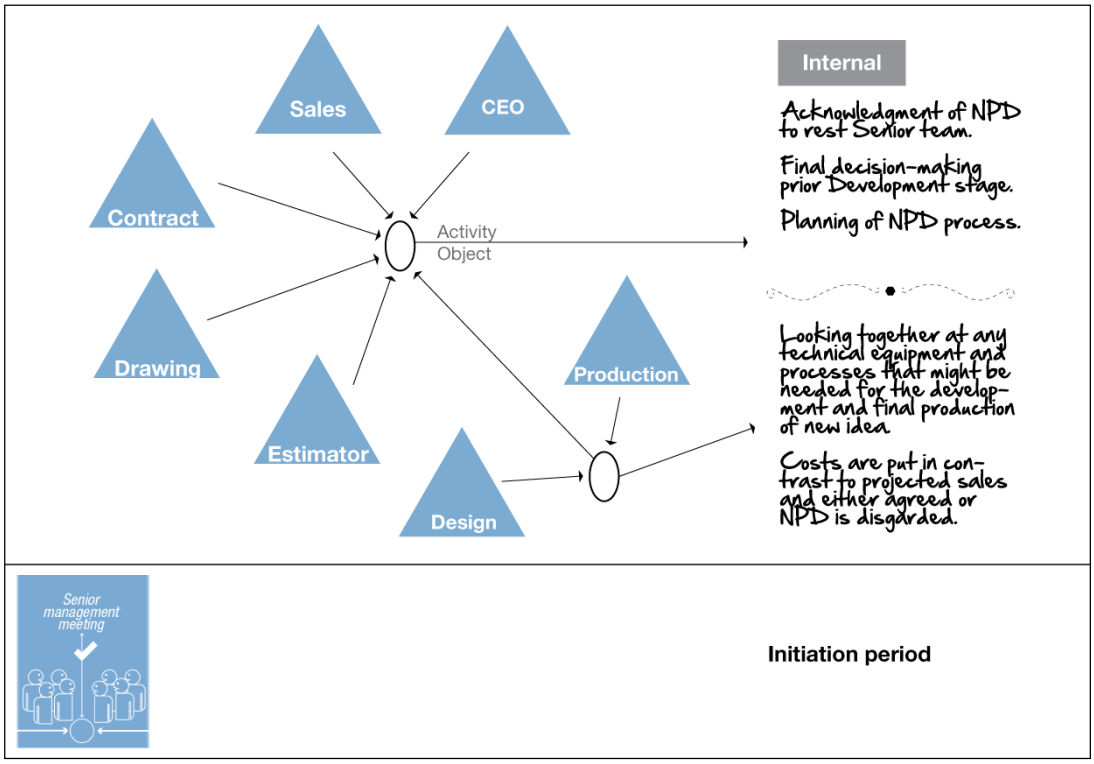


Figure 31. Transition from Initiation to the Development period: senior management meeting in-forms managers about NPD

5.2.2 **Development period**

Development of a New Product

At the Development period of the NPD process, the Design team's activity becomes more central and transforms from sketching conceptual ideas into a more advanced creative practice. Similar to the Initiation period, internally and during the design process, Paul (TM) and Laura (DE) still work in close collaboration with the Technical Sales team and occasionally with input from the Production team;

> *"As a company when we develop new products we try to involve as many people possible. We as the Technical Sales team, the Product development team, the Manufacturing and Shop-floor have a great density of interactions when developing a new product"* Peter, TS

As described earlier (Initiation period), the Technical Sales and Design team form a bundle of practices (Schatzki, 2005) in their attempt to find the right systems (from external suppliers) that offer a good starting point suitable to the needs of a specific project. Similar to the complexities faced by the Technical Sales team at the Initiation period, the difficulties for the Design team in attaining their object of activity (NPD) would vary according to the particular project. More precisely, Laura's (DE) and Paul's (TM) main activity would have a dual focus; not only to understand the needs of the particular client (in collaboration with the Sales team) but also to resolve all technical issues imposed by the particular project. In the project example discussed at the Initiation period involving the development of security glazing for a public hospital, the team's design actions were significantly driven by the particular security peculiarities;

> *"…so you have to make sure what they said they want, we actually feel it is correct; we wouldn't want to fit an inappropriate window that should have been for major security but it isn't and that could lead to a disaster… So we are trying to make sure we are specifying for the right job."* Laura, DE

To achieve this, the two teams work in parallel both within the internal and external levels of the organisation. Externally both teams focus on the project's needs, an activity that involves talking to the customer and finding the right system suppliers. Whilst for the Sales team this activity would be a continuation of the same object of activity at the Initiation period, for the Design team the involvement with the external

client directly impacts their design process. The following project example (1) illustrates this;

> *"…we are constantly working with the end-user to make sure what we're developing is not only what we want but it's something they are going to want when we go out there, before we find the best products, they (Sales) are the ones who are in contact with the people who are going to use them… then we develop this into steel which a higher level of security e.g. there are cases where we use both aluminium and steel for different profiles, and that's a design problem we work in the Technical Department […] so we had to go out and find who had the right systems that would be appropriate for us to use and create for our needs, we looked at about 10 different System Suppliers and we found one that we felt we can do something with, we brought it in, got a sample of it and all the paperwork to go with it, but it was a bulk standard of an aluminium for sliding window... it didn't have any excess security and it was full of leakage areas which for us is a big thing... so it was a case of us having to sit down and think what changes we need to make to get it to a product that would be suitable for the different markets we work."* Laura, DE

At the internal level, the Design process often involves collaborative efforts amongst the two teams and Nick. The following project example (2) demonstrates how this is done;

> *"It was about a window handle that was very easy to break, so we had to sit down and think of solutions. We did a brainstorming with Paul and put a number of different ideas, we then grouped them according to their technical difficulties. Then we reduced these ideas into three. The next meeting involved the team, Nick (MD) (who is always involved in NPD as he enjoys being in the ideation process and has a Sales background too), and James (TSD). All together as a team we go through advantages and disadvantages and we collectively decide which one we want to develop further…the team has different skills and different backgrounds so that helps to make a decision based on a multiple perspective."* Laura, DE

Sample Prototyping

For Paul (TM), an important part of this activity is the management of information such as fire test reports that have been carried out by third party companies "and looking through again […]is it feasible, is it possible and ultimately issuing a certification for that product, will it work?". At the same time, Laura (DE) is involved with developing more advanced design work through software tools, which eventually the team uses to analyse in order to test its effectiveness. These designs become later the vehicle for the team's object transformation, and that is, transforming the intangible idea into an actual tangible product. Hence, the team develops internally the sample of the

design solution by using the company's manufacturing tools and the personal experience of the team's manager, in particular. Although the team could be asking other experts from the shop floor to help with the prototype development, they were also conscious of their existing workload. Nevertheless, the task of sample-prototyping offers an opportunity for the Design team to informally interact with the shop floor workers and have early discussions about production issues.

Developing a sample prototype of the product allows the team to undergo a series of internal tests and analyses and make the necessary changes before it reaches the potential customer. It also allows the team to experiment and explore different possibilities. The design process along with the sample development is often a lengthy process, which might take more than 2-3 months. This activity is the most crucial according to Nick, whose key role is to constantly keep an eye on the entire process. As he noted "*the hard part is making the product, how it looks, how it functions etc. and that takes a long [time]".* Furthermore, the analyses of the samples could eventually be the main factor for deciding whether to go forwards with a given project or not;

> *"In another case we had a new enquiry [where] we had to develop a few samples and soft models but it eventually didn't go well because we sat as a group again and decided that the costs of maintenance for this product would outweigh its financial benefits so we decided not to go further and look for other opportunities."*
> Laura, DE

Following the internal tests and analyses, externally the prototype transforms into a tool of communication between Glazing and the client. More precisely, when the teams (Sales and Design) 'feel' that the sample product is ready, it is then given to the client in order to be tested and analysed by them. This is an important moment in the NPD process because important decisions are made about the future of the entire project life. If the proposed product passes the customer's scrutiny then the process follows the same route as that of re-developing an existing solution described earlier. Nick (OMD) would carry additional management meetings with his senior management team in order to update them about the NPD (Figure 32).

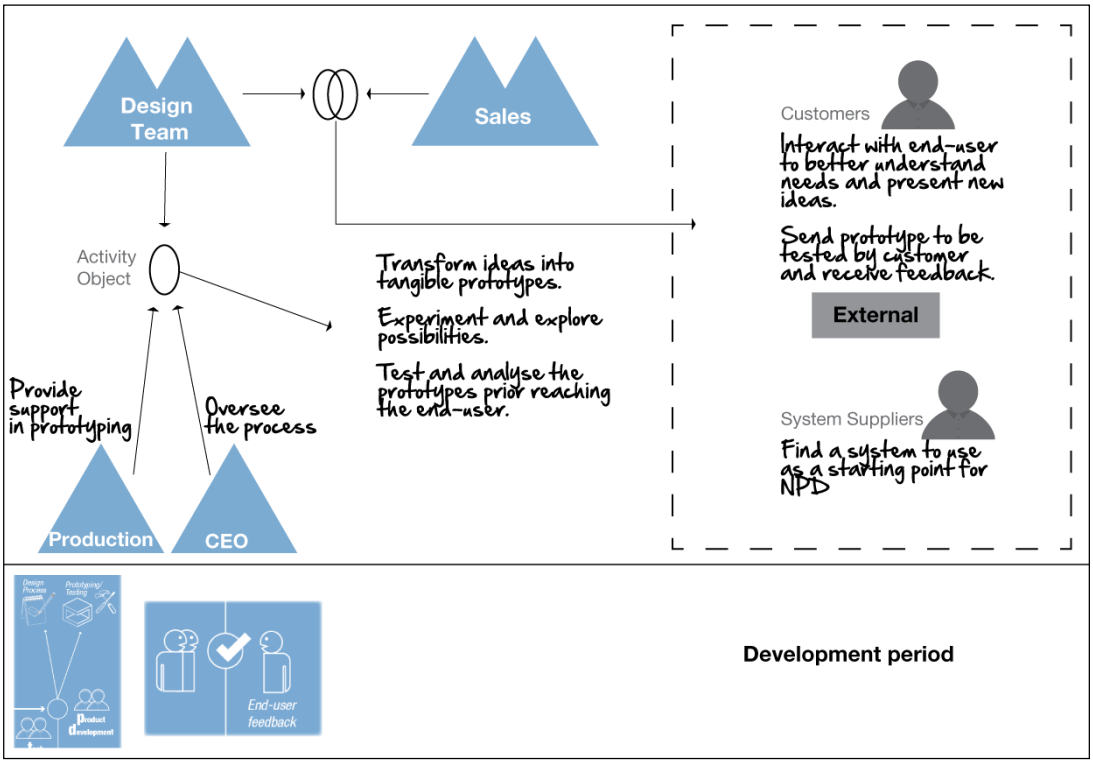


Figure 32. Activities while designing and prototyping early in the Development period

During the Development period the Estimators wait for the Design team to come up with the tangible outcome that will allow them to put a realistic price on the final product. As John (ED) argued, his role is in the periphery and becomes active at the end of the design process;

> *"It's never finalised until making it, unfortunately there is always something that [doesn't] work on that 3d model, it isn't quite right, for example, so we are getting feedback...this product today is slightly different tomorrow…"* John, ED

On the other hand, the final designs are sent to the Drawing Office team who standardise the drawings, not only for the particular project but for future ones too. Along with their internal interactions with the Estimators, Contracts team, Logistics and the people at the Production, Keith (DOM) and his team at the Drawing Office are also involved externally with the Architects who need to approve the designs so they know exactly what they are getting into, prior to the Implementation period (Figure 33).

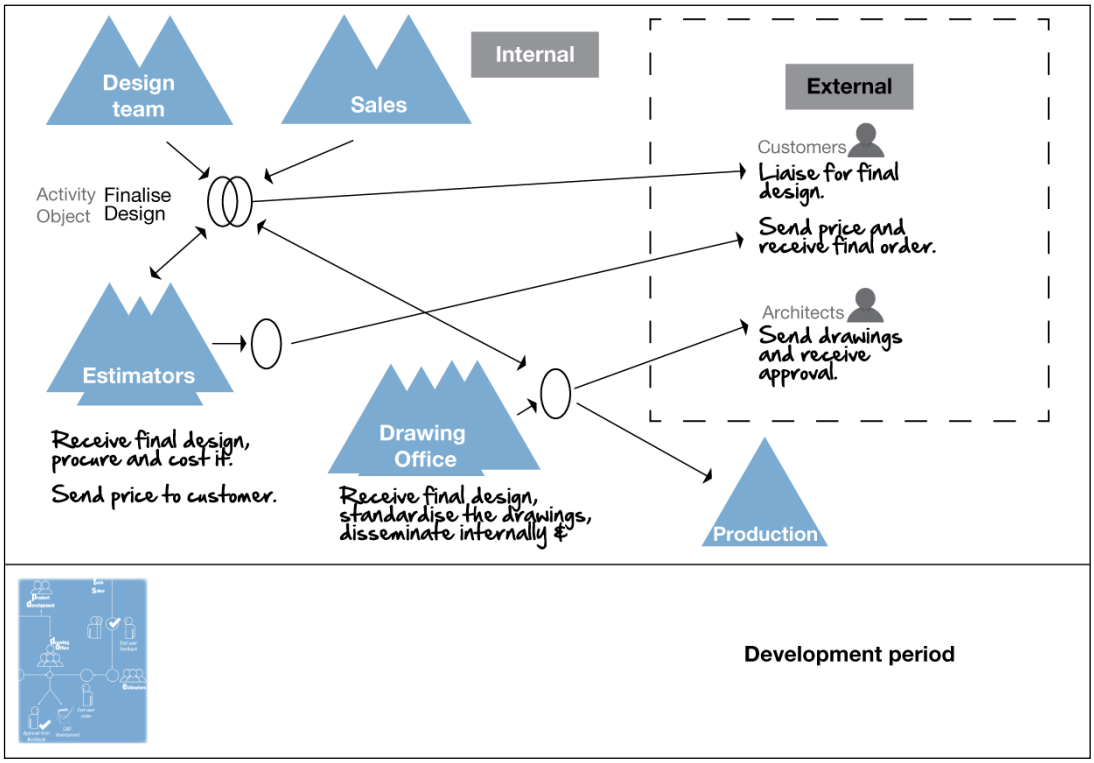


Figure 33. Transition from Development to the Implementation period: finalising design and pre-paring for manufacturing

Developing an existing solution

As noted earlier, at the Initiation period an enquiry that involves an existing solution proceeds with the Estimators collecting all the relevant information regarding the project. The Estimators would have worked also on batch sizes and materials, what are the best products to use and so forth and "cut the cost down and make sure it is suitable for the client and provide alternatives as well." (George, PM)

When finally an enquiry becomes an order, there would be new 'players' to enter the process. More precisely, the next immediate individuals to be called in are the Drawing Office and the Contracts team who are effectively sorting out the timetable for the job. Together, the three functions review the final order for any changes from the original enquiry. For the Drawing Office, the internal object of activity is to produce standardized detailed drawings based on the information given from the Estimators. Externally, the Drawing Office team occasionally would also interact with the customer to get further information related to the product to be developed according to the particular needs of the project. Both internal and external activities lead to the creation of drawings that impact the work of many other functions in the organisation (Figure 34).

The Drawing office team consists of manager, Keith (DOM), who has been for 17 years with Glazing and his two associates. Along with the development of detailed drawings, his role is to deal initially with planning when things need to be done and the general management of the workload and of his team. Occasionally, Keith and his team consult the Design team about specific technical issues that they might encounter. Paul's (TM) and Laura's (DE) activity at this period can be described as *peripheral* as they would be involved when asked to provide support.

According to Nick (OMD), efficiency is vital for the Drawing Office and it is something that has been improved significantly the last 8 years with the introduction of CAD software resources;

> *"…8 years ago to do the turn over that we do today would have required about 10 people in the Drawing office, today we are doing the same turn over with only 6. It is not that we are working harder, it is just that we are now using computer software and has increased our efficiency. That is a very important part of the business."* Nick, OMD

At the Development period, the team's internal customers would be a) the Contracts team who put the programmes together, b) the Logistics who do the procurement and c) the Production, who without the drawings cannot manufacture the products. When Keith (DOM) and his team have the detailed drawings ready, they first pass them to the Contracts team.

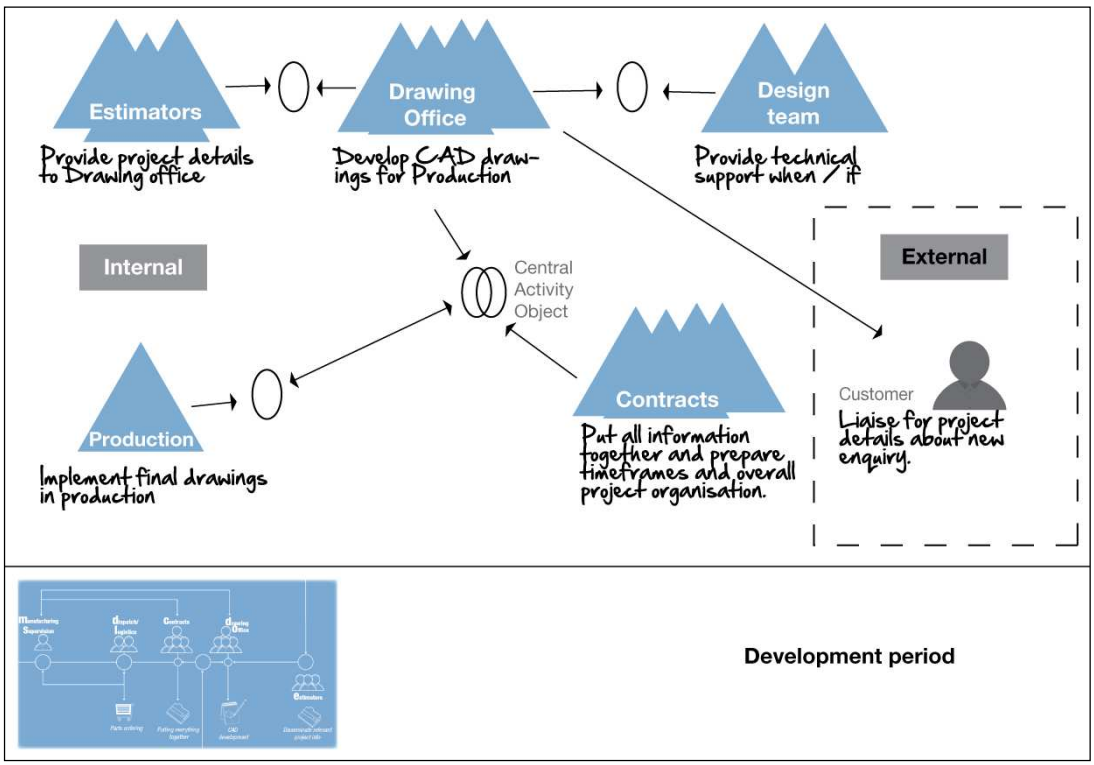


Figure 34. Key activities while developing an existing solution to suit new customer's needs

For the Contracts team, the object of activity spans across the Development and Implementation periods of the NPD process, both internally and externally. At the Development period, the team which consists of one Director and two associates (not interviewed) are linked with the Drawing Office because they have to plan the entire process by doing "the paperwork, making sure they have got everything they need, putting a timeframe together so, we need approval, we need dimensions for this stage, we need our drawings approved by this stage…" (Laura, DE). Furthermore, through the detailed drawings, the Contracts team liaises with George (OM) and they plan together the duration of the production process as well as the date that the products will be ready for installation. The next period is the Implementation, where the activities around production would take place.

5.2.3 **Implementation period**

The Implementation period at Glazing involves two overall objects of activities. First, it would be about manufacturing and dispatching the new products to the customer's site, while managing their installation there. Second, it would be about managing the knowledge gained from the NPD process in order to transform it into a routine; in other

words, transforming the NPD into a standard product solution ready to be re-developed and customised to suit new clients. Accordingly, the teams' object transforms as well to serve their own priorities and goals.

Re-development: Manufacturing & Dispatching

At the Production side of the business, George's (OM) object of activity would be to oversee the transformation of raw materials into finished goods during the manufacturing process. Under his management, there were two manufacturing supervisors and specialists for each of the main materials, Aluminium and Steel, and about 30 blue collar workers at the Shop-floor. George would also rely on the Contracts team timetable to manage the individuals in the factory and plan the production ("plan the orders in, plan production slots, making sure the process control standard are all in place to work correctly"). In addition, he would also be involved with the maintenance of the factory tools and machines, an activity that he finds very important since, as he argued, "as long as you look after the machine, they look after you too" (George, OM).

When the detailed drawings reach his division, George would list everything the factory needs to get the product made, and that information would be shared with the Logistics department who control the ordering and deliveries of the materials needed. Together with input from the Finance department and occasionally Nick (OMD), they decide how to buy the materials for everything to hit the factory according to the timetable but as well at the expected costs ("if it takes too much time for the material to arrive we are going to lose money" George, OM). In some cases, especially when the new project enquiry has been led by the Estimators (during a standard enquiry), George would liaise with them about the best product to use, any systems etc., and would also keep in touch with the System Suppliers**.** Having everything sorted, it comes down to George's responsibility to get it made (Figure 35).

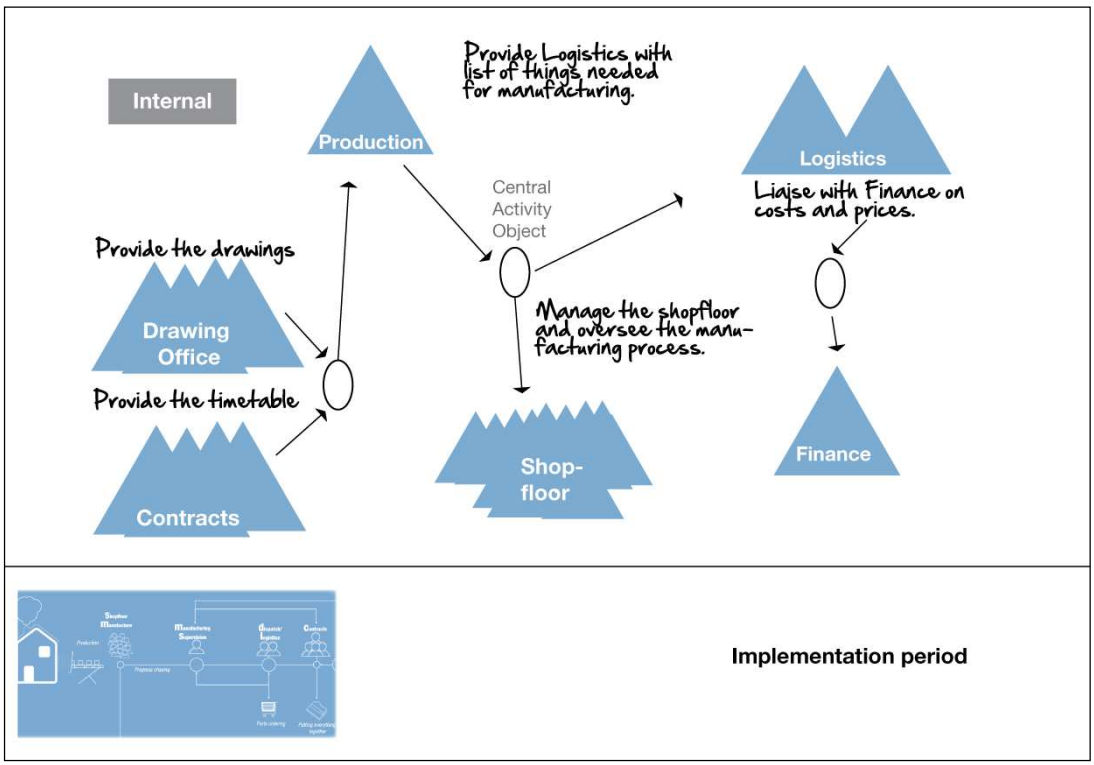


Figure 35. Activities during the production of an existing solution

At that period, the Sales team would be involved with progress chasing at the shop floor checking how far production is and to make sure that it meets customers' expectations. At the external level, the team might be asked to chase customers for financial reasons such as when not on time with payments.

The site installation of the re-developed systems normally involves different teams for different reasons. One of the most frequently involved teams is the Drawing office whose drawings provide the guidance for installing the systems and for that reason, the team is in constant interaction with the site manager and the subcontractors who do the actual physical work. With them would also be the Contracts team, who are in charge of the site. In the periphery are the Production Manager and/or the Design team, who might be called for any technical issues with the product. Figure 36 provides a visual representation of the standard product development process.

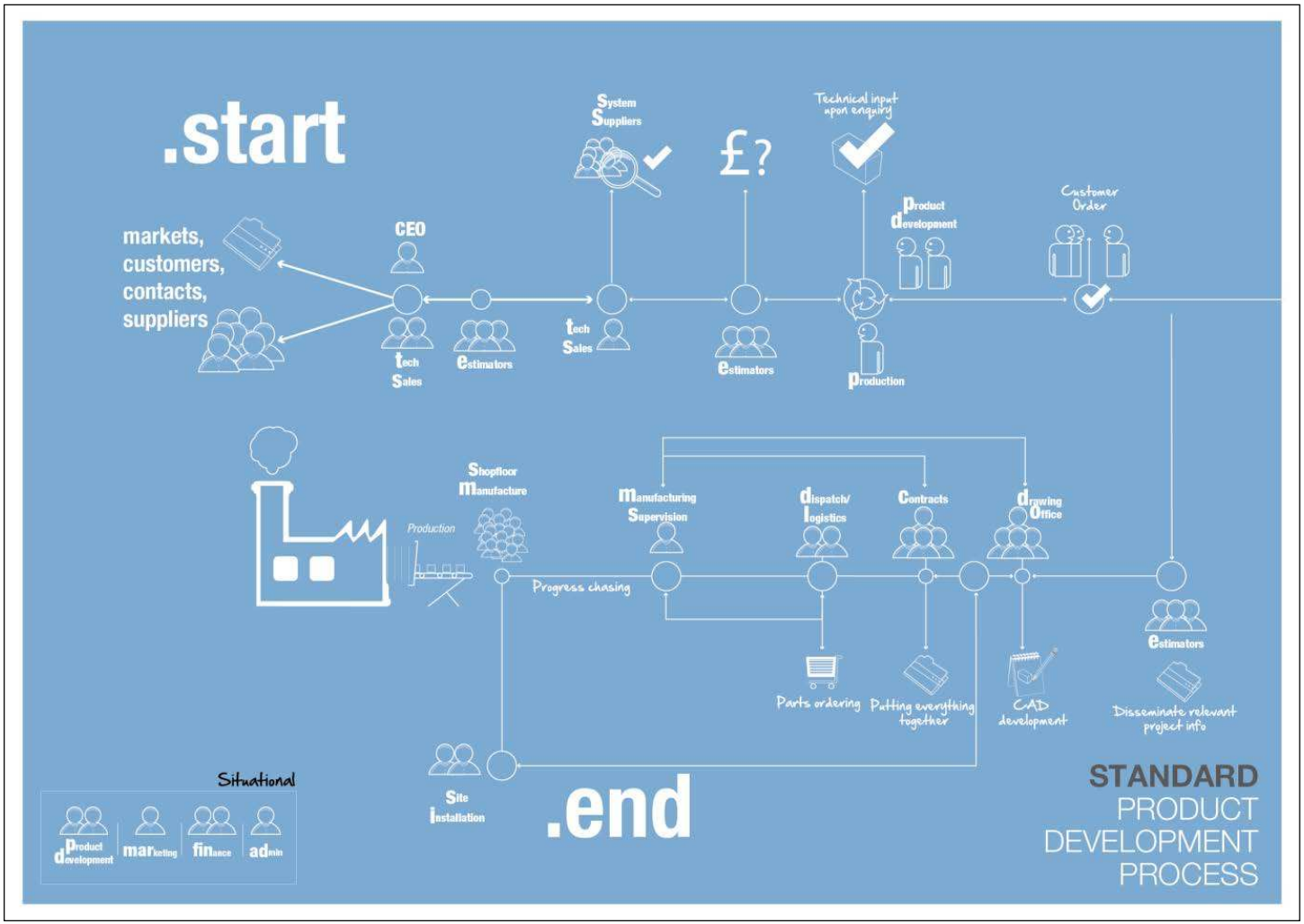


Figure 36. A general schematic representation of the way a standard product development process unfolds at Glazing

NPD: Design Input and Management of New Knowledge

One significant change that would occur during a NPD is the involvement of the Design team with regards to the Production. In particular, Paul (TM) and Laura (DE) would spend much time overseeing the manufacturing process of the first 2-3 new products, checking for any faults in the product to quickly resolve. At the same time, the team listens to the shop-floor workers with any needs (e.g. a special manufacturing tool) they may ask to help improve the manufacturing process.

Following the production of the first batch, the Design team's object of activity moves from developing into managing the knowledge gained through this process. More precisely, Paul and Laura organise a series of meetings with the people at the factory (production and shop-floor workers) with whom they have new product reviews (Figure 37). During these meetings, the team gather the shop-floor practitioners involved in the NPD and discuss the best practices, prior to getting to the next production prototype.

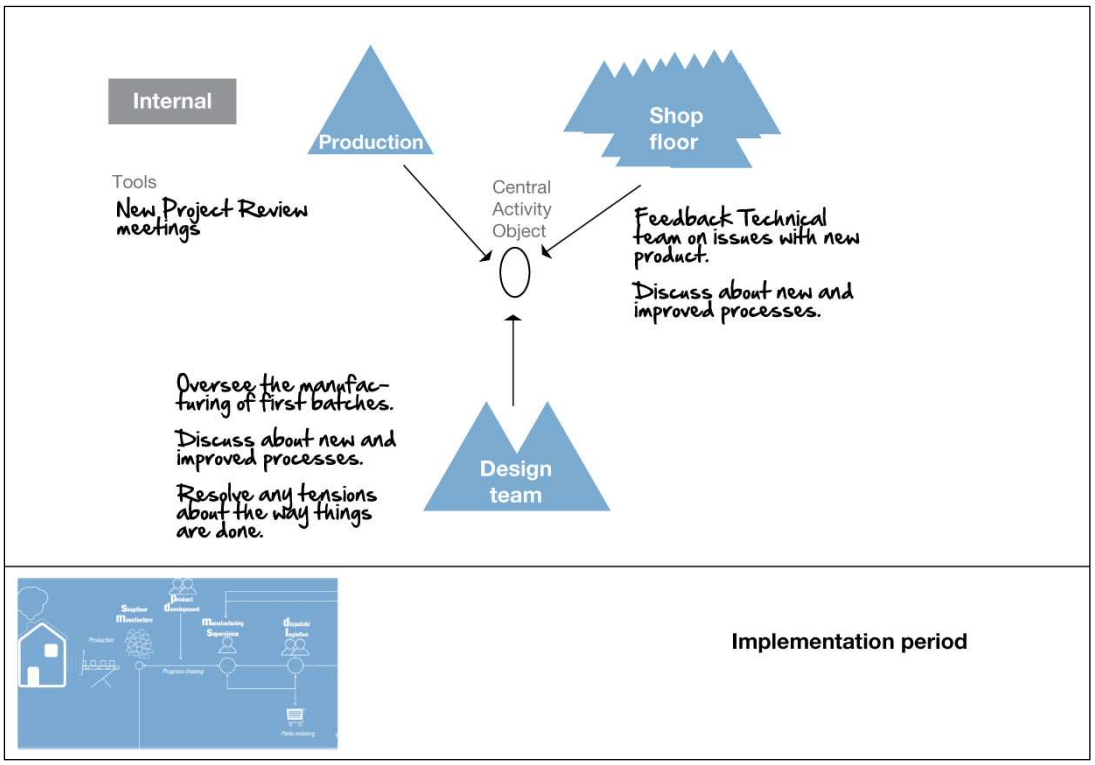


Figure 37. New project review meeting about the new development

Participants are able to mention problems with certain processes discuss potential changes and reach mutual understandings of the way things are to be done;

> *"…this worked very well because we found out a lot of the things they were just moaning about, they did raise concerns that we've now been able to change, and it also gave us the opportunity to explain why some of the choices have been made, so they would say why we are doing things like that when we can do it like this – and then we explain why we do it exactly like that and not otherwise, so that created a shared understanding and stopped any complaints."* Laura, DE

Glazing benefits from these meetings not only because the teams resolve any issues between their practices but also because very often unexpected ideas produce new processes and practices. According to Paul (TM), many times the team had been called to discuss a new process or a new practice that the workers had found to improve existing capabilities and they are then asked to help to implement this. In other instances, the Production workers had been concerned with the future of specific projects that require unusual high amounts of time from them. In such cases, they would liaise with Nick (OMD) about bringing in new machines and tools for the production, a decision that Nick makes based on his and the sales team projection on the market's value. Figure 38 depicts a visual representation of the NPD process at Glazing.

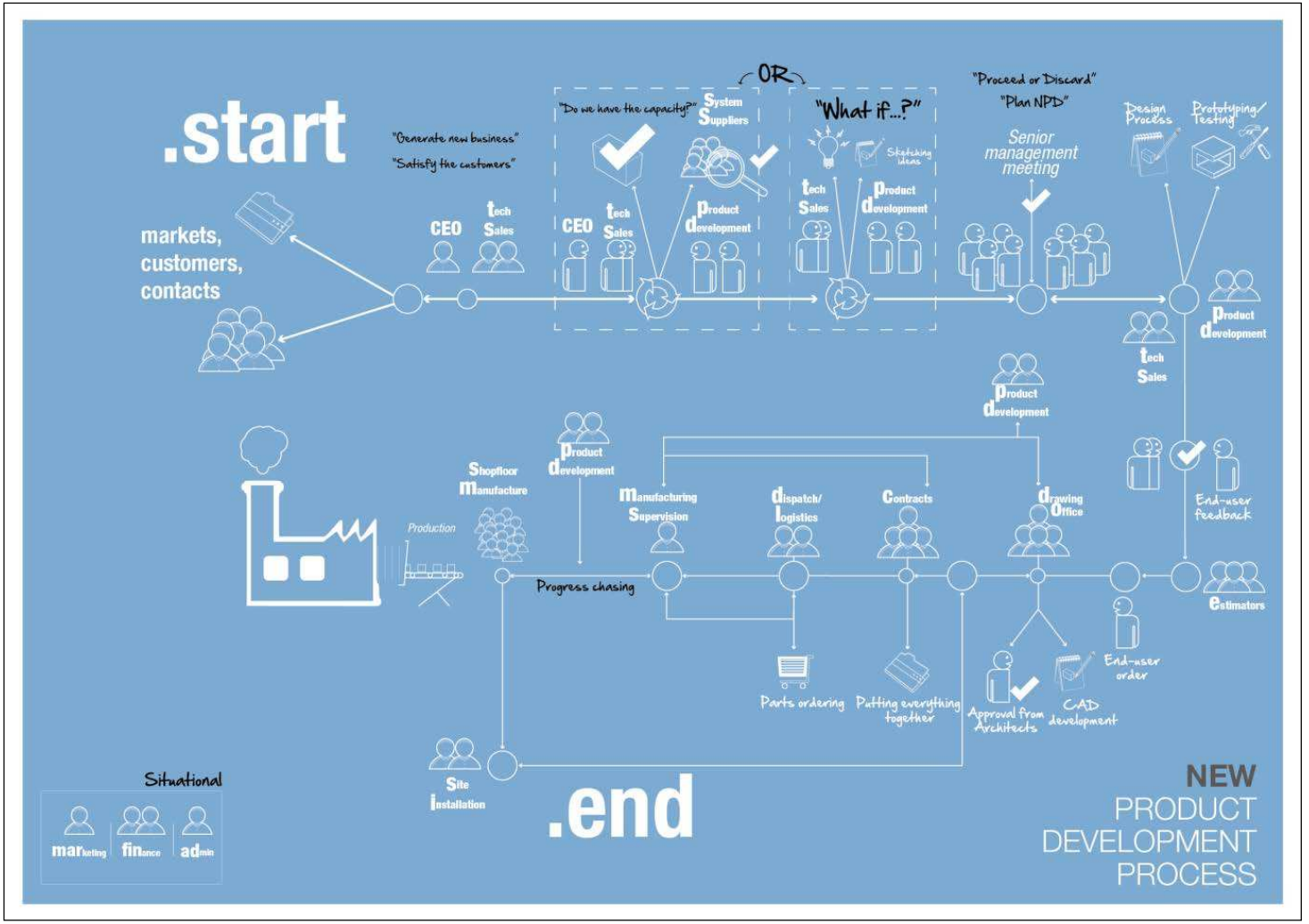


Figure 38. A schematic representation of the NPD process at Glazing

5.3 *Brushware*

5.3.1 Initiation period

Traditional business – 50%

Brushware's traditional side of the business concerns products from the company's existing portfolio and require no significant creative efforts. Therefore, the process is relatively straightforward and routinely managed by the operational organisational members. In fact, Chris (MD) noted that because of the long history in the area, the company has well established routines in place that enables it to function without any of the senior management team being present at the organisation at all;

> *"So If no one turned up, the business would open up, would start, it would run, it would take orders, it would do Design, we would manufacture, we would dispatch...and it would've run for probably quite a while."* Chris, MD

The typical people whose central object of activity is to receive new enquiries about standard development are staff from the Sales function. As Emma (SM) pointed out, on a day-to-day basis the new but standard enquiries (products from stock or with little design and manufacturing) are routinely dealt with by the sales members without the need for her or any other senior manager's input. Her input is required usually in the case of an enquiry concerned with something out of the ordinary such as an order with a large number of items. In general, in the traditional side of the business Emma's object of activity is around the management of the internal Sales team, while she occasionally deals with issues relating to customers (yet rarely directly as she noted) or stock related issues, progress chasing, reporting of sales figures at senior management meetings and so forth. For example, in the case of an unusual order (e.g. size of order), Emma relies on input from the senior management team on things such as the technical feasibility of the enquiry, how to approach it and how it should be presented to the customer. Apart from the internal sales team, the company also employed a number of external Sales personnel who were 'out on the road' pursuing new customers by 'knocking on doors' or representing and showcasing Brushware's products in tradeshows.

Another person who occasionally receives new enquiries, although as a secondary activity, is the Estimator (*not interviewed*). According to Sam (MND), the Estimator

receives enquiries from various customers over the phone due to his rich knowledge of both the technical aspects of the company's products, the manufacturing processes needed to develop them and the costs involved to produce them. Sam further noted that the Estimator had an extensive knowledge of everything related to the manufacturing side of brushes, as he was previously involved in production as a process engineer for more than 20 years[26]. The Estimator's involvement spanned across both sides of the business, traditional and specialised markets and for this reason his practice appears again in the Development period (section 5.3.2).

BGP and NPD in Specialised Markets

Before turning now to the description of the initiation of NPD, it is useful to look at the Brushware's activity system through the lenses of the Business Growth Plan (BGP) object of activity, as it was going hand in hand with the efforts of shifting attention towards exploiting opportunities in the specialised industries. As briefly noted in section 4.3.2.2, Brushware envisaged it would implement certain organisation-wide changes through the BGP programme. These changes were particularly aimed towards the management of the company across all levels and consequently across all periods of the NPD process. There were a number of internal issues that Chris (MD) wanted to tackle through BGP. For example, Chris felt that whilst the company had a very good process of putting a problem right, they had also *learned* that if things were not resolved early then they would often reoccur. Chris's (MD) actions involved meeting with his senior management team (mostly informally) to resolve such problems;

> *"Come on guys, let's sit down and let's get to the bottom of this - and then this does not happen again. That's kind of what we do as a Senior Team". Chris, MD*

In close proximity to Chris is Sam (MND), a key member of the senior team, who was promoted by Chris from the role of manufacturing manager into a Manufacturing Director. Sam has an engineering background with a long experience in the area, prior to joining a manufacturing company, as he pointed out, such as Brushware. According to him, having an engineering background was particularly useful to the *new strategic focus* towards NPD that the BGP was trying to implement (Figure 39). He explained this by drawing a line between traditional manufacturing and engineering, the former being

[26] Part of the information was obtained from the company's official website staff profile.

concerned with repeatedly developing the same artefacts while the latter with ‘creative thinking’ and new products (innovation).

Sam’s (MND) role in the BGP object of activity was driven by his personal perception of Brushware’s strengths and weaknesses. For instance, he particularly highlighted a paradox that was characteristic of Brushware’s culture; from one side, Sam expressed his great appreciation upon the company’s important history, which had generated a legacy of *“a culture where people want to work for the company, they want to stay here”*. However, at the same time, as he further argued, this in fact had also created a culture where people were too comfortable to change things. For example, the company employed many people who were with the company for more than two decades. When Sam joined the company, he found that it was very ‘old-fashioned’. Hence, Sam (MND) and Chris (MD) were trying to change this in order to ‘modernise’ the business and bring; “*a few different skills into the business*”. In Sam’s view, part of this change meant two things. First, that Brushware needed to be more strategic and less operational by dropping some of the things it was doing before. Consequently, he added that the company would have to become more innovative within an industry where ‘innovation’ is not a necessity for survival but because the lack of other innovators offered an environment with many potential opportunities. For Brushware, these opportunities lay in the ‘specialised’ part of the business. However, specialised markets consisted of very fragmented sectors and as a consequence, Chris (MD) felt that the company was ‘spreading a bit too thin’ – a metaphor he used to describe the company’s notion to simultaneously chase too many projects and consequently to not be able to give enough attention to all. As he further added, a big part of the BGP plan is about *strategically* focusing on the fragmented sectors, really *understand* the area and its needs in order to proactively offer novel solutions. At the same time, the company needed to improve the way NPD was managed internally.

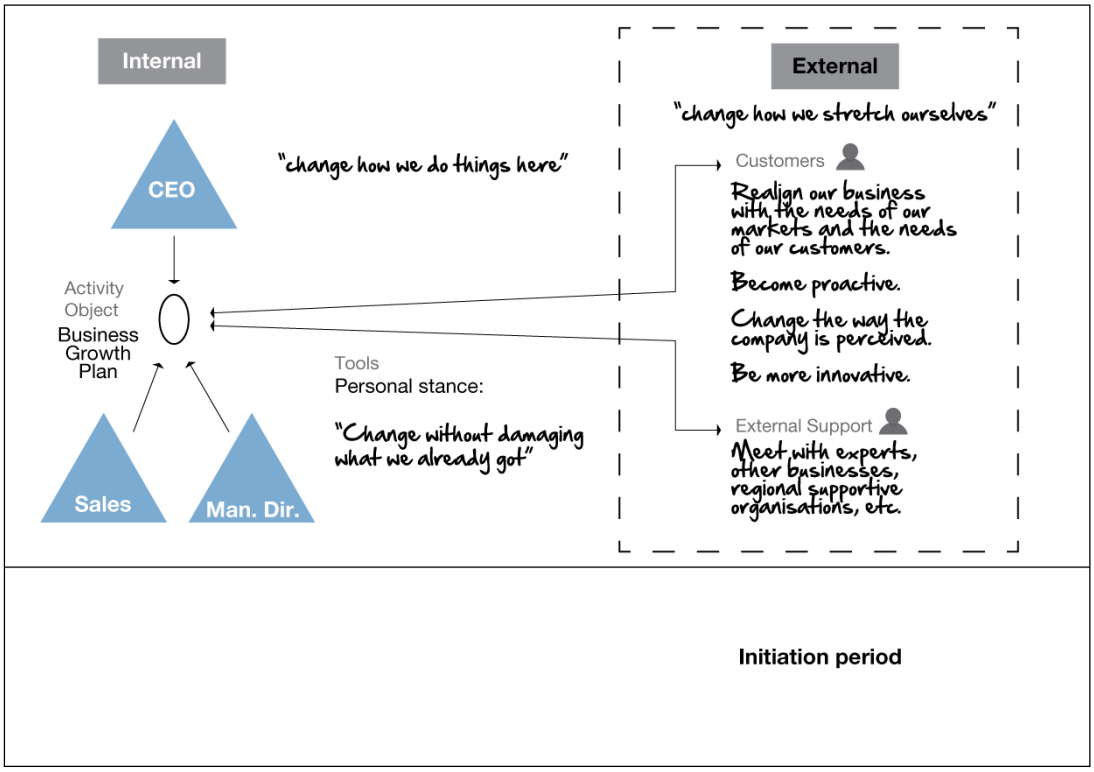


Figure 39. Initiation period was driven by the aspirations accompanying the BGP plan towards strategic change

Become proactive: 'Focus, understand, develop'

One particular crucial action in the BGP object of activity is about shifting from the traditionally reactive ways of initiating NPD into more proactive actions. Hence, at the Initiation period the senior team's object of activity is to "*focus on particular markets that we are already established in and really get to know them, really understand them and then develop products specifically for them*" (Chris, MD). Similarly, Emma's (SM) actions are around marketing these separate markets of the business and towards the change in the way customers perceived what the company was offering. This was a relatively new strategy and was actively employed within the pipeline maintenance industry over the past couple of years (discussed earlier in section 4.3.2.2).

Ad-hoc project management in NPD

While the senior management team effectively ran the business, the management of new projects is not always as clear-cut as the formal structure dictated. For example, the initiation of new projects does not always pass through every senior team member, as there was a general notion of ad-hoc project management:

> *"…people picking up things because they hit their desk first and just get on with them… [and] what we have realised is that there are not necessarily consistencies, so I might project manage one and then we might get another one and one of my colleagues [will] project manage that".* Chris, MD

Consequently, Chris pointed out that the management of NPD is not done either quickly enough nor well enough, and this was one crucial area the company was trying to improve through the BGP. Part of this effort was about getting the key organisational members activities more 'visible';

> *"We have got a lot of strengths as a business but there are certain things that we don't want to do so we want to try to get those things out of the existing team, if you like, by assigning responsibilities - knowing who has got what, knowing who gets on with whom, all [those] sort of things."* Chris, MD

Part of the reason behind the 'obscurity' of practices related to the informal culture of the organisation. The small size of the business, as well as the open plan arrangement of the working environment, which significantly drives informality;

> *"…the informal relationships, the unseen lines of communication, that is, what get things done in our organisation".* Chris, MD

Sam (MND) noted that the informal channels of communication amongst the staff members are simplifying the process of making decisions "*by having a ten minute conversation sitting [at] our desks*". Nevertheless, Sam also pointed to a number of formal channels of contact, as "*it is a way of maintaining it on a professional level*". These involved a weekly management meeting, a monthly board meeting, as well as an annual formal meeting regarding the BGP progress.

External support and adding some structure to NPD process

In response to the NPD management weakness, Brushware (through Chris (MD)) frequently turned to external support from various experts and organisations for advice about better structuring the NPD process. Chris personally interacted with lots of different external people such as advisors, universities, other companies, regional support organisations (e.g. Design Network North). According to Chris, the amount of business support that exists in the region is one of the real benefits about working in the North East of England. Chris was regularly trying to adopt best practices by liaising with a number of key contacts about how other organisations with similar characteristics (i.e. size, industry standards, etc.) managed their complexities.

New project example: existing / new customer novel solution.

The ad-hoc approach to NPD meant that the way the initiation of the NPD process unravels is very different depending on the situation. In the specialised side of the business, Brushware was trying many different things, which were not based on any standard procedure. For instance, many of the new enquiries are either derived from or targeting specifically the company's existing customer accounts in the area. Within pipeline markets in particular, Chris is personally project managing a number of key customer accounts. Through his membership with international pipeline associations, Chris would often hear people's needs and problems and identify new opportunities or receive an enquiry which would initiate NPD.

Alternatively, Chris would also be involved at the very start of a new contact or a new lead by "*overseeing them and presenting what we can do as an organisation and that will then be picked up by the rest of the business*". Again, the project could be managed in many different ways and with a variety of individuals. For example, Sam (MND) who very often is the lead project manager argued that he is doing it mostly because there is no one else to do it:

> *"I've got one of our Sales guys doing the day to day speaking on the telephone...but equally one of my colleagues could be doing one of those roles as well...it's kind of...on the pipeline side I tend to lead, I'm more involved in that industry, but [with] some of the other industries it might be more likely that my colleagues deal with those projects…*[In pipeline] *I would be keeping Sam*(MND) *in the loop but quite often I would work with some of his team [technical/production]."* Chris, MD

> *"...so generally if there's any project management to do, I'll do it but only because we don't have anybody else to do it."* Sam, MND

Chris illustrated a most recent new project with an existing customer account and how the NPD process initiated and progressed thereafter.

More precisely, in one of his visits at a pipeline association event, Chris listened to one of his customers describing a particular design problem, which demanded a bespoke product that the company had never developed in the past. It was this insight that led the company (senior management team) to look for a new set of creative skills

to help with the ideation, design and development of the new enquiry[27]. Brushware eventually hired a junior Product Designer, Tom (DES), particularly for that one project (on a one-year contract basis which was turned into a permanent position following Tom's high performance on the project).

Tom, was a recently graduated product designer at the time and carried with him as set of creative skills and tools such as 3D CAD software and product and graphic design skills, most of which were absent from the company's NPD process. In this project, Tom had a very early draft idea about the specific design problem which enabled Chris to have a strong concept design[28] to pursue the potential customer.

In this new project example, Chris was not in direct contact with his senior management team, Sam (MND) and Emma (SM), but he was only keeping them in the loop about its progress, either informally or formally during the weekly management meetings. Instead, Chris managed the new project with one of the company's on-the-road Sales agents. Together, they met the customer where they presented Tom's early draft design idea and had the very first discussions on the feasibility of the proposed design solution. With an early positive response from the customer, Chris then turned externally to receive advice about what strategy to adopt for protecting the potential Intellectual Property (IP) rights;

> *"I went initially to the customer with the sales person, we went together, to talk to them to say 'look, we think we've got an idea you might be able to help you with a particular problem, listen to the problem in bit more detail, I then took some IP advice based on this particular issue…"* Chris, MD

Generally, when a new enquiry involves the design of an entirely new product, Brushware tries to manage any potential Intellectual Property (IP) rights as early as possible. According to Chris, managing the IP was one of his official roles in the company, although, as he admitted, it was a relatively new practice for Brushware. The company had recently began appreciating the value of protecting its own IP rights and the strategies

[27] Finding the right creative skills was at the foci in the 'becoming more innovative' aim of the BGP plan and was partly the result of past disappointments when the company went and outsourced these skills. In that past 'bad' example, Chris and Sam contacted external design practitioners to come up with a design solution for a particular problem. Regardless of the good design ideas produced by them, the project faced serious time delays and many design revisions. For Sam, this was a product development and design weakness that the company was trying to improve through BGP.

[28] According to Sam (MND), part of the BGP changes involved the introduction of a new design/ideas wall, a dedicated space where the senior team and members of the technical team (i.e. designer, estimator) can share opportunities and ideas. In addition, it was hoped that the ideas wall would help improve project management by choosing the right people with the right skills to manage projects based on appropriateness of fit.

devised for that purpose had only been practised for the past 3 years[29]. Chris noted that Brushware had learned the importance of understanding and resolving the potential IP rights at the very early phase of a new project, otherwise it could turn into a mess. Yet, although it would be in the agenda of every new project, there was no defined route that the company would follow to effectively deal with it. As Chris argued, even getting expert IP advice and support was often not enough as advice based on real-life examples with both a commercial and practical value were extremely difficult to find. He distinguished practical and commercially astute advice from general advice "*that doesn't go and say 'spent a lot of money on the patents', because that's the general advice you get, that's not always what you want to hear".* Consequently, there were no typical strategies for managing the IP rights in NPD as these were being devised based on experience and the idiosyncrasies of the new projects. For instance, on many occasions the company would decide to leave the IP rights to the customer;

> *"…we had [a recent project] where we had a new machine commissioned and the machine manufacturer wanted to own the IP for the machine so we had to make the decision, you know, is that in our interest, what are the implications...and in the end we were happy for them to have it. It really depends on the specific instance." Chris, MD*

Moreover, Brushware did not have a design file in place where the various IP strategies could be stored and revisited in similar situations, although it was something Chris noted he would like to create in the near future. In the new project example, after the initial design presentation to the customer and the signing of the IP undisclosed agreement between the two parties, the next step was the further involvement of Tom (DES) and the Sales agent who went back to the customer and discussed the product in more detail. When the customer expressed her satisfaction and approval of the more detailed design, the process continued by the signing of a mutual contract including a final agreement on future IP rights (Figure 40). The next step was the actual making and testing (Development period) of the new design idea.

[29] From the date of the interview

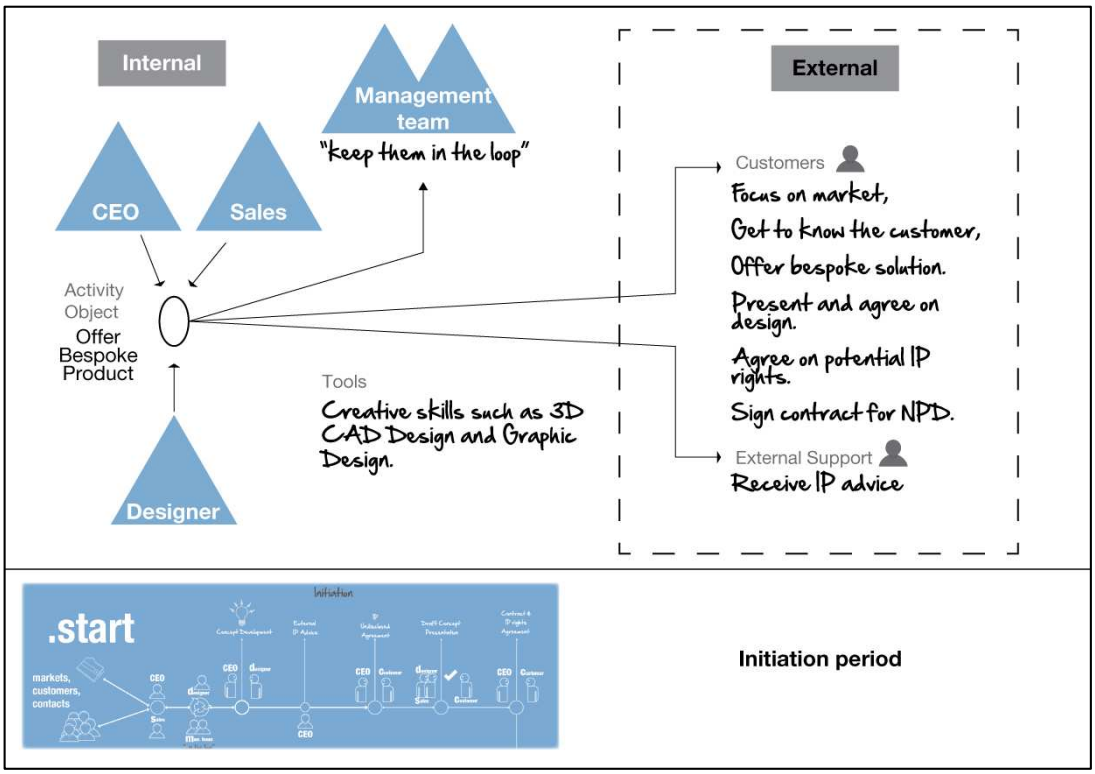


Figure 40. Key activities at the Initiation period of the bespoke NPD

5.3.2 **Development period**

Object of Activity – To develop a new product for the specialised markets.

Design process in NPD

After the concept was presented and all contractual issues with the customer are resolved, the next period that follows is the actual Development. Then, it is still Tom's (DES) object of activity to organise the process and further develop the initial designs in order for the product to be ready for production. Tom shared his role in the design department with the Estimator, who had been the experienced person dealing with new customer enquiries in the past, although he would not do the design work of novel customised products. Working with the expert Estimator was a learning experience for a novice like Tom. Furthermore, part of Tom's activity is also to look at how to manage the process considering that there was no defined structure to follow;

> *"As far as I know there's no really a clearly defined process, we basically go through everything until we have sort of 'ticked off the boxes' that we think are important"*

> *"…and then of course there can be times that we have missed something and we have to go back and whatever…but by the third time…[we] seem to get through alright…to the sort of production stage."* Tom, DES

Apart from the Estimator, Tom is in close communication with Chris (MD) and also someone from the Sales team (varies depending on the project) to get any relevant customer information. At the same time, Tom informally plans what needs to be done in collaboration with the senior management team;

> *"We are trying get as much done before we do any work, as possible, we sometimes do have to go back and review things as we go."* Tom, DES

According to Tom, his interaction with the senior management team is amongst the most important aspects to his design practice. As he argued, the management team is very open to new ideas and very interested in the work that he is producing;

> *"…the company as a whole is willing to look into new ideas, which is why it seems to have gone pretty well so far really."* Tom, DES

Prior to Tom's arrival at the company, Brushware had been outsourcing various design projects externally, a practice that was characterised by many disappointments. Sam (MND) provided an example about a project that Brushware had initiated in collaboration with a regional design college which, although resulted with a good design solution, the product had not been launched even 3 years later, as it had to go through repeated iterations and redesigns;

> *"That is one of the weaknesses we see in the company. It's a product development and design weakness. And that is why as a business we said we need to be more innovative. To be more innovative you need a good product design process, we need to know what we are doing with design"* Sam, MND

Prototyping

During the design process, Tom is concerned with the transformation of his conceptual ideas into tangible prototypes. His prototypes are usually sent to the customer to trial them before agreeing to a final order. The interactions with the customer at this phase are usually between Tom and Chris, whilst the Sales agent who initiated the NPD (as in the project example described earlier) is kept in the loop through emails (Figure 41). The agent's involvement comes into play again at the final stages of the NPD where the final order is ready for dispatch (Implementation period).

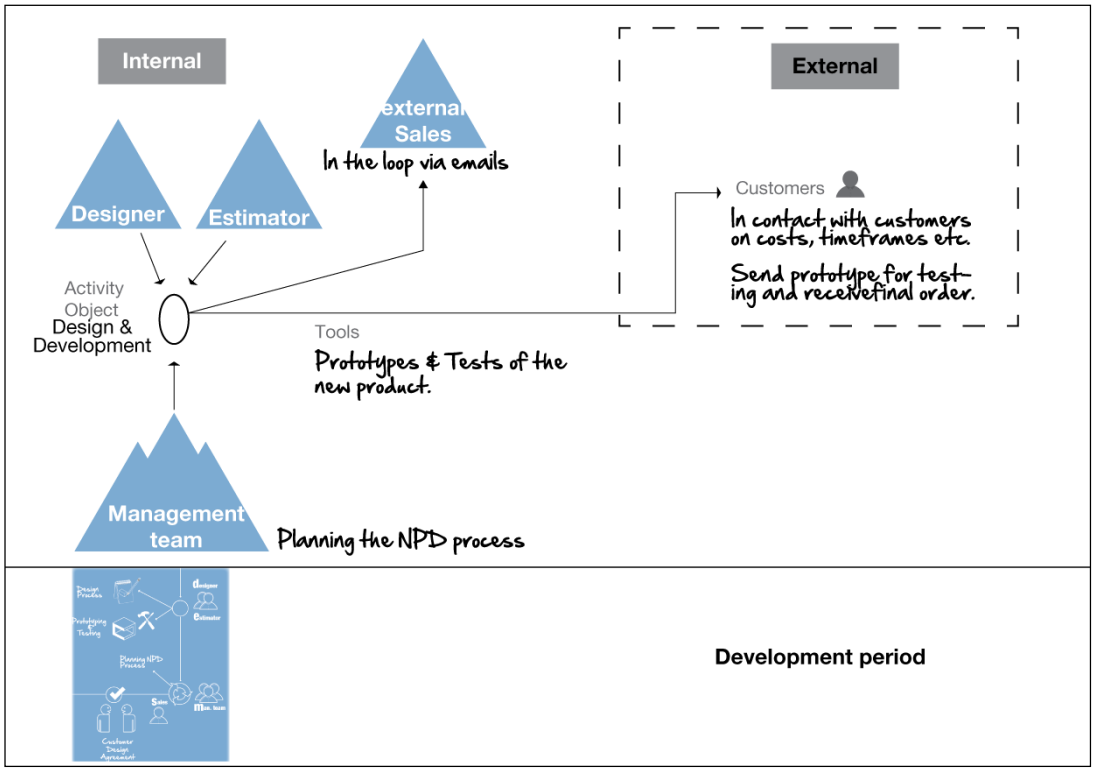


Figure 41. Key activities during the development period of a NPD

5.3.3 Implementation period

Production

The final phase of the development process finds Tom (DES) in liaison with the production side of the business which includes the Procurement, the Engineer and the Manufacturing Supervisors and together they make things ready for production. However, as Tom noted, interactions with a production colleague can also occur at any other phase of the NPD process, if that is needed. Again, Tom talks to a different number of manufacturing staff based on the type of project he is working on.

> *"It's a different person but the functions remain the same**...**it's the same process but changes according to person's knowledge in each function. And because of where I am, in the middle of everything really, it doesn't change why I'm looking [at] the information; it just changes the person that I go to"* Tom, DES

> *"…there are people working on different machines so you know who is the person to talk to for a particular thing..."* Tom, DES

> *"You acquire this knowledge by getting to know the people...something that I've learned last year, that there are certain people who can help you with certain things."* Tom, DES

One of the key people Tom interacts frequently at the Implementation period is one particular Manufacturing Supervisor (not interviewed – MS from now on), who was the link between the development team and the shop floor. Sam (MND) provided insights of MS's brokering role in the company:

> *"We got 12 people here and I do try to speak to everyone, everybody knows me, everybody knows that they can come and speak to us, I tend to be, you know…if anybody has got a problem then I'll tend to sort it... I'll hear about it...but the sort of main person hear is MS. MS is the Supervisor and me and MS have a lot of informal communication, so I keep an idea of what is going on at the Shop-floor mainly via MS […] is a type of person who people will go to and sort of speak to probably intermediary, more intermediary than maybe they speak to me…but MS keeps it informal to what's happening...because as I have tried to move away from the Shop-floor, it is difficult to maintain a link and I sort of try to maintain that link through keeping a sort of pretty close informal relationship with MS. We still do the formal stuff, but it tends to mainly be done informally."* Sam, MND

According to Emma (SM), the Sales people would also liaise with MS to work out production priorities according to customer needs;

> *"…so if we want to shuffle jobs around for the customer, maybe [we] try [to] prioritise things a little bit…"*

The successful implementation of a particular new product goes hand in hand with the quality of project management that is practised during the preceding phases and in particular the Development period. In the past, bad project management had generated many problems and according to Sam (MND), this was one of the key improvements Brushware aspired to. As Sam further pointed out, a better process would reflect a better project management of the Development period, as while the company knew how to design a good product it was failing to generate profit due to bad time management;

> *"When I was mentioning about a particular product that we designed and didn't implement very well...one of the things that we have identified is when we got new things happening we didn't design new things but we need to be better at managing the project...so we might come up with something that works but actually getting it to generate cash [relates to] the length of the project and what we need to do is develop a bit better project management."* Sam, MND

According to Emma (SM), delivering the product to the customer for a certain time requires the coordination of the practice among different functions such as Procurement (when the materials are in), Manufacturing (when the production is completed) and Logistics (getting the new product ready for dispatch) and the Sales (progress chase) who are in direct contact with the customer (Figure 42).

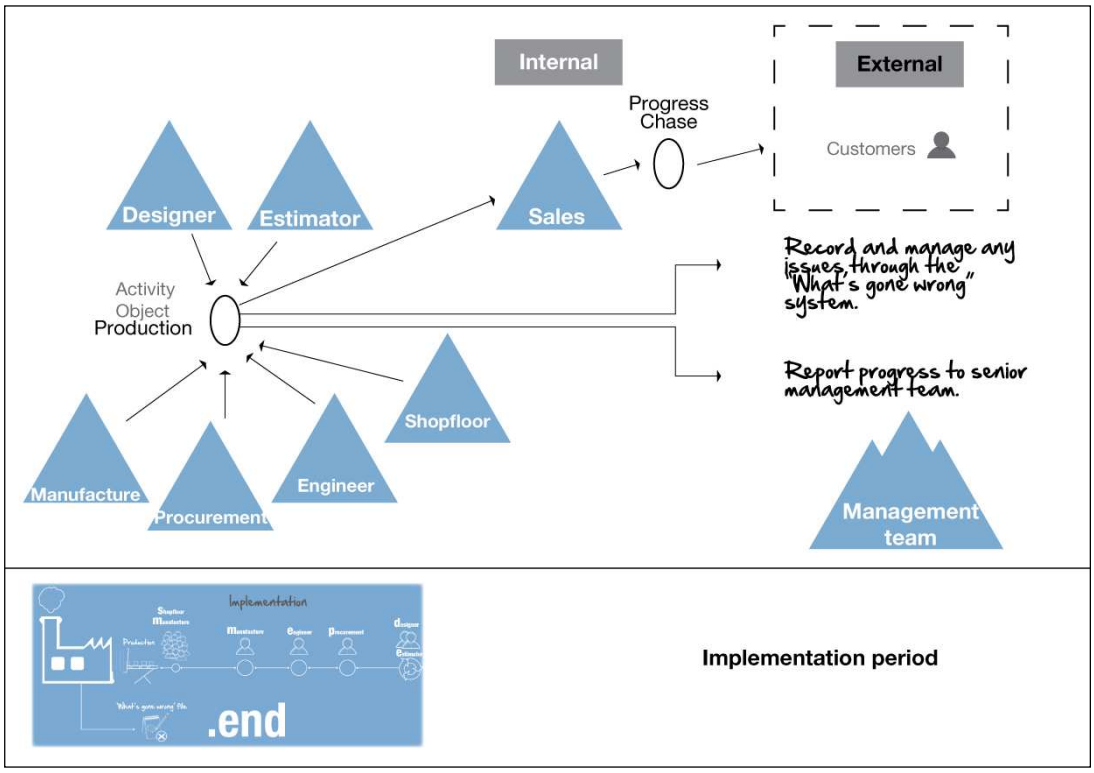


Figure 42. Key activities during the Implementation period of a NPD at Brushware

Finally, Brushware had in place a 'what has gone wrong' system as a way of recording any issues that may occur after the product reaches the customer and, in doing so, to identify the person who would be best to sort it out in future occurrences. A schematic representation of Brushware's NPD process is depicted in Figure 43.

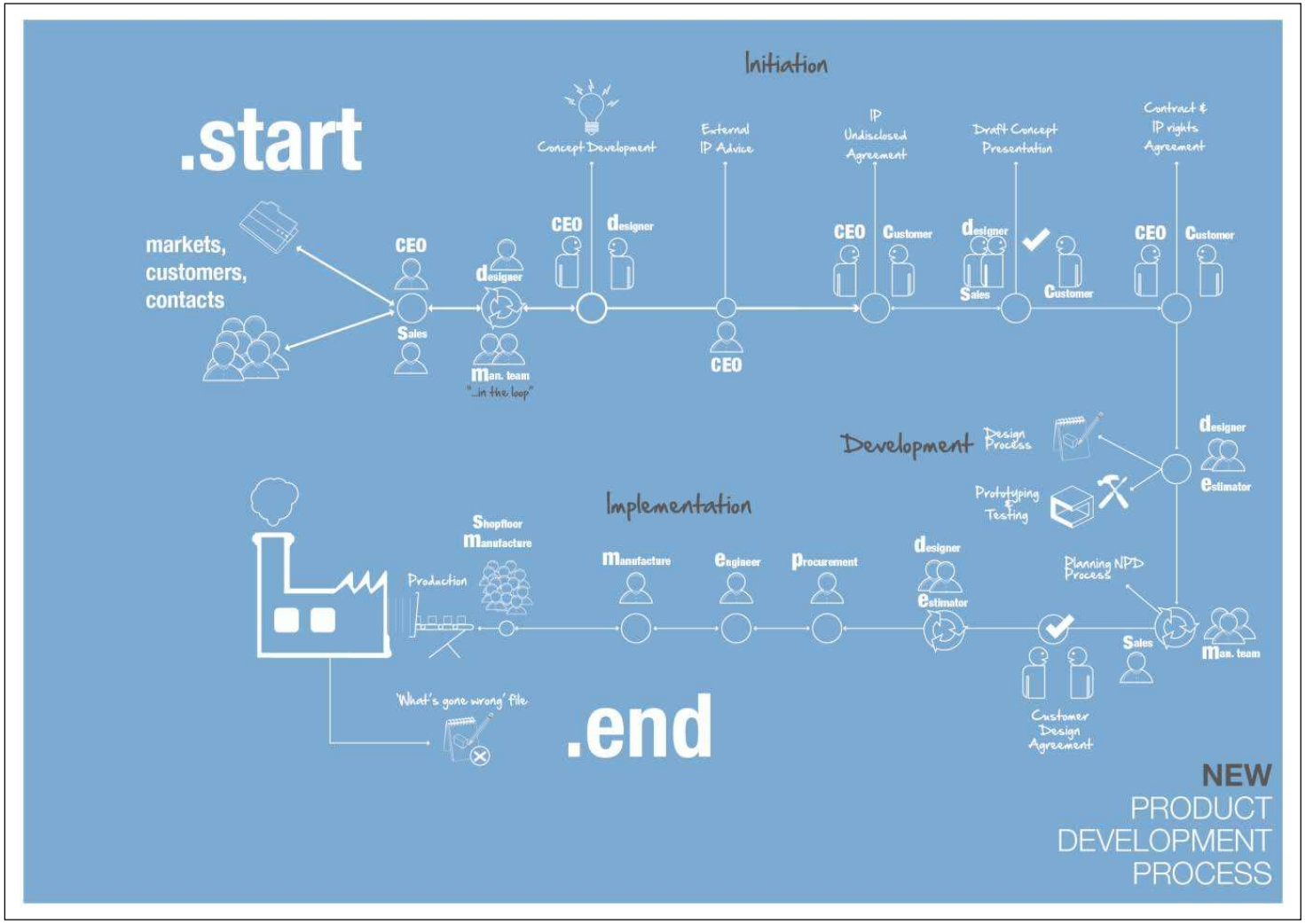


Figure 43. A schematic representation of Brushware's NPD process

5.4 *Pharma*

Object of Activity – Growth and efficiency

5.4.1 Initiation period

For Pharma, there are two main sources for initiating NPD: i) projects that initiate reactively, i.e. new enquiries coming from (new or existing) customers, and ii) projects that initiate proactively, either based on insights gained from market research, or a new design idea conceived by the technical/design team. In general, the key people whose object of activity is directly linked with the initiation of NPD includes members from both SE's and Pharma's sites such as Sales members, SE's site Technical Sales Director (TSD), Alan, Pharma's Design Manager (DM), and Ben, Pharma's Site Manager (SM).

Strategic orientation

The typical route through which new projects initiate at Pharma is through the two site's Sales teams that receive new enquiries from various customers in the pharmaceutical industry. The markets where Pharma operates and the sales the company was trying to attract are officially driven centrally from the SE site and in particular the Technical Sales function managed by a TSD. While each site has a different market focus (pharmaceutical (Pharma) versus health care (SE) and each Sales team receives enquiries usually specific to the particular market it is concerned with, Pharma received new enquiries also from SE's site team, who may find a particular enquiry a better fit for Pharma to follow-up. Similarly, the decisions about Pharma's market orientation are influenced by both its internal key personnel and the directions from TSD (and the stakeholders' demands) at the SE site. One way to illustrate this situation is through two main examples discussed by the respondents: a) the sales teams' market research activities and b) Ben's (SM) report on internal capacity.

Market research by Sales team

As mentioned already, market research is the object of activity for the two Sales based at each site. Since it was not possible to interview members from the SE site, the analysis herein focuses only on Pharma's team.

More precisely, the Sales department in Pharma consisted of three full-time members and one part-time. Two of them were particularly involved with the UK market, and the rest with overseas exports. Brenda (S) has been with Pharma for 6 years and is solely involved with the overseas sales side of the business. As her official role suggests, Brenda's (S) object of activity is fundamentally concerned with spreading Pharma's products to new or existing overseas customers. Together with the rest of the Sales team, they are in constant interaction with customers who approach Pharma with new enquiries. When not directly involved with a new customer, Brenda is the person to be called from internal functions such as the internal Sales desk (UK division), the Customer services, and/or the QA team, to provide input for certain problems with various customers. Furthermore, Brenda's foreign language literacy makes her important to other functions such as Procurement, who occasionally turn to Brenda for help when dealing with international suppliers. Brenda's impact on the initiation of NPD comes from her activities in market research through which she puts forward suggestions on identified opportunities during the monthly formal management meetings (at the SE site). Brenda identifies opportunities in various international markets by studying what competitors do and whether there are opportunities for Pharma to operate in those markets or not. To some extent, her insights influence the future strategic directions of Pharma at the top level.

Scenario 1: Receive a new enquiry (Reactive)

When a new enquiry received by the Sales department requires the development of a new custom product, Brenda's role is to prepare a document that best describes what the new enquiry is about; *"this project is, for example, an APE no. bottle, the quantity is 10ml and the bottle has to look like this, has to be packed like that*" (Brenda, S). This information becomes part of the design brief that is sent to the Technical/ Design team who come into play and take over the project.

Scenario 2: Develop first, sell after (Proactive)

The practice of marketing research has not changed dramatically since the time Pharma operated entirely independently. An example of the way a new project used to initiate in the past was illustrated by Alan (DM), who talked about how his bundling with the Sales team resulted in the development of an innovative product in the supplements market[30].

In this particular project, everything started when the Sales team noticed the uniformity and lack of differentiation between most of the existing packages in the particular market. The team had noticed this while doing their routine market research initially and by approaching and discussing their observations with major leading supermarkets in order to find out the prospects of offering alternative products. Their market insights were then fed back to Alan (DM) who eventually came up with a novel design that after launch later became a highly successful item.

However, Alan often proactively designs new products without waiting for a customer enquiry;

> *"It is really that idea, you know, [of] getting out there, developing products…forget about waiting for us to be asked...I would have a list of things I need developing which the Sales team or* [Technical] *Director they have heard a whisper that there's a product out there that needs this type of dispenser ...and before, hope-fully before we are asked we would have already designed it."* Alan, DM

Such an NPD example was the development of the innovative child resistant packs. According to Ben (SM), Pharma strategically differentiated itself from its competitors by deciding not to do what everyone else was doing, that is, not to go for cheaper productio*n* but rather, to really focus on a product that did not exist but the market would demand in the coming years. This strategy paid off because Pharma through Alan and his team (former design team) designed and developed a wide range of products that offered novel child resistance closures. Consequently, that decision not only extended Pharma's patent portfolio but also added to its reputation and attracted new enquiries because of their expertise in the specific product type.

This is the kind of reputation Pharma had gained through years of developing robust plastic packages for various uses and was the number one reason, according to Alan

[30] At the time, Pharma operated in more markets than solely pharmaceutical.

(DM), to feel reluctant to stretch out and provide more holistic product offers such as the additional filling of consumable products (e.g. pills). In his eyes, this involved Pharma in a practice they have no prior expert knowledge of, and would likely have a negative impact on their reputation and credibility;

> "*I don't think we would have the credibility...if there is one thing that Pharma has, it is the credibility, you know, because we have been running for long enough, our products have been written into specifications, so we've got a reputation for that. I think if you went into filling then you'd [be] sort of diluting that, I think…"* Alan, DM

Similarly, although the company had *the technical facilities and expertise (resource rich)* to develop other types of plastic products within the same industry (Alan described a case where he was involved in a project of developing needle-less injectors and which were very successful), it was still reluctant to divert from where Pharma's *niche market* has always been. In part, this was also due to the *lack of serious competition* other than the Far East and as Alan pointed out, most of the competition is not involved in the pharmaceutical industry but rather in the vitamin mineral supplements (SE's market).

What markets? Initiation from internal capacity

The strategic decision regarding Pharma's operating markets could equal be influenced by the company's internal capacity. This role and object of activity is mainly fulfilled by Pharma's newly hired Site Manager (SM), Ben.

Generally, Ben's main object of activity is the everyday management of Pharma as he ultimately acted as the CEO of the site. Consequently his role and influence spanned across all levels and phases of both standard and new product development. The main tools in his activity related to his long manufacturing experience that was cultivated while working in heavy engineering and the automotive industries. Ben noted that regardless of the fact that in manufacturing businesses "*the problems are the same wherever you go*", working in a company like Pharma where the final outcome referred to everyday products, was a learning curve for him.

Ben spent a significant proportion of his time dealing with the financial side of the business as he "*like to believe I keep quite [a tight] control of what is going on in the business*". Part this involved interaction with the financial controller of Pharma where together they prepared the yearly business operations plan. At the external level, he

annually liaises with external financial auditors who audit corporate compliant type issues, and so forth. Occasionally, this involvement may influence both the initiation and discontinuity of a NPD. More precisely, Ben highlighted that he reports to the Sales team on a regular basis (through his monthly meetings with the board of management) about areas where the company might have an excessive capacity, which is untapped, or in contrast, what are the limits that Pharma would go to, to attract new business. The former case refers to situations such as when past projects were 'terminated' incomplete and hence there was available capacity, which is used to guide the Sales team market research, irrespective of their strategic plans;

> *"As I said, we have fixed and firm guidelines as to what margins we would accept on products...that depends [on] whether we have got available capacity or not...clearly if we have some areas of the business, some technologies where we have available capacities, we might relax our guidelines...and that judgement is made by the Site management teams. So I would regularly [say], at the board of management meetings, 'okay guys, on extrusion blow moulding I have got one and a half million pounds of Sales capacity...or so many thousands of hours. On that particular business I know that I normally insist on a contribution factor of X, but in this case if you can fill that capacity I would accept Y..."* Ben, SM

Similarly, when the expected costs for a new enquiry exceed "*certain guidelines in terms of the gross profit that we would like to achieve from our part*" then Ben (SM) has to decide whether to proceed or to "*say no, we're not going to offer that product because that would put us in a bad position*" (in terms of commercial vulnerability).

Initiation Source: Design

Interestingly, new enquiries do not necessarily have to reach the Sales team first before reaching others. Pharma's design reputation in its segment had many clients contacting Alan (DM) directly to speak to him about new projects, quantities and prices[31]. Quite often, Alan is interacting with the clients independently from the Sales team because, as he argued, "*actually finding out what they are after instead of waiting for the Sales guys to interpret it*" (Figure 44).

[31] Often, Pharma would offer its design and manufacturing expertise to external design consultancies that approach the company to have their conceptual idea manufactured.

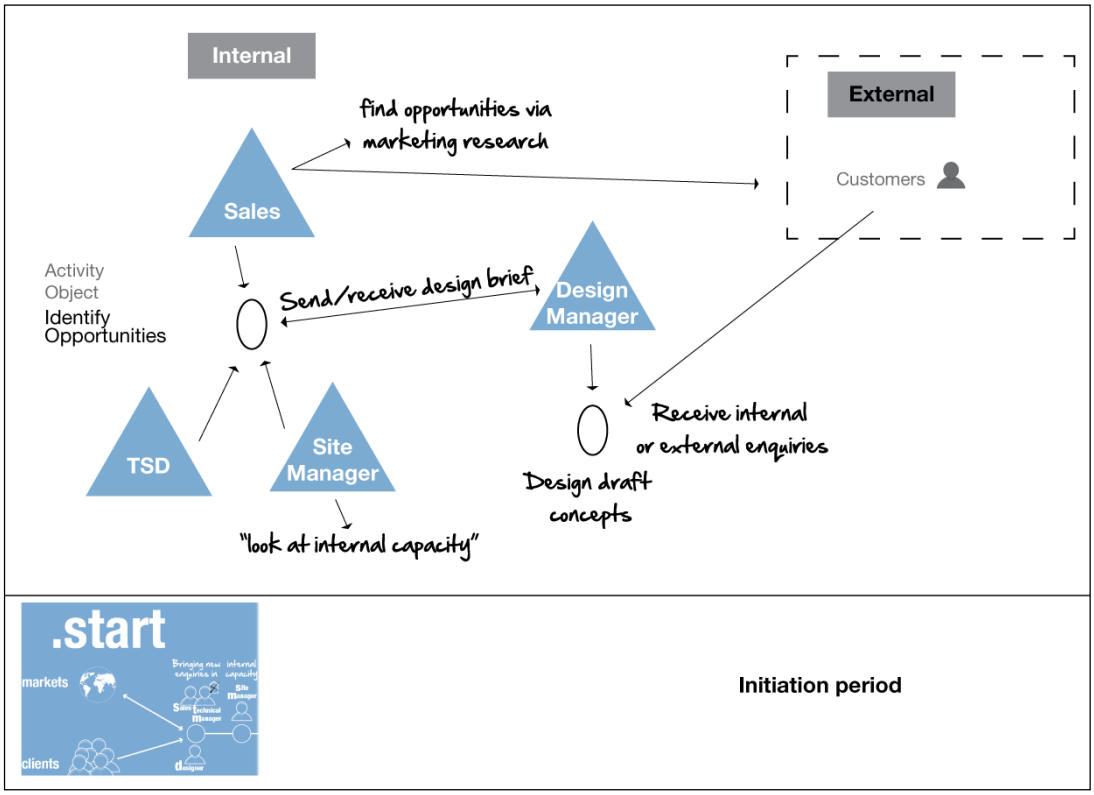


Figure 44. Key activities at the Initiation period of a NPD

Alan also noted that whilst in the past clients would go first to design consultancies to develop a new product, Pharma's design reputation built throughout the years changed that reality and now customers started approaching Pharma directly. According to him, while consultancies are very capable of offering good design ideas, Pharma's competitive advantage was their knowledge and expertise in thinking about 'quantities' along with 'functionality'. Furthermore, Pharma had more to offer to satisfy its customers compared to design consultancies. More precisely, Pharma's manufacturing facilities offered a "one stop shop", as Alan called it, which included not only the plastic containers but also the printing (dry offset or screen-printing), the labelling, and essentially the whole packaging. Design expertise and resources therefore were among those competences that Pharma decided to protect after the company's merge with the SE;

> *"We took the decision that the Design site was never changed...it is basically, what we wanted to do to manufacture the product, whatever it takes, designing it, the right price, your filling lines, you know, we would take care of that...".* Alan, (DM)

Costing and decision-making

Prior to the Development period, Brenda (S) (or any other Sales rep) passes the specifications and the draft drawings from Alan (DM) to the Technical Director/Sales (TSD) who is located at the SE site. TSD first has to find out whether the new project better fits Pharma or SE based on their technical facilities. TSD liaises with SE's Commercial Manager (CM hereafter) and together they calculate the initial costs for the particular enquiry and look at its economic viability. TSD is also the person to make the formal project plan that includes what tasks need to be done by when and agree them with the customer. However, as Ben (SM) pointed out, for any new project to actually move forward and become an offer to the customer it is the responsibility of the relevant Site Manager:

> *"The Site Manager decides whether the contribution is significant enough to warrant placing the offer...if it's not, he has two choices: a) no, I'm not happy that you offer that or b) alternatively, I am happy that you offer it but these are the things which will going to have to be done before it comes into production, in order to bring us back to a good cost base."* Ben, SM

Therefore, a new project hitting Pharma finds Ben (SM), TSD and CM jointly discussing what machines or new moulding tools are needed and whether the costs are worthwhile to proceed or not. Finally the estimated price is circulated back to the customer for approval (Figure 45); "'*okay, the price is this, send it to the customer', and then the customer would come back and say 'I like that price, could you do me a drawing?'"*. After reaching an agreement with the customer, the process moves from the Initiation period to the actual Development period.

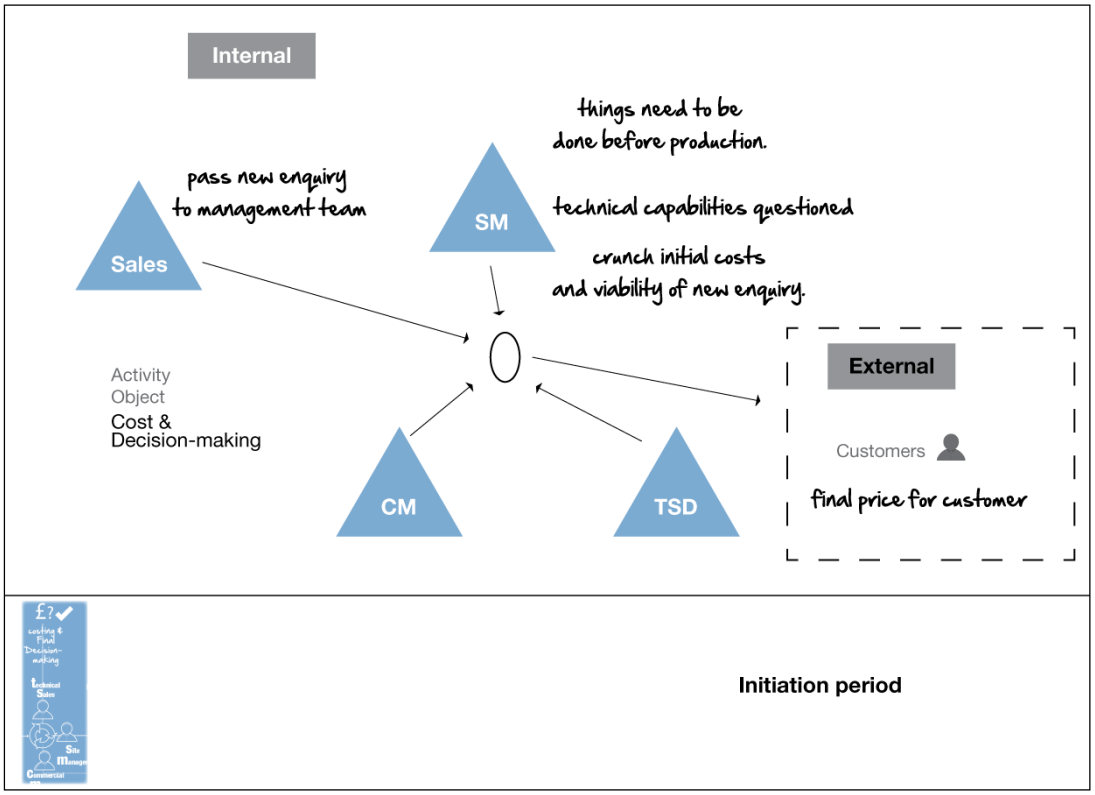


Figure 45. Decision-making point before entering the Development period

5.4.2 **Development period**

Ideation phase

Alan's (DM) primary object of activity is the design and development of new products which goes hand in hand, in priority with a constant interaction with the Sales team and the customer;

> *"I spent a lot of time on the phone with them...either fumbling about or going to see clients with them or...they are coming in with the enquiries and they come directly to myself and then we decide whether jointly if it's worth progressing."* Alan, DM

During this phase, Alan's activities are concerned with 'filtering' the brief and coming up with the initial concepts. These concepts are in a constant feedback loop between him, the Sales team and the potential clients. Before developing any draft concepts, Alan audits the filling lines of the potential clients in order to understand the exact customer needs;

"…and we sort of asking the questions, there are a lot of times that they do not want to reorganise their filing lines, they just want a new product, so we provide this." Alan, DM

Coming up with new ideas happens while in contact with the end-client (Figure 46). Yet, as Alan argued, he does not make it easy for them instead he tries to present them with two or three different ideas and ask them to choose one they prefer;

"The first one is you know 'here's what we think you want' > 'this is what I think you want' > 'and here's another one in case I got it totally wrong'... and normally what happens is you know 'I like that feature, quite like the look of that, can we... (sort of combining features for the different ideas)... so we go with it". Alan, DM

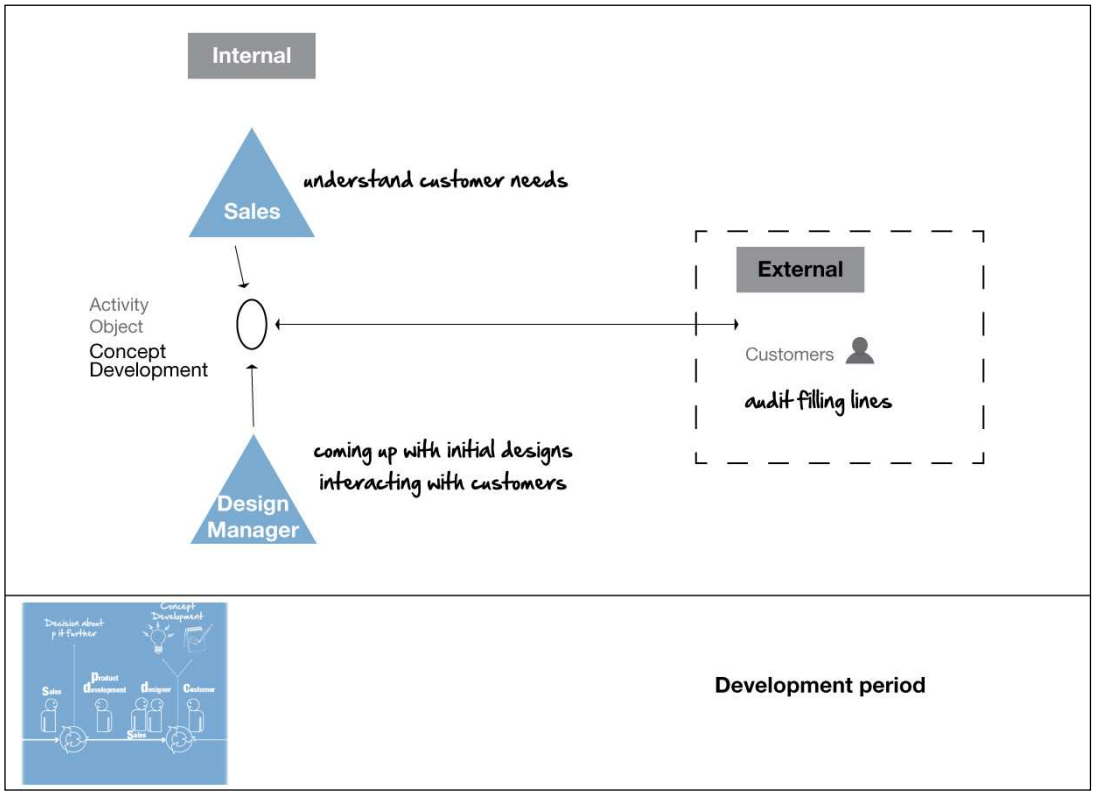


Figure 46. Early design activities during the Development period of a NPD

At the Development period, there are two central scenarios that were highlighted by the respondents, both of which relied on the decisions made by the top management team and Pharma's technical capacity to deal with the needs of the new project.

Scenario 1: 'Capacity is enough, proceed with detailed designs'

Developing the drawings

If Pharma's technical capacity decide that it is adequate to support the needs for a new project, then the next step involves Alan (DM) designing and developing the actual product details (Figure 47). There are certain tools that aid Alan in this activity, including professional 3D CAD software such as Pro/Engineer[32], as well as the Stereolithography (SLA) 3D rapid prototyping facilities that Pharma has in-house.

During this period, Alan is in close collaboration with two main individuals. First, along this process, Alan's 'right hand' is Steve (TECH), whose object of activity is to collect all relevant project information such as costing and build materials, how many are going into the box and the pallets (for dispatch during the Implementation period), does it need any secondary work, what tools are used and their standards as well as customer specifications, all of which go into an internal project document[33]. This information is important to both internal functions such as Customer Services who get information about customer specs this way, or to send to the actual clients;

> *"…at the end of it they've got all this information, they can have the drawings if they want, they get the visuals, the models, the costing […]so they do not have to have a go with a sort of consultancy who do the first bit and then they have to do it again".* Alan, DM

Intellectual property

During the development of a new product, Alan (and often TSD) is consciously looking for potential IP protection and therefore discuss this issue with the customer. According to Ben, Pharma traditionally has a long list of patents on its products and a huge percentage of its annual sales derive from its own patented products. In some instances, Pharma agrees with the clients to own the design rights, for instance when the client is a design consultancy and Pharma manages only the production side. Yet, the majority of the products Pharma develops are protected by patents. A great example is the development of the child resistant products mentioned earlier.

[32] PTC Creo, formerly known as Pro/Engineer, Parametric Technology Corporation (PTC) Inc.
[33] However, Alan suggested that much of the knowledge held in these files, although theoretically should be used to replicate the same project, is still located within the email exchanges between key members, such as the TSD and QA.

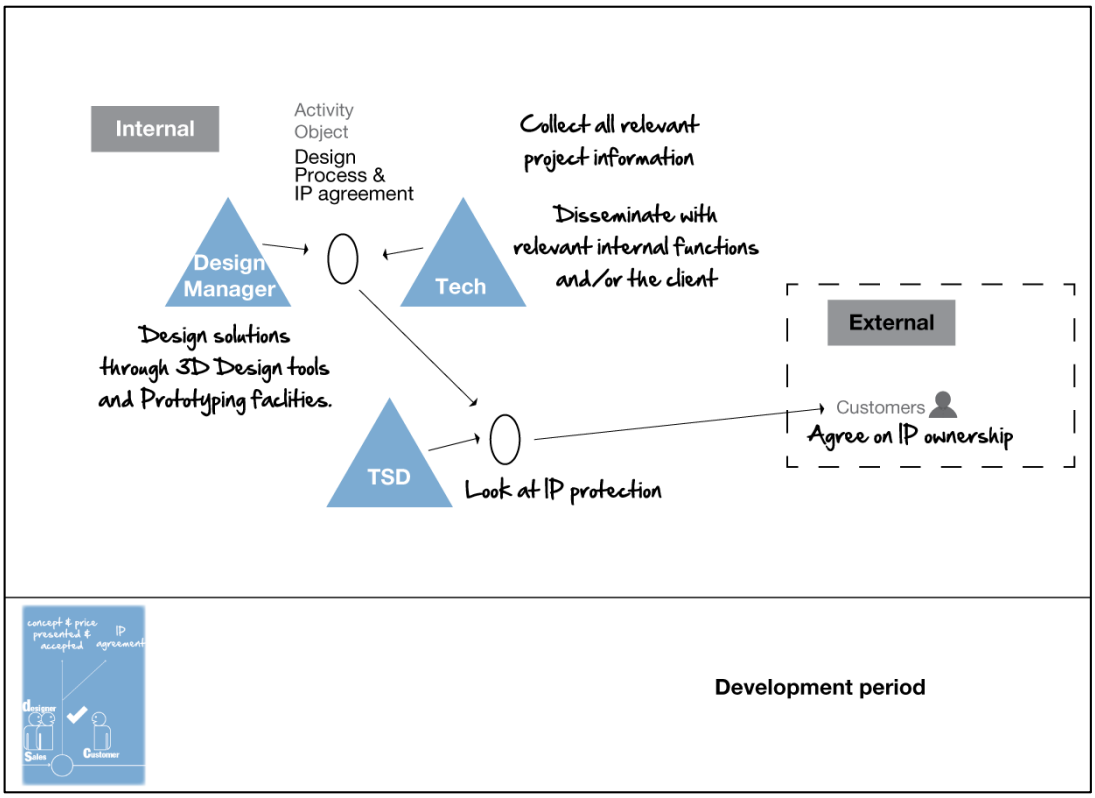


Figure 47. Key activities in the Development period of a NPD

Ordering the tool

Alan (DM) liaises with TSD to develop specifications based on the former's drawings and to order the new injection mould and dye for manufacturing the new product. The tool is then ordered by TSD and when delivered Alan's activity is to trial it in collaboration with the Production team who need this in order to accept it for the production phase. The importance of getting the right specs and tools for the production was highlighted by Alan;

> *"I'm a great believer of the right machine...you know the machine is going to run production, that's a really important part."* Alan, DM

As he further added, although it is convenient to do everything offsite (with regards on tooling), the lack of adequate financial resources meant that much work was done internally. For instance, Alan mentioned the fact that whilst the tool makers have their own moulding machine which they can use to trial a new tool, Pharma does the final adjustment of the tooling on-site, a practice that Alan particularly favoured.

Next is the Engineer team's involvement. Sam is Pharma's Engineer Manager (EM) for the past 15 years. His main responsibility and main object of activity at Pharma is the technical processes of the site. Sam is also a manager of 14 engineering personnel which are divided into two teams; a) the Tooling Engineering team and b) the Maintenance team, each of which have their own supervisor to report to. On a day-to-day basis, Sam, through his teams, is responsible for the maintenance work within Pharma (impacts mostly the Implementation period). This activity often bundles with the Customer Services team and the Planning member with whom he works in close proximity and tries to "*understand what the customer requirements are, customer requirements in terms of priorities for the maintenance team*" and to "*let the Planning guy know where we are in terms of, if we have machines or prep tools […] to plot them out on his plan".* Essentially, this information feeds back to his maintenance team who make sure not to have a breakdown on a machine which would delay the product delivery to the customer (Implementation period).

In scenario 1, Sam's (EM) involvement comes after the tools are purchased and just before the Implementation period when he has to "*pick the project up and deliver that to the Manufacturing (Production) team*". At one point, his Tooling Engineering team inspect the Dye in order to make sure that meets the manufacturing standards, whilst his maintenance team would "*check that everything is fine*" (Figure 48).

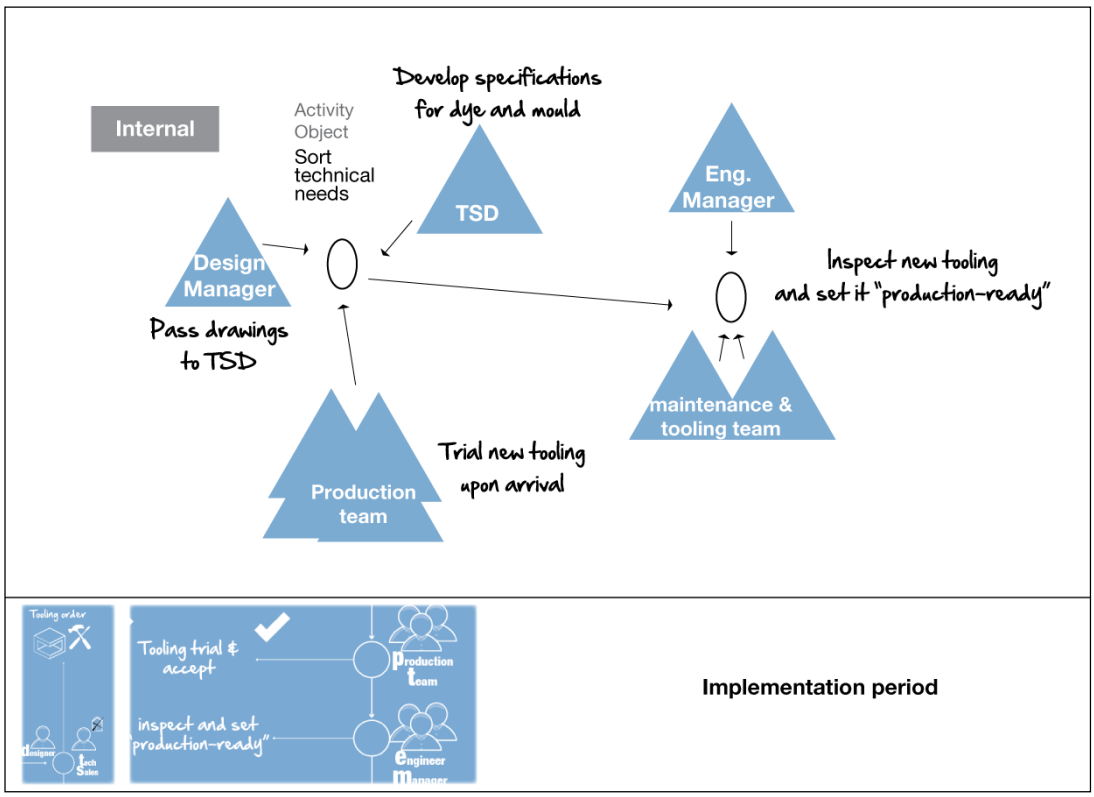


Figure 48. Preparing for production during the Implementation period of the NPD

Scenario 2: Need for new machinery

In some instances, the meeting at the Initiation period amongst TSD and Ben (SM) may conclude that the new project requires the purchase of new manufacturing equipment and hence a new production line. In this case, Alan (DM) is still involved with developing the design work of the new product. However, the immediate next person involved at that point is Sam (EM), who is responsible for specifying the new equipment (Figure 49). More precisely, Sam (EM) does this in close collaboration with his Engineer & Maintenance team as well as Tim, the Operations Production Manager (OPM) by "coming up with a specification of what we need". Sam then turns to the external-level, where he goes to speak to equipment suppliers about specifications and prices. From there, Sam has to share this information with Finance in order to get approval about the new equipment. Furthermore, Sam liaises with the Procurement team which have to order it. When this is sorted and delivered, Sam is in constant interaction with external contractors to do the installation and maintenance of the new machine on site. From there, the process follows the same route described in scenario 1, where the maintenance and engineer team make sure of its production readiness before sending it to the OPM to put into production.

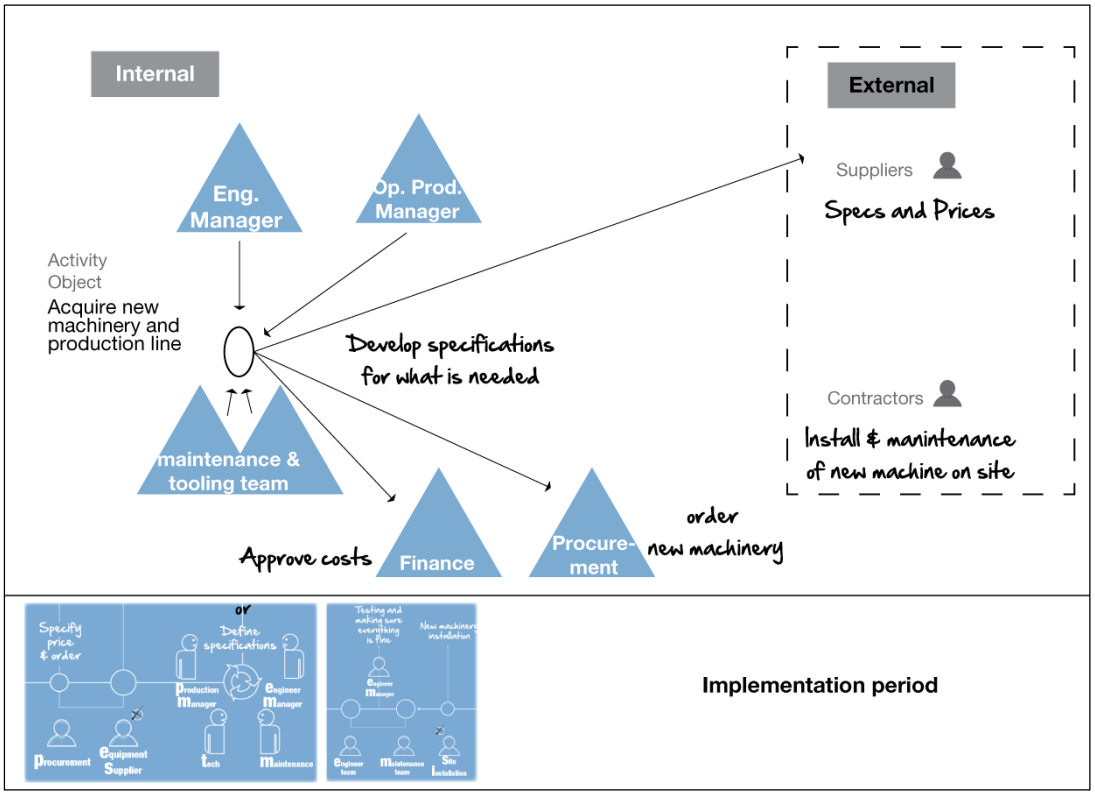


Figure 49. Acquiring and implementing new production resources to meet novel complexities

5.4.3 **Implementation period**

Big formal project meeting and ready for production

Before production begins, Pharma has an internal management meeting about the project plan where responsibilities and key milestones are agreed and signed off through a standardized format recently implemented by Ben (SM). The signing off points takes place every month during project review meetings. Steve (TECH) argued that the database program that Ben introduced to the company had a very positive impact to the communication of the different functions. As he noted, in the past, functions such as the production team felt alienated from the development process and some even tended to deny awareness of particular planning when things went wrong[34]. Similarly, Alan (DM) noted that in the past the development and production operated as if they were two separate functions[35]. At this phase, the new project becomes “a production item” (Sam, EM) and is the responsibility of Tim (OPM) and his team to manufacture it.

[34] Implying the notion to find excuses and not take responsibility for not meeting timeframes
[35] Implying the lack of close collaboration between the two.

Tim (OPM) has been 3 years at Pharma and his object of activity is the manufacturing side of the business. Tim supervises the manufacturing team which include its supervisors and operators. As the Operations Production Manager, Tim is responsible for dealing with staff issues such as attendance and disciplinary issues and to "*ensure the welfare of the people that working for me are looked after*". Furthermore, Tim occasionally demonstrates to customers the company's capabilities during tour visits at the shop floor.

During production, one of the most frequent actions for Tim is the daily planning during early morning production meetings, a practice that involves interacting with Sam's Engineering team, Customer services, Procurement, QA and the Planning team. The latter is among the most important tasks at the Implementation period. As Andrew (TECHN) pointed out, planning the production involves the coordination of practice at the shop-floor and the presence of multiple shift managers with power to control day to day responsibilities, represented an area of tension and conflict of interest in terms of setting priorities and task allocation (Figure 50). In addition to this object, Andrew, who had been for about 15 years with Pharma and 30 in industry, has as a secondary object of activity the training of novice manufacturing technicians.

Materials and relationship with suppliers

For the production to happen, Tim (OPM) needs to have the necessary materials for the specific product. As Alan noted, in the past Pharma had a bigger warehouse where stock material was stored. This changed since the merge with SE and therefore Pharma now needs to order the materials every time just a day before they are meant to be used. This practice creates certain issues that Pharma is looking to improve. For example, according to Alan (DM), having to order the material at the last minute means that there are a lot of tool changes and therefore unnecessary costs. Yet the biggest problem, as Ben (SM) noted, is Pharma's relationships with its suppliers;

> *"Our interaction with suppliers is terrible […] suppliers in this industry are too strong and we are too small...so there is no relationship building between supplier and customer".* Ben, SM

In the last year only, Pharma had around 8 cases where suppliers suddenly stopped to produce key materials Pharma used which in turn had an immediate impact to the

company's production of a novel product as it takes up to 2 years to re-register (a patent) e.g. if it is for a pharmaceutical application.

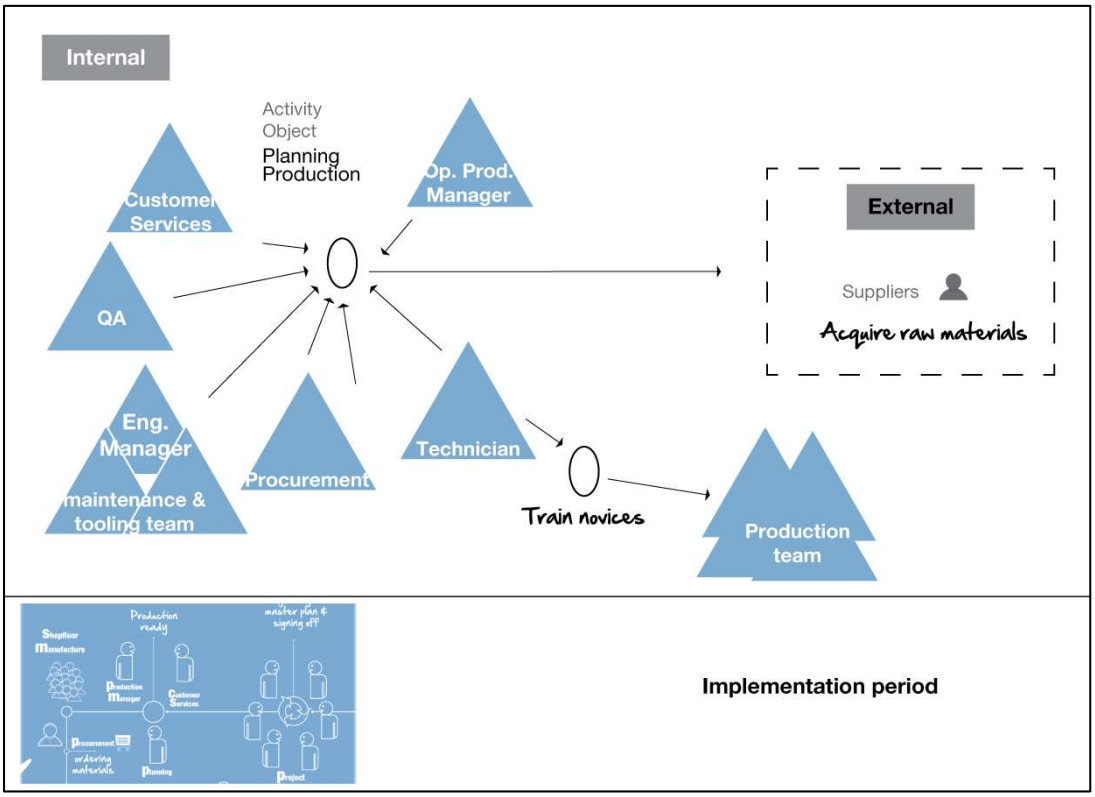


Figure 50. Planning production during the Implementation period of the NPD

Production-site changes

The production site at Pharma was undergoing major changes since the company's merging with SE, and the placement of Ben as a Site Manager. More precisely, at the time of the case study, Pharma was under a big Change Management program sponsored by the Manufacturing Advisory Service (MAS) incentive. Essentially the programme's aim was the reduction of all manufacturing costs based particularly on established techniques such as the Lean Manufacturing techniques. As Ben (SM) described, these techniques were meant to *"eliminate all wastes, reduce all non-value added activities, change the balance of non-value adding activities to value adding-activities"*.

Ben is the leader of the change management program as he is particularly experienced with these techniques while working in the automotive industry where these manufacturing practices are essential. Not only that, but as he claimed, many of the systems that Ben envisaged to implement at Pharma were actually his own developments;

> *"I write them myself! Because that's what I do with my spare time...I write systems".* Ben, SM

In managing and implementing the new programmes, Ben created a new – separate from the regular part of the business – function, named as Continuous Improvement (CI), consisting of two leading change agents. The two change agents have been working at Pharma in different positions prior to Ben promoting them to the new CI function, an ex-shift manager (from the production site) and a Quality Assurance (QA) member. To become change agents, the two were undergoing an intensive year of training, including a postgraduate program concerning Lean Manufacturing[36] techniques. Moreover, these new to the company techniques were being disseminated across the Manufacturing, QA, Engineering and CI functions through a series of workshops that were taking place internally in the organisation.

In Ben's eyes, the change programme is fundamentally "*a cultural change for the business*". As he explained, these changes are particularly necessary for a company like Pharma, who is operating in a heavily regulated industry such as prescribed drugs.

> *"When I came into this business, I was a little bit surprised, honestly speaking […] that the systems and procedures were not what I would consider to be efficient and robust."* Ben, SM

Yet making the necessary changes was very difficult for existing people in the business who are "*struggling to keep up with that pace of change*". For this reason, Ben created the CI function through which someone can drive the changes in the business and "*someone who can make objective decisions, who is not influenced*" (by other functions) and by reporting directly to Ben to make sure that "*any obstructions that he may have driving the change [in the course of the] business can be knocked out*".

Moreover, Ben argued that the implementation of techniques originally deriving from large organisations are not problematic because, according to him, size does not matter

[36] Lean manufacturing techniques are concerned with production practices that aim at production efficiency and the reduction of waste from non-value added activities (see e.g. Womack & Jones, 2010)

as it is not about buying expensive systems, but about making the company more efficient by adding more structure in the company;

> *"…it wasn't quick at all, that's part of the problem...it's very paper driven, it's a very labour intensive business, it has no systems or very limited systems, it's control of data and therefore it's analysis of data distribution, is slow…it's inefficient...and that's what we are trying to change"* Ben, SM

The new techniques through the CI function have an impact in all periods of the NPD. For instance, Alan (DM) mentioned how he is looking for reducing the actual weight of the product right at the beginning of the NPD and consequently that affects the specifications for the production tooling.

'Orphan' Projects

As was noted earlier, in some instances the new projects may terminate at any point and not reach the end-user for a number of reasons, such as having a difficult customers or difficult approval procedures. This result in excess capacity of materials that trigger the initiation of another NPD following Ben's report to the management and Sales team (discussed at the Initiation period). Furthermore, projects might reach only a few stages before they are either terminated or postponed for unknown time. According to Ben, this could happen when certain Pharma's functions (Sales in the example provided) either do not fully understand the customer needs or do not communicate that information effectively to the top managers. Such an example is the project which the company started developing for an overseas client, which found them even purchasing new machinery for the project and yet 2 years later it was still not in production.

Last but not least, in the scenario where a new product is developed but then terminates unexpectedly, Alan (DM) would look for other customers who might be interested in either that particular product, or incrementally changing it to suit their needs (a similar practice to Ben's report upon internal capacity) (Figure 51).

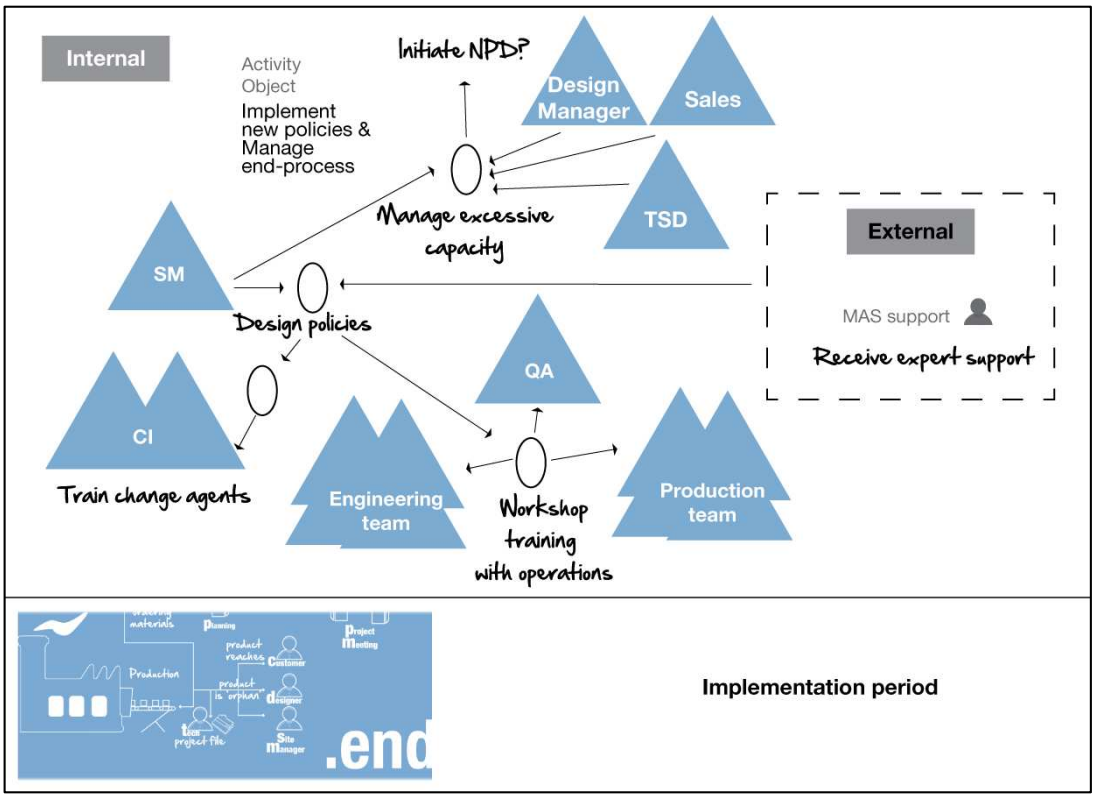


Figure 51: Final activities of the Implementation period

A visual representation of Pharma's NPD process is depicted in Figure 52 (next page).

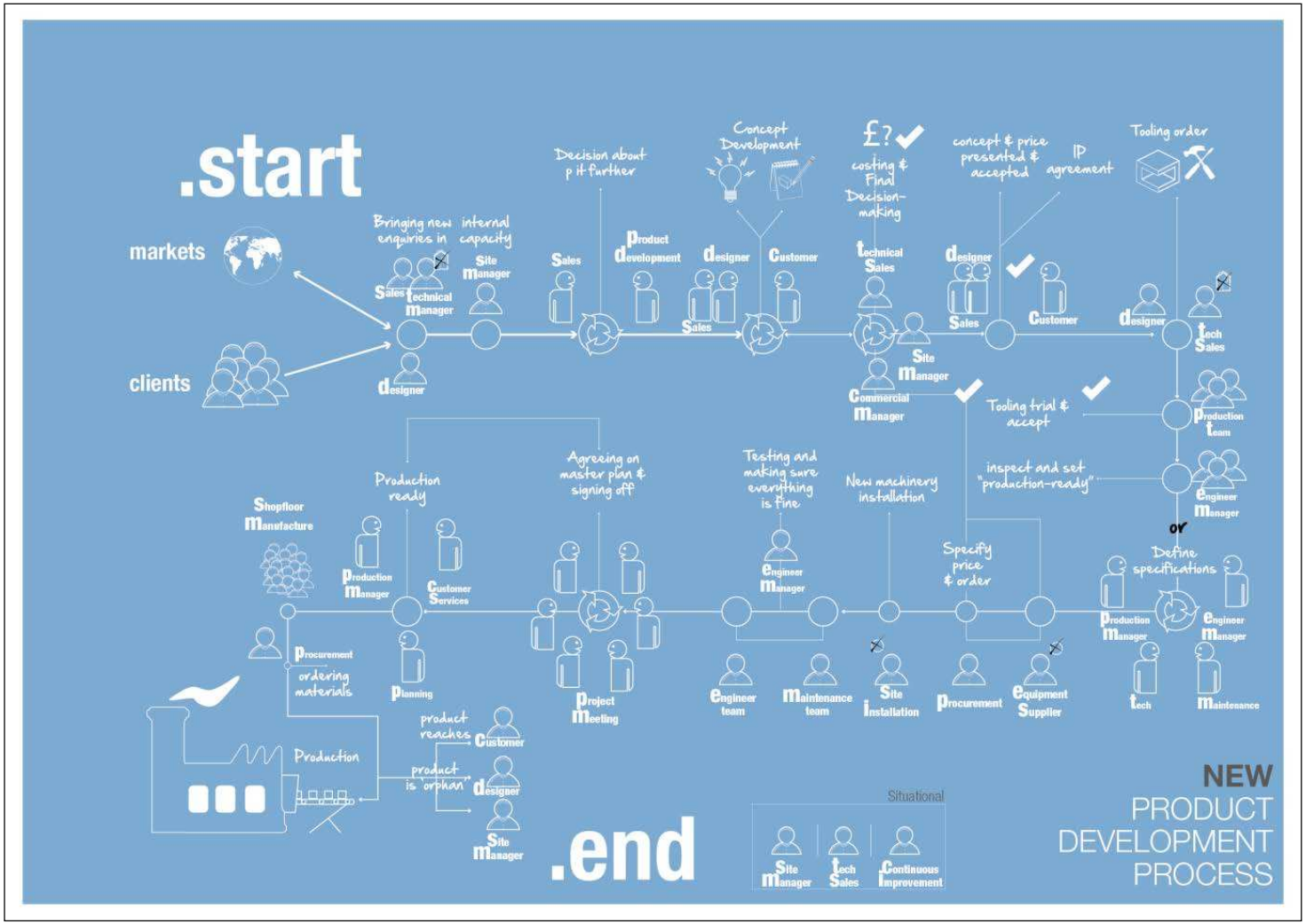


Figure 52. Visual representation of Pharma's NPD process

5.5 *BoPro*

5.5.1 Initiation period

At BoPro new projects generally initiate in three ways; a) feedback received from the on-the-road Sales agents, from market/customer/distributors', b) from customers directly enquiring for either branded or unbranded products, and c) from product ideas initiated internally by the Design team. The main people directly involved with the initiation of a NPD are BoPro's senior management team consisting of Nadia, CEO and Design Manager (CDM), Louise, Equestrian Brand Manager/Marketing (M), John, Production Manager (PM), and Kat, Manufacturing Supervisor (MS). Finally, there are also a number of externally based Sales agents.

a. Feedback from external Sales agents

The external Sales agents are independent and self-employed and have been loyal to the company for about 20 years. BoPro relies a lot to their insights into market needs and demands, as well as in representing the company to its distributors (both UK and overseas). Apart from Nadia (CDM), who personally manages certain key customers, the person directly responsible for receiving and disseminating the information coming from the Sales agents is Louise (M).

More precisely, Louise's object of activity is around the Marketing function, which she is managing herself. Prior to joining the company 4 years ago (from the time of the study), Louise worked as a marketing assistant for a company distributing tableware. For her, becoming part of BoPro and gaining more responsibility was a step up in her career – an exciting one since she particularly enjoyed working for the horse-riding market. In her new role at BoPro, Louise contributes to the yearly formal business plan, which is about achieving a certain percentage of growth for each product area. For this reason, the Marketing function at BoPro is closely linked with the external Sales agents. Louise (M) is in constant contact with each one of the agents to find out information such a *"how they've been in to see a customer, what the feedback is from the customer, how often the customer ordered, what products they take and what other opportunities there are…"*.

Initially, agents report about sales performance by emails. As the key recipient of these emails, Louise gets on the phone with them to discuss about the emails in more detail. Any issues raised around sales performance affect in turn the decisions regarding changes in the product types and their marketing. These decisions are made by Nadia (CDM) who, as the CEO, *"wants to know exactly what is going on, all the time...and wants to know where we are at, what is happening, what is preventing the project"*. As Louise further added, initiation may be triggered following negative feedback received from the agents regarding the sales performance of an existing product that has been launched. In this case, both Nadia (CDM) and Louise (M) *"start looking and asking questions 'why?'"*. In general, the feedback coming from the agents help BoPro to identify if specific demand exists and therefore, if there are any opportunities the company can tap into or if there are any problems with existing products that the company ought to resolve (the latter scenario is further discussed in the Implementation period).

b. Customer enquiries

The initiation of NPD also derives straight from customer enquiries. BoPro's strong brand value and expertise in the equestrian market enables it to regularly attract new customers who approach the company for the development of a particular product. According to John (PM), many continental customers enquire about 'unlabelled' products; products designed and manufactured by BoPro but the customer is allowed to use their own brand label. Generally, new customer enquiries still involve the external Sales agents who are commissioned to do so during events where the company exhibits its products such as various tradeshows[37].

Moreover, according to Louise (M), BoPro normally prefers to work on one project at a time. The reasons were the human ("*not enough people to be looking at doing a different project*") and financial resource limitations that the company faces, as well as the frequent cases where NPD lasts for lengthy periods of time. Lack of financial resources has a detrimental effect on BoPro's persuasion to engage in NPD, especially in other market sectors. As Nadia (CDM) pointed out, regardless of the high quality design solutions that the company is able to offer, BoPro was having inadequate funds to support the necessary marketing practices needed to enter a new sector.

[37] Louise (M) particularly pointed to one of the agents as the most active amongst the rest of agents.

c. Proactive product design

The information that Louise acquires from the external Sales agents is shared with Nadia (CDM) and together they discuss things such as a recognisable need or gap in the market or even the performance of competition (Figure 53). Both cases can potentially be the sources of inspiration to Nadia to begin ideating potential new product solutions. For Nadia, the tasks relating to the actual product development (including design and making) relate to her biggest strength and expertise. However, her involvement in the Design function is more frequent than what she ideally prefers (as an owner-manager) due to the lack of a mature established design department in the company. As pointed out earlier in section 4.3.4.3, the problem with retaining staff had a major impact on the design function at BoPro.

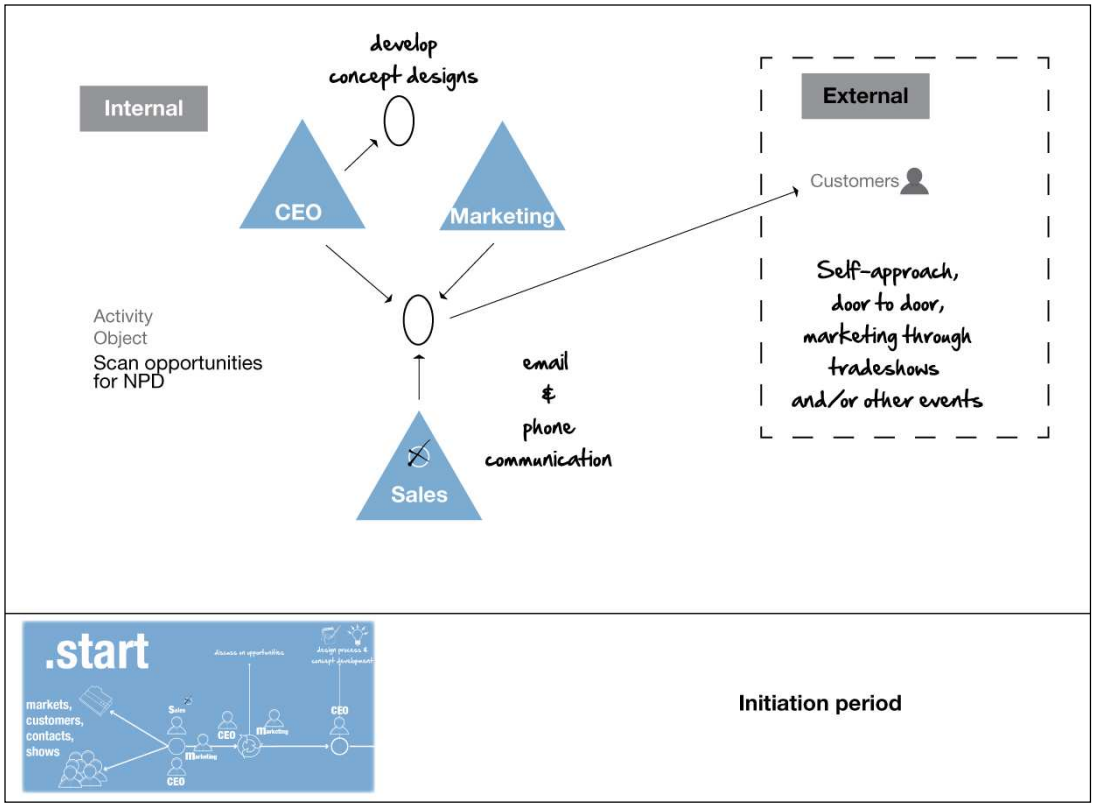


Figure 53. Key activities leading to the initiation of a NPD

Planning NPD

The way Nadia keeps up to date with progress was done both formally and informally. The feedback coming from the Sales agents and/or potential customers is fed to the formal planning of current and new projects at BoPro.

BoPro has in place two types of meetings; a) a weekly meeting for project reviews where the management team (consisting of Nadia (DM), Louise (M), Kat (MS) and John (PM) discuss "what we are going to do, when, how, these kind of things", and b) a monthly meeting which also involves the 'front office' where HR and the Account manager sit, to discuss overall performance and sales figures.

Nevertheless, as Louise (M) asserted, not everything is planned nor would guarantee that people would actually follow it blindly;

> *"We should do but just sometimes people just roll into projects and sometimes there is no real planning or management...but when there is, like we have got a project at the moment that is a little bit planning and management, someone has to own it".*

As John (PM) suggested, "*there is an awful [lot] of informal discussion going on*". On a daily basis, a great deal of interaction among the management team occurs informally since they all shared the same working space in the company (Figure 54).

Because the NPD process in BoPro was traditionally managed in a relatively unstructured manner, the company recently began thinking about structuring the process. To do so, the company began attending regional business support events such as the seminars provided by the Design Network North (DNN). BoPro developed a relationship with the DNN organisation which translated into a two day workshop with DNN experts that led to a draft flowchart of the suggested process to follow during NPD (e.g. Figure 55). This process was at an early Implementation period at the time of the interviews – though Nadia was very positive about its effectiveness as it helped the project management by giving "*ownership of a project at the different stages*".

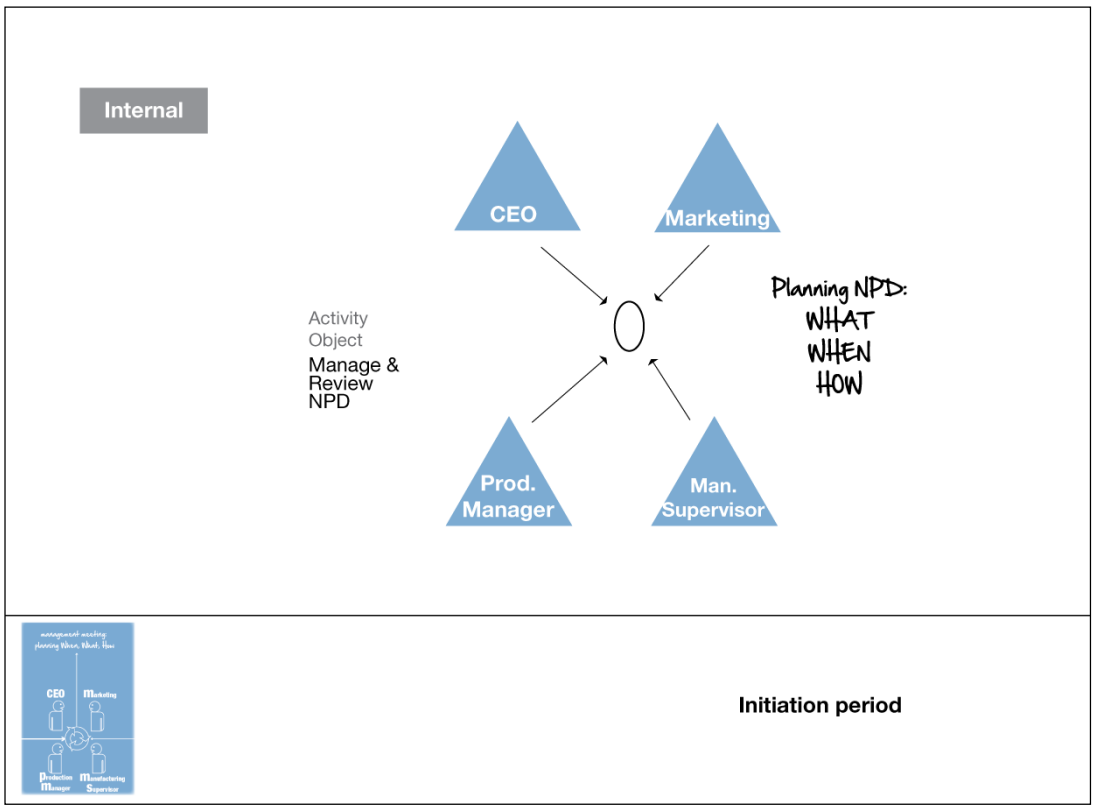


Figure 54. Informally planning the NPD

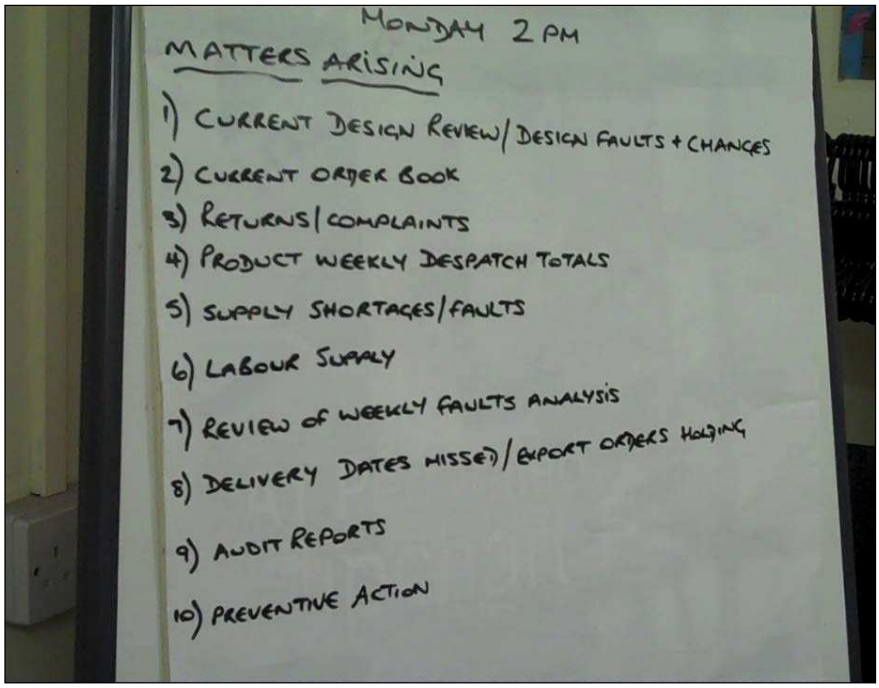


Figure 55. Example of a formal planning of NPD during weekly management meetings

5.5.2 **Development period**

NPD preparation

As mentioned earlier, members of the management and production team like John (PM) and Kat (MS) are informed early about any new projects during the weekly management meetings.

John (PM) has been at BoPro for 5 years and prior to joining the company has had a long experience in the retail industry. John was initially employed for the Procurement position but he was soon promoted to Production Manager, from where he manages the production along with two supervisors, Kat (MS) and one more at the warehouse. Moreover, John is the person to contact in the company when Nadia is not around. For him, dealing with purchasing and contracts are two things that he is good at and the areas he has most experienced of his previous retailing practice. However, John's object of activity[38] and its complexities dramatically changed from what he is previously used to;

> *"Actually getting involved in manufacturing, learning how to put things together, ordering the components… the ordering is very similar to what I used to do but it is components rather than finished products, which is totally different. It's a bit more complex"* John, PM

> *"…and then having to manage the sort of costing…ohm… I mean [at the] retail level you just have a standard mark-up which you put on every item and that is what you are selling...whereas here you've got to cost every single component and then you get to a figure, then you [have to] start putting your profit on, and things like that to come to a price that you sell [at], so it's a totally different activity."* John, PM

Once a new design is finalised, Nadia (CDM) liaises with John (PM) who is responsible for the procurement side of the project. More precisely, John orders all the components such as the fabrics or any other bits that the company does not stock and are needed for the development and production of the new item (Figure 56). As Nadia argued, the realisation of a new product involves the transformation of different individual components outsourced from international suppliers that are combined to make a new product;

[38] On a day-to-day basis, John (PM) is also involved with the maintenance of machines, as well as responsible for the stock of materials.

"the changes in nature...neither part can be sold on their own...so it changes its nature from a cover and a foam panel into an equestrian body protector...designated as made in the UK...it's also an IP protection, it means nobody has everything". Nadia, CDM

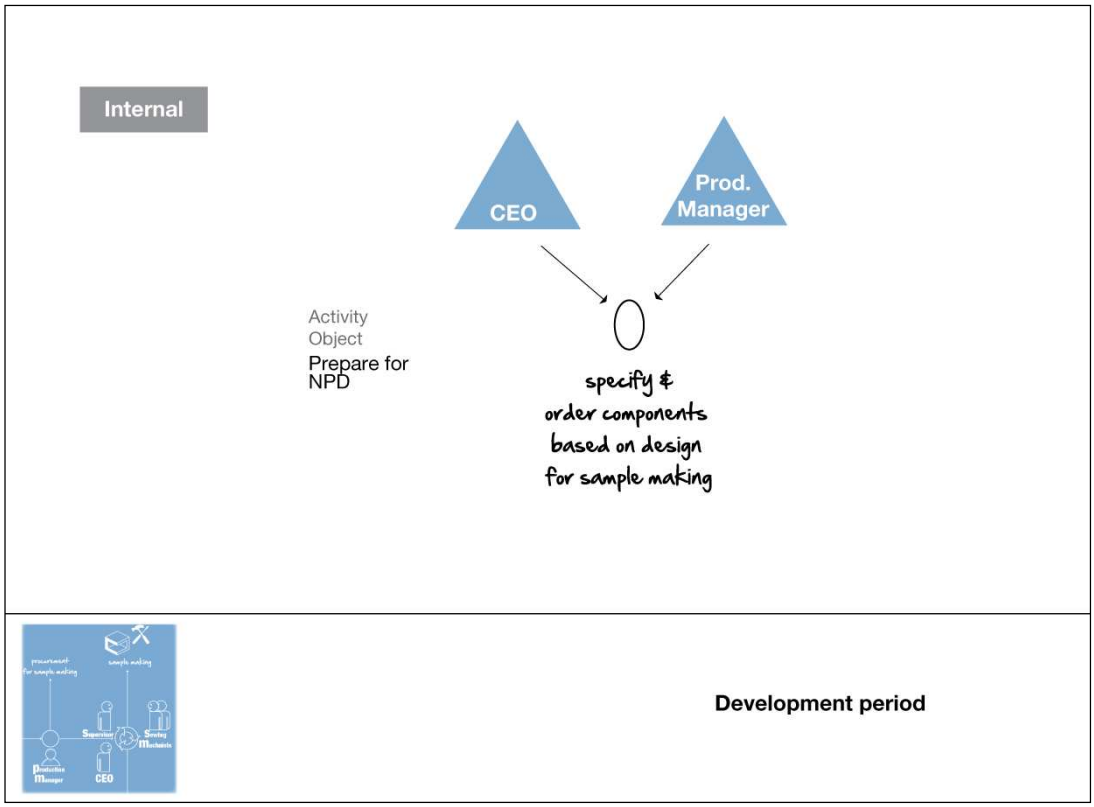


Figure 56. Source critical supplies needed for NPD

Sample Making

Once the components John has ordered arrive on site, Nadia (CDM) uses them to make samples of the new product. This activity involves the Design function[39] and the two Sewing Machinists who make the sample garments. Kat (MS) is responsible for these two individuals and she supervises and plans their practice according to the project needs set earlier by Nadia.

Kat (MS) has been at BoPro for about 16 years during which time she has seen her object of activity dramatically transform from being a packer to a manufacturing supervisor, when she was asked to replace the production manager at the time. Since then,

[39] At the time of the interview, solely Nadia ran the Design function while she was looking for a new product design staff to hire.

Kat has been a Manufacturing Supervisor at BoPro and although she has nothing to do with managing the production, she assists John (PM) with anything related to the planning (production) and shop-floor organisation (what needs to be done and when) (more on Kat's role is explained in the Implementation period).

Samples are used as boundary objects; when samples are ready, Nadia sends a variety of them, i.e. different colours and/ or different fabrics, to the end-user to make sure they are satisfied with what the final product is going to look like. They are also used for marketing purposes and events mentioned earlier such as tradeshows or when sponsoring a sports team. This activity is the source of various incongruences amongst the individuals involved, particularly the marketing and production personnel (Figure 57).

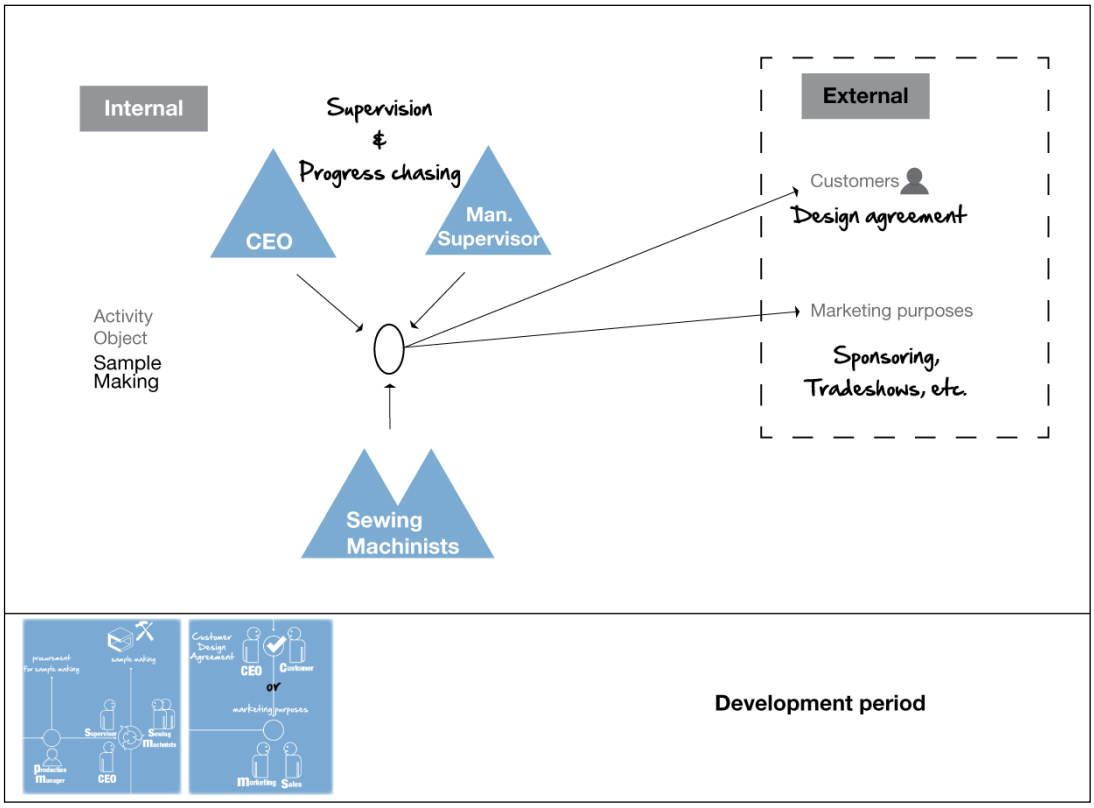


Figure 57. Activities during the prototyping phase of the Development period

One such example to illustrate this is when Louise (M) asked Kat (MS) to organise the Sewing Machinists for the development of new samples which had to be ready as soon as the following day. This created a clash of priorities and a threat to Kat's object of activity, which is to keep things well planned and for production to be on time. However, there was not much Louise could do about this short notice as she received the spon-

soring team's sizes very late. Nadia (CDM) who intervenes and decides about priorities normally manages such tensions. From Louise's (M) point of view, part of the problem is the lack of understanding of the practice between the two (herself and Kat). Louise noted that she does not have a clear view of what the production process involves and how her practice disrupts it;

> *"…because when you are living in a world where you order something and expect delivery the next day, I cannot comprehend and I cannot tell a customer that new orders are going to be in 3 weeks, it just doesn't make sense...I can understand it when it's made in the far east and comes in huge quantities, but when it looks [like] a normal product and there is a long lead time, because you run out of something or there is not enough staff, then I just cannot understand how...I just think it could be more modern and quicker?"* Louise, M

In response to this issue, Louise began participating more frequently in the production meetings and this activity helps all parties develop shared understandings of each other practices;

> *"…then I understand their point of view and they understand mine too...and I can also know that if something will take 3 weeks instead of being told 3 weeks later and then talking to the customer saying 'sorry...'".* Louise, M

Product testing and Safety Standards

Upon customer's satisfaction with the product's design and making (sample trial), the project goes back to the Design function (Nadia, CDM) to work on further technical details to get it ready to be tested for the safety standards (Figure 58). Nadia makes sure that the product is in the right condition to pass the Safety Standards and she relies to an outside agency to do the final testing. The 'meeting the safety standards' object of activity was described by Nadia as one of the key competitive advantages of BoPro.

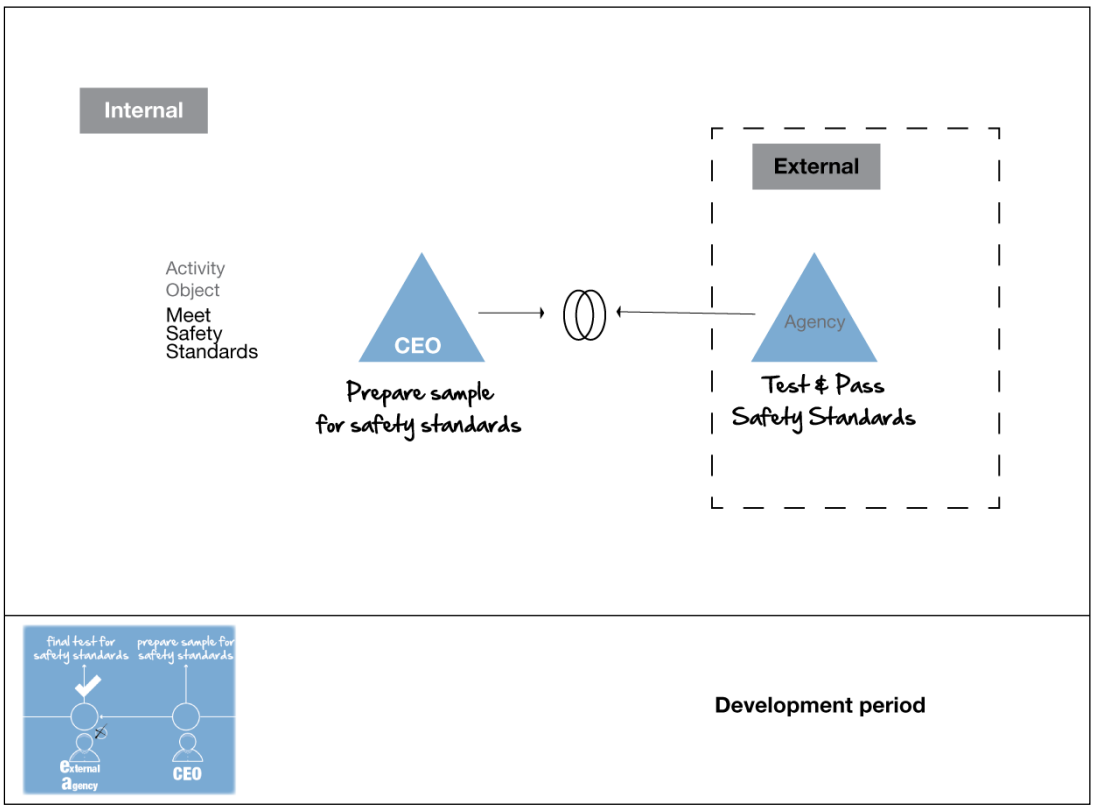


Figure 58. Sampling and testing to meet safety standards

5.5.3 **Implementation period**

Production

Once the design, sample and testing phases of the NPD are completed, the project is given to John (PM) to proceed with the manufacturing. John's object of activity is to plan the production, order the components for the full range of production and depending on the type of product to decide whether the manufacturing is better done in-house or off-shore. Every product that BoPro designs and develops is based on outsourcing the raw materials (garments, foam) and doing the final assembly in-house. The company has a well-established and long-term relationship with the suppliers of these components.

In close collaboration with John are the two Manufacturing Supervisors. Up until that point, Kat's involvement is with the daily business and the existing production process. During an NPD process, her part comes after the new products are ready to be put into production;

"My role does not start before the products are designed and prototyped…when it's finally 'oh, I think this is the garment, then it will come downstairs to my team" Kat, MS

During the production phase, Kat is responsible with progress chasing and the supervision of the shop-floor workers, making sure that things such as garments that need cutting are being done on time. Moreover, she organises the supplies that John (PM) had previously procured (Figure 59).

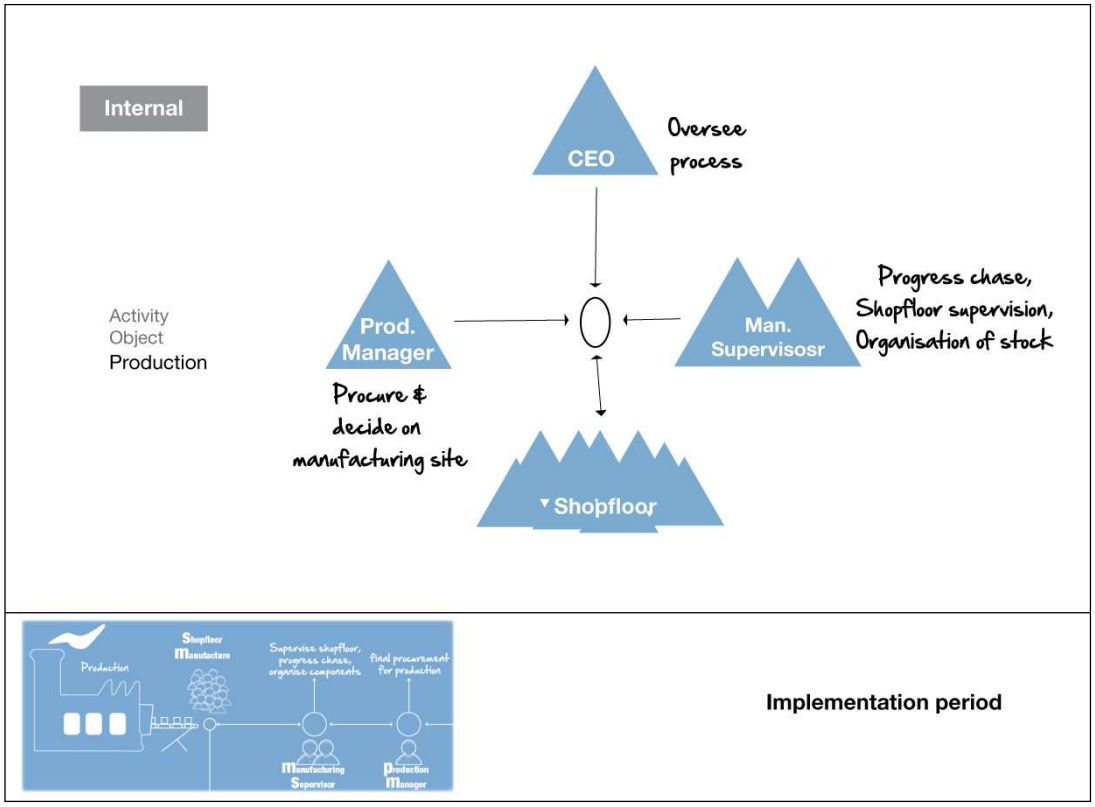


Figure 59. Preparing and initiating production

Towards the end of the manufacturing of the new product, Kat's (MS) object of activity is to organise the dispatch and logistics of the order. In this activity, she is in close collaboration with the Warehouse Supervisor with whom she completes the order and finalises the dispatch of the packed goods.

In the scenario where the new product is initiated proactively (through design), Nadia (CDM), Louise (M) and the Sales agents are concerned with finding the retailers to sell it (Figure 60). As previously discussed in section 4.3.4.2, finding a retailer was a task that the company had found many difficulties dealing with, mainly due to their demands and the relationship between big and small brands.

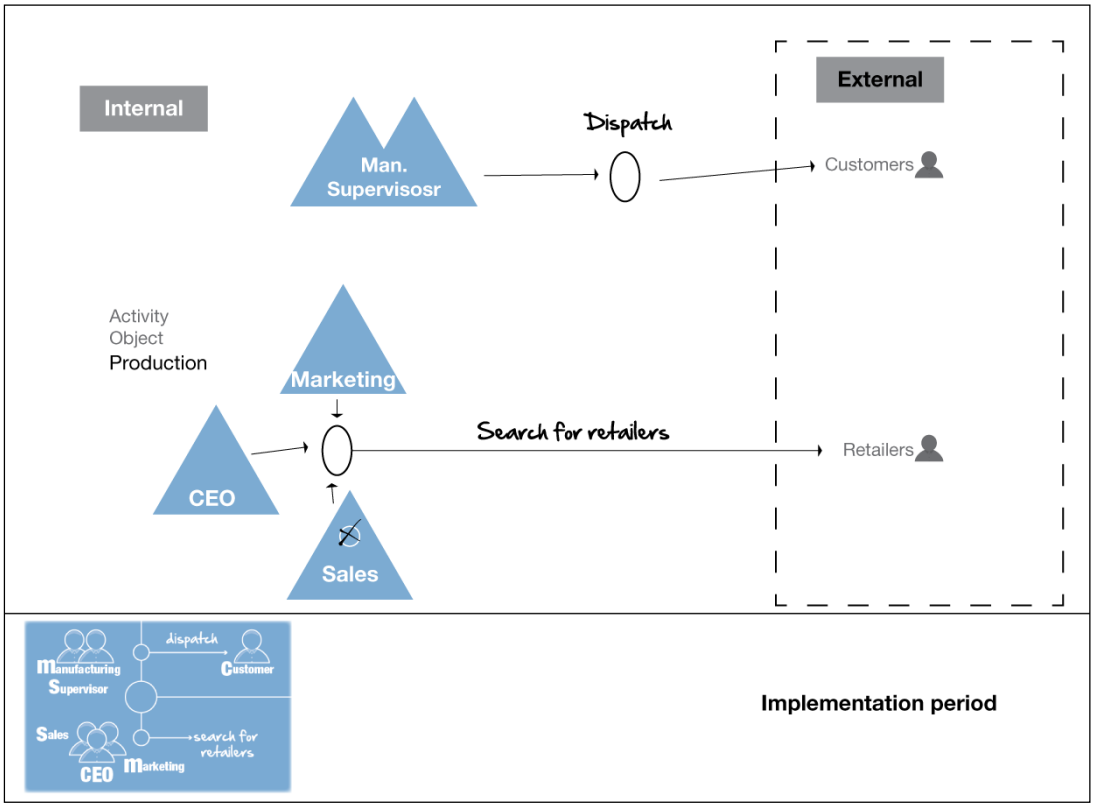


Figure 60. End of the Implementation period of the NPD process

Project review and back to the start

Once the products reach the end user they become subject to the design reviews during the weekly management meetings. As mentioned earlier, the discussions there involve customer feedback from the Sales agents with the management team particularly interested in possible customer complaints, faults and/or changes that might be needed. Louise's marketing role often finds her meeting with key retailers directly and asking them about their opinion or feedback from customers regarding the 'fit' of the body protector designed by BoPro. An example of this was given by Louise (M) to illustrate how a product that the company had been developing for some time, later proved to not have the expected 'fit'. This problem eventually led to the initiation of another NPD;

> *"When for instance, last year I went down to *** for feedback and the body chest we had upgraded, it took a year and a half upgrading, [it] did not fit anybody...and customers would then come back and say 'I'm not ordering anymore from you' and it is [these] sort of comments…and I would then feedback this information to the CEO and to the Designer, when there is one…the Designer would either try to redesign it or argue about it, whilst the CEO always see things*

> *from the company point of you. The CEO would then drive forward a new design [and] would probably want to improve that garment."* Louise, M

In other instances, the company could equally decide that it is not worth working on a particular product anymore and end up stopping its production. Dissatisfaction could equally come from the Sales agents themselves, who find it either difficult to sell a particular product or consider it a low-value item in terms of giving them very little in return, hence they prefer to stop spending their time selling it.

> *"But the feedback from the [Sales] agents and the general feedback from the Management team is ...I'm looking at sales and what does or does not sell, would then persuade the CEO not to revamp that product again, do not waste any more time on it, bring a new one out...it is better".* Louise, M

Figure 61 in p. 240 depicts BoPro's NPD process.

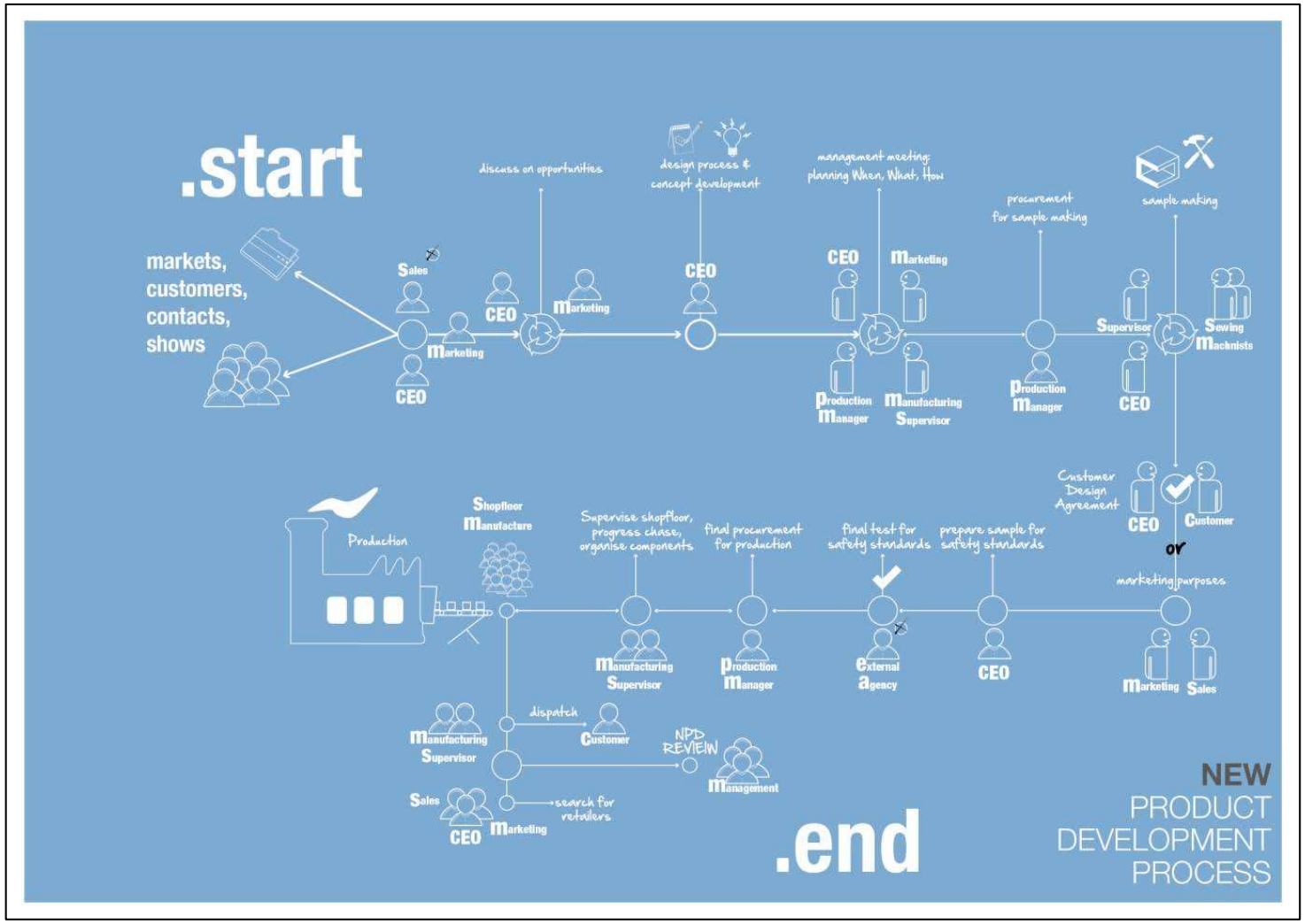


Figure 61. A visual representation of BoPro's NPD process

Chapter 6.
Surfacing Obscure Drivers to Innovation: Cross-Case Observations of the Innovation Journey

6.1 *Introduction*

This thesis explores the research question; how New Product Development (NPD) practices in small and medium-sized manufacturing enterprises (SMEs) are influenced by obscure practices, deployed to meet emerging challenges that enable SMEs to remain relevant to their markets.

In this chapter, I outline how this study has addressed the aim of the thesis: to increase our knowledge and understanding of the hidden dynamics at play in the innovation practices of small-to-medium sized organisations. Chapter 2 provided insights into the wider arena of organisational research and concluded with the integration of key concepts into multi-level theoretical frameworks. These frameworks were also the drivers towards the construction of an appropriate research strategy presented in Chapter 3. There, I have tried to argue why a practice-based (theoretical) and qualitative case study (methodological) approach was most promising to satisfy the needs set by this study. I have also outlined how an exploratory pilot case study led to the development of a NPD activity card tool which was adopted as a data collection method. Furthermore, Chapter 4 introduced the four SMEs visited by the study, and their general characteristics such as their size, sector, formal structure, and various historical events. The four SMEs' NPD process were analysed in Chapter 5 based on the adopted three-phase model (Initiation, Development, and Implementation) and actions through a multi-level framework drawing upon the theoretical lenses of Activity Theory.

Below, I am addressing the critical question of "what have we learned" from this exploratory research study. Hence, the focus shifts towards the creation of a more integrated picture of the NPD journeys of the four SMEs interviewed. To achieve this, I discuss patterns of innovation behaviour through a cross-case analysis of phenomena most pertinent in the three-period model of the NPD process presented in Chapter 6. Each period reflects an enquiry that relates to the 'way we do things around here' of the four cases;

1. *Initiation period: '*Are we doing the right things?*'*
2. *Development period:* 'Are we doing the right things right?'
3. *Implementation period:* 'Did we do it right? What have we learned?'

Through these general NPD phases, a number of secondary questions are explored: Who are the key individuals and teams involved at each period? What are the tactics towards the development of new business? How do they make decisions at the Initiation, Development and Implementation period of NPD? How different levels (micro and macro-level) interact and influence the company staff members' practices and therefore a company's agility and innovation behaviour at each period? How *visible* are these phenomena that affect companies' capacity to innovate to both them and outsiders (i.e. level of awareness)? More importantly, how important is it to elicit them, early and with clarity, in order to direct design expertise to the specific needs of the contexts which we want to support?

Before moving to the investigation of the questions described above, the attention will shift to an entirely different time-period of organisational life; a period which provides key insights on the events that seem to have shaped the most current innovation behaviour of the four SMEs. This period, termed in this text as *the transformational period*, draws upon Engestrom (2001)'s third principle of AT, an activity system's *historicity*, integrated with the concept of *gestation period,* proposed by Van de Ven et al. (1999). As I argue further, one important aspect of paying attention to a company's transformational period is that it provides highly relevant and useful insights about the management of the whole NPD process and a company's capability to remain agile.

6.2 *A Transformational Period*

One of the five principles of Activity Theory enunciates that an activity system's "*problems and potential can only be understood against their own history*" (Engeström, 2001, pp. 136-137). Studying the *historicity* of the system in question allows one to understand the way *the object of activity* has been transformed in its most current state. This is important in that the exploration of social practices does not rely solely on the concepts, procedures and tools adopted within particular activities, but are also contrasted against the practices' history. While an Activity System's key aspects are their *multi-voiced-ness* and *contradictions* that lead to *expansive transformations*, one essential question to answer here is; *what events influenced the system in question to behave the way it presently does?*

Here, the two concepts are used to highlight the *transformational period* that was observed in the four SMEs analysed in Chapter 5. This period was found to include various (internal/external) influences and (shock) events that led to changes at both the internal (e.g. ownership, teams, culture, resources) and external (e.g. markets, support) levels of the organisations. As a consequence, these events significantly affected their most current attitude towards innovation and, as I argue, they dramatically affected the nature of the object of activity (strive to innovate or not) of organisational member's practice analysed in chapter 5. Moreover, in line with AT's principle of *expansive transformation*, this period "moves through relatively long cycles of qualitative transformations" (Engestrom, 2001, p. 137) and hence it represents both past events and on-going efforts towards change and adaptation. Putting it differently, the *transformational period* is used here to revisit the events that seemed to have shaped the most current forms of organisational behaviours and attitudes towards innovation. Doing so, it helps to better understand behaviours by explaining the phenomena that put organisations onto a certain path of dependence that drives their decision-making and problem-solving approach.

In general, the transformational events spanned across different lengths of time, often lasting more than five years, while some were being implemented during the study's intervention. This means that companies differed in the level of transformation they were experiencing; some were at an early phase (CS3-Brushware, CS5-BoPro) while others had already gone through major transformational phases (CS2-Glazing, CS4-Pharma). In all cases, however, the transformational period was a continuous process.

Finally, this period also provides a first glimpse of the conceptual links between key multi-level phenomena that this study set to explore.

6.2.1 Events and shocks influencing agility in the four manufacturing SMEs

A number of precipitating events were identified as key influencers of innovation behaviour in the four SMEs. These events seemed to follow a general pattern of five key events, albeit there were variations in their consequence and chronological order they manifested at each SME.

- *Typically, the first event was about sense making and* recognition*; certain key individual(s) (top managers) recognised the need for change to respond to identified threats/opportunities. Individual characteristics and external influences are at the forefront during this event and resulted from both reactive and/or proactive tactics.*
- *A new (strategic) vision was devised and followed by a personal quest for its implementation. Vision construction was usually tacit and informal, hence the more people involved the less visible are the principles that drove the decision-making process.*
- *Further* shock events *such as the clash with existing paradigm and/or changes in leadership/ownership provided the necessary leverage that brings on board the rest of the organisation.*
- *Transition into the new era was a gradual, continuous process and involved changes across two central parts of the organisation; a) technological (resources / capabilities side) and b) its internal and external sociocultural and relational characteristics (peoples' side).*
- *During the transformational period, innovations of various types (e.g. paradigm, position, administrative, product, process) were produced often under the radar, which in turn increased the organisations' overall capacity for future innovation.*

For example, such pattern was demonstrated in CS2-Glazing's history, part of which was reported in section 4.3.1.1. Figure 62 depicts, through a multi-level approach, the way this transformational period unfolded at CS2-Glazing[40].

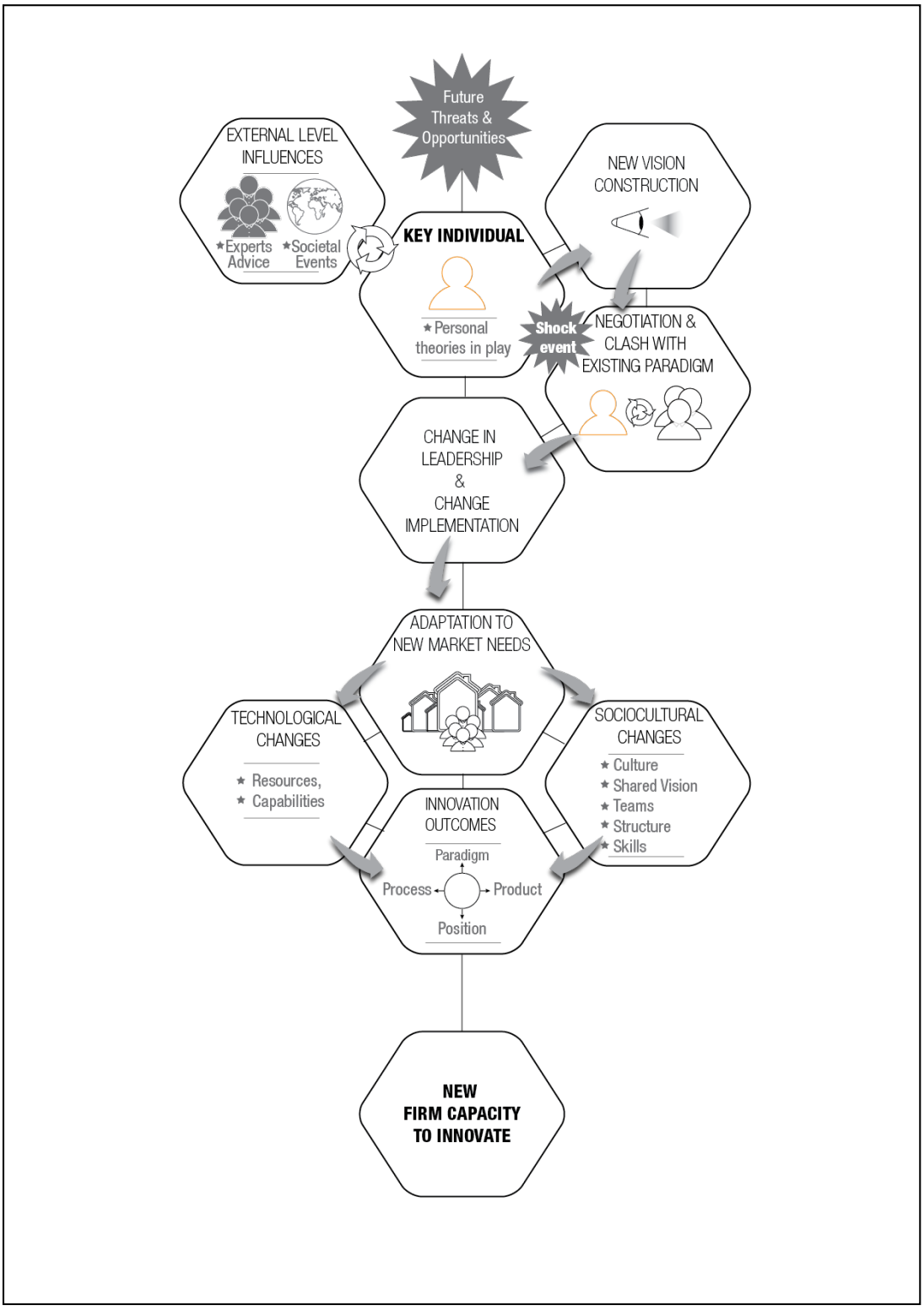


Figure 62. A general pattern of events depicting the transformational period at CS2-Glazing

[40] Not following a strict chronological order

More precisely, the first critical event occurred when Nick, current owner of CS2-Glazing, was at the time a newly appointed Managing Director by the company's former shareholders. Nick carried with him a set of *personal theories* which he wanted to put in practice as opposed to the directions set by his bosses (upper echelons). It was his belief that CS2-Glazing would have had a lot more to gain from spending more time *meeting experts and advisors* externally and a bit less time internally getting to know each staff member better. His decision to pursue this activity was later proved the right one, as Nick was able to collect vital insights about the state of the market CS2-Glazing was operating in, along with relevant threats and opportunities. Through his *interactions with external* peers, Nick came to the critical discovery that the company needed to change in order to avoid a future substantial market share decrease (hence a general threat to CS2-Glazing's own existence). This *recognition for change* drove a sequence of events that significantly determined its future behaviour. Nick's sense making of the market led him to the conceptualisation of a *new strategic vision***.** This vision was about *incrementally improving* CS2-Glazing's existing business model by changing how the company framed *what* it did (*paradigm innovation*) but also *where* it was to offer its new products (*position innovation*). Key creative moments were the "*strong as steel*" and "*being preventive*" *metaphors* that Nick used to communicate CS2-Glazing's resilient products that were traditionally made out of steel. Nick's strategic vision coincided with major events that were taking place at a societal/national level at the time; that is, there was a general climate of fear due to recent terrorist attacks and the social discourses frequently revolved around security and preventive issues[41]. These discourses inspired Nick to look at the *security* glazing market as a potential environment for innovation and, hence, economic prosperity.

Entering the new markets generated novel complexities and uncertainties that generated a risk of investment in resources that the former shareholders were unwilling to provide. For them, doing what they always did was the most logical choice (and their comfort zone) and Nick had challenged this establishment. The resulting *clash of paradigms* created a *shock event* that manifested in a mutual buyout agreement between the former shareholders and Nick, who took the personal risk to invest personal resources in order to implement his new vision of CS2-Glazing's future existence.

[41] Not derived from the data but from a post-hoc comparison of the time internal to the company events were taking place and to popular world events (i.e. attacks on the London's underground) of the same period.

The new environment in which CS2-Glazing began operating in its new era, shared an important difference to the company's traditional practice; the new markets did not relate to the heavy industry which CS2-Glazing traditionally involved with and, consequently, there was a lot less demand for steel-based systems. Instead, the new customer demands revolved around lightweight and low-priced systems. This reality forced the company to adopt a new material, aluminium, as it satisfied both demands of being lightweight and, more importantly, a lot more cost effective than the preceding steel-made systems. The introduction of the new material, in turn, increased the company's capability for novel designs (product innovation). Moreover, it led to an essential investment in both technical and human resources; the new material needed new tools and machinery, while production teams experienced a reduction in the steel-based side and an introduction of new, aluminium-based experts. These changes introduced new manufacturing processes and knowledge spillovers from the new staff which amplified the organisation's ability to introduce future process innovations. Meanwhile, in response to the increased new product enquiries, CS2-Glazing eventually expanded its factory facilities and its overall manufacturing capacity.

Finally, a key critical change following Nick's new vision regarded CS2-Glazing's new social context; the new organisational form consisted of clearly defined, yet horizontal, functions driven by a top senior (orientated towards new business development) and secondary management teams (team leaders). The *new corporate culture* reflected that of its owner's (Nick) *personal theory*; to focus externally in order to understand the customers and develop novel outcomes with them in mind. Under this *user-centred mindset*, new coherent teams were created either by shuffling existing experienced members to new positions or by investing in new practitioners that shared similar values. New and old practitioners blend into existing and new teams, essentially disseminating the shared value across all areas of the organisation.

A very similar example of transformational period was observed in CS3-Brushware where Chris (MD), took over the day-to-day management from his father (i.e. from the 5th to 6th generation family member, see section 4.3.2.2) and brought a new *personal theory* into play that was closely linked with an eagerness for *change* (section 5.3.1, pp. 192-4). The new leader's (Chris) interactions with external experts and advisors led him to the recognition of potential threats and opportunities. With this in mind, he put in place a newly formed senior management team and eventually created the Business Growth Plan (BGP) – a strategic plan that particularly aimed at an internal

cultural change. BGP was essentially the company's response to environmental pressures driven by 2008's credit crunch and an attempt to adapt to the new economic landscape. The new *vision*, guided by BGP, was to transform the 'old-fashioned' style of the company and adopt one that reflected *innovativeness*. In the past, striving for innovation was not a necessity in the low dynamism of the markets in which the organisation traditionally operated[42]. Yet, innovation was seen as a necessary ingredient for expanding in the more dynamic and fragmented, specialised markets that Chris had found to offer novel opportunities. Like CS2-Glazing, the new focus for CS3-Brushware was a user-centred approach to innovation; first, to really comprehend the needs of the markets and, then, design for them. Furthermore, the company was also trying to change the way it appeared to its customers (*paradigm change*) by redesigning both its brand and website to better communicate its new design offers. Becoming more innovative, however, meant that CS3-Brushware had to change the way things were done internally. The BGP plan was seen as an opportunity to tackle various recurring problems that had been part of the organisation's 'way of doing things here' and which often manifested as a socially sustained ethos of tension avoidance (Morgan, 1997). That is, old-timers were too comfortable to change. At the same time, considerable efforts were put by Chris to not damage the existing legacy his family had nurtured in more than a century as quality brush makers. Hence, CS3-Brushware's challenge was all about ambidexterity, that is, finding the right balance between enjoying the stability that traditional practice offered versus the opportunities for growth of the uncertain and risky new markets. Some of the core organisational changes that followed included a) the reformation of its internal structure to the needs of the three distinctive market segments the company operated in (see section 4.3.2.2) and b) the employment of new creative skills (in particular product design, discussed in section 5.3.1, p. 199) which allowed the company to develop novel ideas in-house as well as to set to improve the NPD process.

Among the four case studies, CS2-Glazing and CS3-Brushware reflected the highest level of *proactive* behaviours of change and adaptation as responses to certain threats and/or opportunities contingent to the organisations' internal and external idiosyncrasies. In contrast, the transformation periods of CS4-Pharma and CS5-BoPro followed a more *reactive* path.

[42] "The concentration of competitors determines the dynamism of the market in which the firm is operating and the consequently greater or lesser need to undertake innovation activities (Schumpeter, 1942)." (Barge-Gil et al., 2011, p. 14)

For example, CS4-Pharma's transformation was the product of the greatest *shock event* amongst the four cases (merging with its main competitor). This event was not the result of a proactively planned decision but instead a *survival* one, following the company's largely damaged financial health (section 4.3.3). The resulting *change of ownership* was a key *shock event* as many of the changes were *forced* by the new board of directors and much of the strategic control (along with technical and human resources) was relocated outside CS4-Pharma's premises. This had a general impact on CS4-Pharma's *innovation behaviour* (yet not on its capacity to innovate) in three major ways; first, CS4-Pharma's main UK competitor was not anymore a threat which meant that the two jointly enjoyed market dominance (at a national level). Consequently, the company was less likely to undertake innovation activities due to a lack of dynamism in the market (similar to the CS3-Brushware's case in the traditional business). Second, new ideas and new projects regarding product innovation began following a radically different *decision making process* from the past. In the new era, the majority of new directions guided from market research initiated by people outside the company's grounds (SE site), while new ideas had to be negotiated, accepted and approved by the new upper echelons (board of directors) located at their SE site (section 5.4.1, p. 205). This situation was very different from the past, when such actions were the responsibility of people loyal to CS4-Pharma. Third, contingent to the company's recent economic difficulties, CS4-Pharma's new focus was particularly aligned with efficiency and the reduction of operational costs (see e.g. section 5.4.3, pp. 220-2) thus, the odds of introducing process innovations as opposed to product innovations were higher. These changes also consisted of organisational efforts towards a cultural change, albeit in a very different way from CS2-Glazing and CS3-Brushware (efficiency over innovation). Related to this was the company's reorganisation following its acquisition; the new top manager (site manager) was an expert with extensive experience of lean manufacturing techniques and internal policy making, while some resources were allocated for the training of internal technical staff to these techniques.

On the other hand, CS5-BoPro (the smallest of the four cases studied) represented the most notable example of an SME that suffered particularly from the known disadvantages of size, such as the *lack of financial and human resources* (sections 4.3.4.2 and 4.3.4.3). The company struggled particularly from the fierce competition of large brand rivals and a general attitude of retailers to prefer big brands with wide product ranges as opposed to CS5-BoPro's niche products. Together these three internal and external conditions (lack of resources, competition and retailer relationship) formed a cocktail of factors that critically affected the company's attitude towards innovation.

For instance, entering new markets or developing a radical new idea was often a challenging ambition due to the company's struggle to fund the critical market research. Moreover, the company suffered from a lack of long-term and high-level skilled staff which was bringing a degree of instability and uncertainty to its internal functioning (for example it affected organizational memory). CS5-BoPro's weaknesses closely resembled the reality of what has been previously referred to as the *"paradox of the SME"* (Friedman, 2004; cited in Millward & Lewis, 2005, p. 382), in that the company showcased an entrepreneurial flair to exploit emerging opportunities but not the means to fully pursue them. On the other hand, CS5-BoPro was trying to counterbalance these complexities by focusing on its top quality product design (its owner-manager was also the chief Designer) and user-centred customisation (body protectors made to fit) both of which consisted of its key advantages over competitors. Hence, CS5-BoPro's transformational period was about placing its design capabilities in a central focus and to develop products neatly customised to fit the exact needs of individual customers, as opposed to one-size-fits-all solutions often offered by bigger brands (section 4.3.4.2). Moreover, the company was exploring other strategies such as to re-position itself in the market as a high-technology expert (due to the high-tech materials used in its products), the development and export of its products as unbranded, as well as to combat price, spills-over by selling to retailers directly (hence giving higher margins) and by-passing low-price distributors.

In comparison to the other three cases, CS5-BoPro seemed to lack a clear, robust strategy for combating the complexities to both its internal and external environment. For instance, the company particularly struggled to find an appropriate way to attract and, more importantly, retain talented employees (section 4.3.4.3). What was more striking is that this weakness was perceived (by its owner-manager) as a problem that originated elsewhere (i.e. the young peoples' notion to not staying at one job for long anymore) rather than to a lack of provision of attractive rewards and/or other career incentives. Yet, it was apparent that CS5-BoPro's owner and design manager reflected a behavioural style that closely resembled an authoritarian and dominating practitioner who, while passionate and proud of her company, may have had a detrimental effect upon other's creative practice. In general, ad-hoc responses and on-the-fly strategies had been the norm, rather the exception, for CS5-BoPro.

6.2.2 External support during the Transformational Period

It is without exaggeration to say that much of the transformational activities discussed so far could not have been achieved without the support of each company's external network. At the core of this support was the expert knowledge and training coming from regional agencies/organisations and universities. For example, in three of the cases (CS2-Glazing, CS3-Brushware, CS5-BoPro) the employment of new creative personnel were graduates from regional universities. In particular, CS2-Glazing had been in close collaboration with experts from a university in its efforts to improve its innovation practices. The company benefited from this relationship by making use of funding schemes such as the Knowledge Transfer Partnership (KTP) programme which led to the employment of a talented design engineer (undertaking postgraduate training at the same university at the time – see section 5.2.1, p. 175) who came up with creative NPD tools. Furthermore, experts from the university introduced to the company creative collaborative tools such as brainstorming techniques which significant impact to its ideation process at the Development period (section 5.2.2, p. 178-9). Similarly, the external support CS3-Brushware was receiving (either by regional sponsored experts or outsourced agencies) was paramount both to its initial conception (BGP) and its (on-going) implementation. In many instances (especially prior to the hiring of the in-house designer), the company outsourced design work either from agencies (e.g. brand and website) or via collaboration with regional universities. Furthermore, the company was receiving crucial advice about strategies to adopt in its Intellectual Property (IP) protection rights (section 5.3.1, pp. 197-98). At CS4-Pharma, external support played an integral part in production improvement programmes, as the new techniques and staff training (see section 5.4.3, p. 220-1) were being sponsored by government initiatives (MAS). Finally, CS5-BoPro had resorted to external support from regional design organisations (Design Network North) to receive advice on the improvement of its NPD management and other strategic matters (section 5.5.1, p. 228).

6.3 *The Initiation Period: 'Are We Doing the Right Things?' 'Obscure' R&D and Structural Characteristics*

The initiation of a NPD is concerned with the period in which organisations adopt various tactics to scan their environments for new opportunities. Past research has outlined a number of activities that are most crucial at this period (often termed as the *fuzzy front-end phase* of NPD (e.g. Molin-Juustila, 2006)).

Quite often, many of these activities are attributed exclusively to the domain of Research and Development (R&D) department of organisations. As noted in Chapter 2, R&D figures such as the amount of investment in R&D have been widely used as measures of determining organisational innovativeness. However, previous research has also shown that traditional R&D metrics have equally received much scepticism about their effectiveness in the actual representation of innovation efforts across different organisational settings (Rammer, Czarnitzki, & Spielkamp, 2009).

Indeed, in this study none of the four cases had a 'permanent R&D' (Rammer et al., 2009) department to drive NPD, albeit many of the actions involved there closely resembled it. Instead, it may be said that every company had a simple *structural differentiation* between a *front-end* side and a *back-end* part of the business (Figure 63). As expected, the people responsible for the initiation of a NPD were the members of the front-end teams, while the latter mostly with later periods in the NPD (Development, Implementation). This part of the business was most exposed to external environmental stimuli and driven by the people who, in most instances, determine the organisations' approach to the "*are we doing the right things?*" question of the Initiation period.

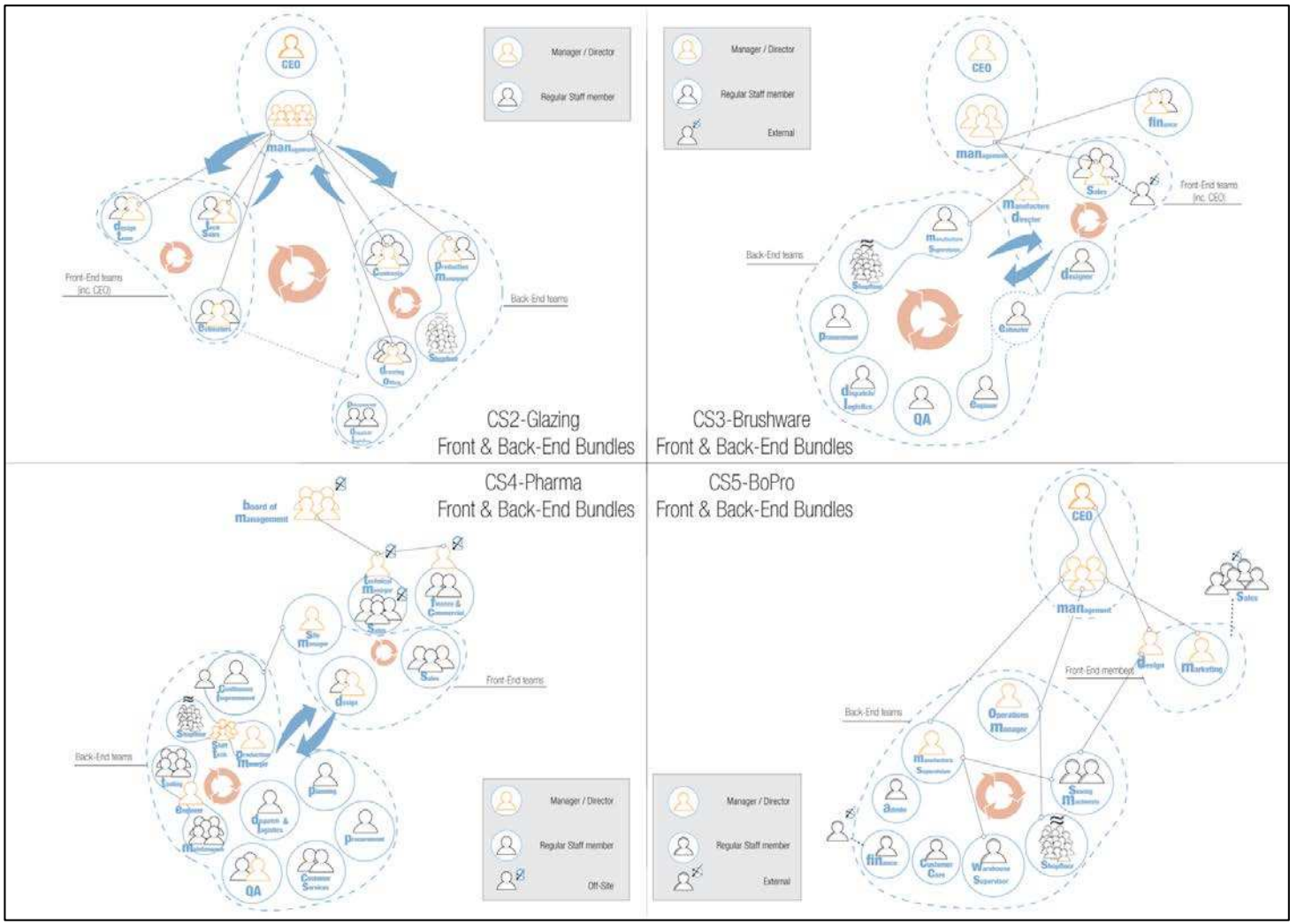


Figure 63. Front and back-end bundles of the four SMEs

Front-end protagonists possessed a key role in their organisations in that they were typically the practitioners preoccupied with the task of communicating to the world their products' superiority and, by doing so, to develop the much-needed new business. Similar to a standard R&D function, the typical actions of the front-end team included, amongst others, the important *market research* and the *interpretation* and *translation* of customers' needs into new product offers, all of which were integral in shaping the arena for initiating a NPD. Embarking on the NPD journey is, by nature, a costly, ambiguous and risky endeavour and its success depends a lot on the front-end teams' ability to be smart in relatively chaotic conditions; smart in discovering new opportunities, noticing unmet customer needs, exploiting existing and/or new technologies and translating market insights into meaningful internal knowledge which, in effect, may lead to the development of novel solutions. Above all, success in the NPD journey for SMEs with scattered resources compared to their larger competitors, relies in the ability of front-end practitioners to find clever ways to put theirs in use (Cobbenhagen, 2000). With this in mind, the following discussion attempts to surface the catalysts of the four SMEs' front-end practitioners that shape the context nurturing the Initiation of NPDs.

6.3.1 **Surfacing front-end protagonists**

For reasons of structuring the discussion hereafter, the members of the *front-end teams* in the four SMEs are categorised in a two-level division of labour based on individual expertise and activities at the Initiation period (Figure 64).

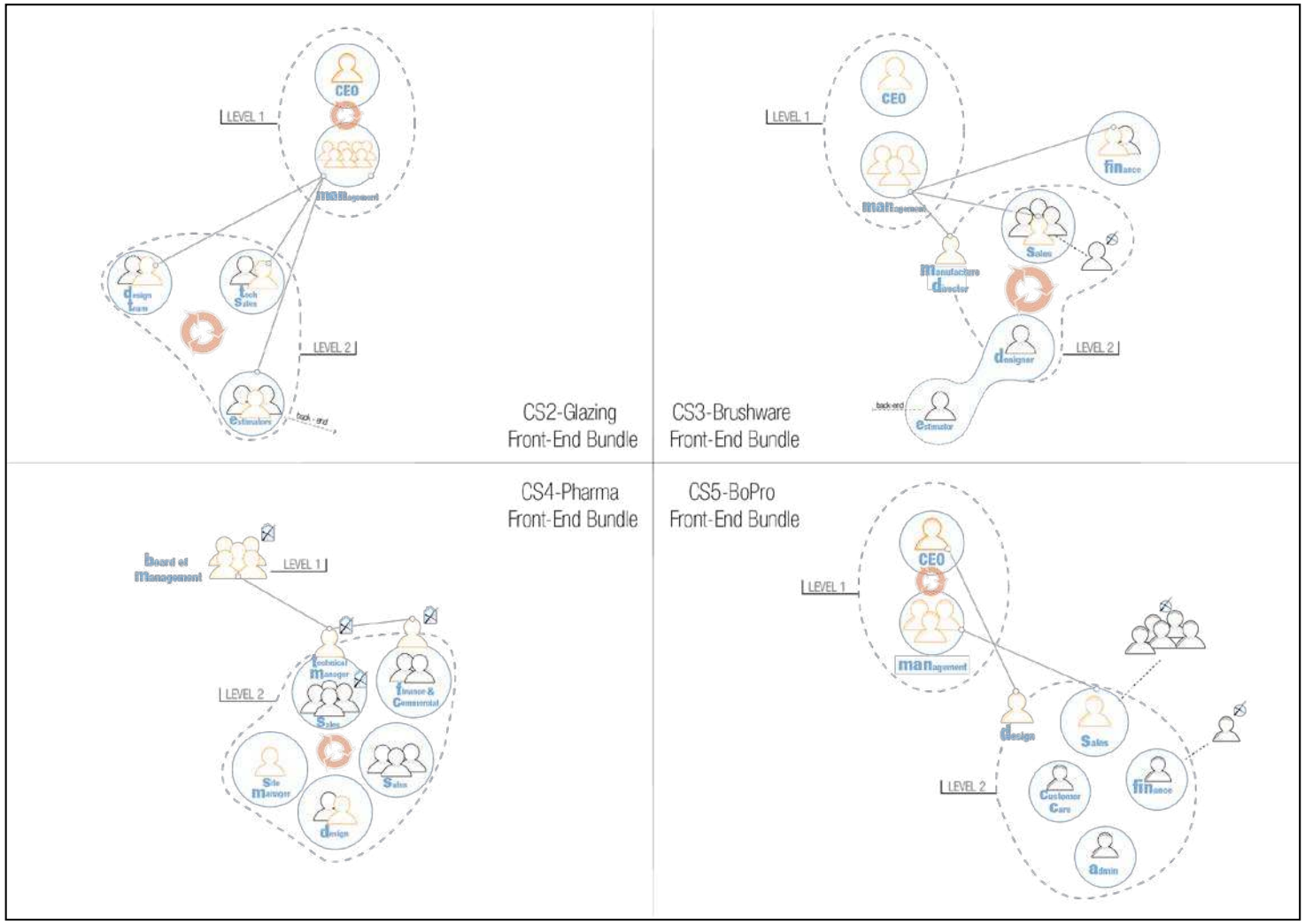


Figure 64. The two level division of labour of the front-end members

The sense-making processes involved were also dependant on the two levels.

- *Level I: At the highest level, sit the people who had a top managerial/leadership status (upper echelons). These company members (mostly owners) were responsible, in particular, for the strategic side of the business. This included the identification of the right markets, following a sense-making process majorly supported by external peers, where the company* ought to *be offering its products and, based on this understanding, to conceive the appropriate strategic directions towards their exploration/exploitation.*
- *Level II: At the immediate next level were the people with a diverse status (both seniors and non-managers), whose role was to receive the directions from Level I members, scan the suggested markets and translate their sense making into the identification of new customers, new projects and eventually new product opportunities. Furthermore, this level comprised of two types of professionals;*

a) *The professionals with a main focus on the sales/marketing side of the business, and*
b) *The technical/design practitioners whose focus lies particularly in the creation of the design concepts and their transformation into new products.*

The key characteristics of these individuals are the locus of the following discussion. Before doing so, it is important to note that the roles of the two-level members were not as clear-cut as they may seem. The multitasking role of many of these protagonists (especially those at a managerial level) reveal an important hidden aspect of organisational practice; although some members at each level were easily distinguishable figures (i.e. owner-managers in Level I), others' roles were more difficult to distinguish due to being simultaneously and actively present at both levels (i.e. the owner-manager also being the designer or the top director also being the sales team leader). As I discuss further, this notion was a common characteristic among all four SMEs and posed both an advantage and disadvantage to them. At one side, the involvement of practitioners in multiple tasks and areas of the business allowed them to absorb more information and, by doing so, to have a broader understanding of a project's intricacies and increase their own skills and capabilities. On the other side, the fact that many tasks were being done in an ad-hoc and informal manner meant that the way a potential innovation happened and/or where it came from remained *difficult to reco*rd.

6.3.1.1 **Front-end: Level I protagonists and leadership styles**

In three of the four cases, leadership style (Table 7) was represented by a single individual; in two cases (CS2-Glazing and CS5-BoPro) they were also the sole company owners, whilst in the family-owned case (CS3-Brushware), the Managing Director was a family member stakeholder. On the other hand, the leadership style of CS4-Pharma was very different (and more complex) as its upper echelons consisted hierarchically of a Board of Directors (see section 4.3.3) located outside CS4-Phama's site (SE) and internally by a Site Manager who acted as a type of CEO. Based on the activity analysis of the Initiation period of the four cases, there are some clear implications that can be extracted from the two styles.

Table 7. Leadership styles of the four SMEs

	Leadership Style	**Management type (other top managers)**	**Decision Making style**
CS2 – Glazing	Owner-Manager	Sole-(3 senior managers)	Both independent and in collaboration with senior managers.
CS3 – Brushware	Family member shareholder (one of the total three family members of the directors' board)	Autonomous Managing Director (3 senior managers)	Mostly in collaboration with senior managers. Family involvement rare and only when significant decisions are needed.
CS4 – Pharma	Board of Directors / Site Managers	Multi-voiced-ness	Top-down but with multiple input and liaison with both sites' directors and site managers. Design Manager also a powerful influencer.
CS5 – BoPro	Owner-Manager	Sole (2 senior managers)	Independent, dominant and top-down style. Often with input from seniors, although not paramount.

Personal commitment and active involvement

The entre/intrapreneurial style of owner-managers at one side (CS2-Glazing, CS3-Brushware, CS5-BoPro) and multiple stakeholders at the other (CS4-Pharma) exhibited distinct differences in the degree of both commitment and involvement at the initiation of NPD. More precisely, the former top leaders' participation in NPD exhibited highly and active commitment in new business generation (sections 5.2.1, 5.3.1 and 5.5.1). Personal liaison with customers as well as a genuine interest and contribution to the early ideation phases of the creative process were some of the things that differentiated the two styles. Furthermore, their direct and indirect presence across the majority of actions at the Initiation period played an influential role with other members of the organisation and their *attitude towards new* developments. In general, top leaders' active involvement at the early phases of NPD impacted the organisations in two ways; firstly, it was easier for them to appreciate the value and, therefore, to invest and *mobilise* the much needed *resources* for the initiation of NPD. Second, their positive attitude towards innovation was also embodied in the *corporate culture which in turn fostered a climate of openness towards 'new'*.

This style differed from CS4-Pharma's in that the decisions about resource allocation originated outside the company's grounds (at SE's site) and were based upon multiple voices. There, the majority of the directors who were responsible for the strategic directions of the company were not physically present and/or directly involved with either their markets or the actual NPD process. The interviews revealed that only the Technical Sales Director was one of the five company directors with a direct involvement in the initiation of NPD (section 5.4.1). This involvement related to his personal role in the Sales function of both CS4-Pharma and SE's site. Internally, leadership at CS4-Pharma was formally assigned to the newly employed Site Manager, who dealt particularly with production efficiency and various financial aspects. Yet, informally this role (including the ability to drive the initiation of NPD) was shared between the Technical Sales Director at the SE site and CS4-Pharma's Design Manager who was responsible for all standard and new developments on site.

The lack of direct involvement with the majority of the company's upper echelons also meant that there was a different process of making strategic decisions compared to, for example, CS2-Glazing discussed earlier. In this case, there was a general reliance upon the Technical Sales team market insights to drive the decision-making at the top level. This practice had been very problematic in the past, as CS4-Pharma's Site

Manager argued (section 5.4.3, p. 224) because of lack of insight into the long-term market conditions skewed the top level's sense making and ability to put in place long-term strategic plans. As he further postulated, in the past the company had mobilised important resources on projects that never reached the Implementation period, hence put the company in a vulnerable position. The high level of dependence upon the Sales team's market interpretation to inform important decision making about NPD, differed significantly from the rest of the cases where the top leaders' were directly and personally involved with their markets.

Initiating NPD

Not surprisingly, a common reality shared among all the four SMEs was that the leaders' role was central in both the *act of initiating* and during the *Initiation period* of the NPD process[43]. Two patterns that emerged from the interviews as critical factors influencing the Initiation period of NPD were a) the leaders' extensive social capital, and b) the creation of a shared vision that stimulated the organisational members' motivation to innovate.

Act of initiating at the external level: Driven by social capital

Successful initiation of NPD relied much on the decisions made *upstream* by the leaders of the organisations and the choices they made about their markets ('where should we focus?') where the new products were to be offered (Cobbenhagen, 2000). Two extremely important tools that supported the decision-making process of top leaders of the four cases were, i) the external social network of experts they possessed, and ii) their ability to meaningfully interpret the conversations with the experts and translate them into new visions. Hence, personal contacts, liaison with industry experts, loyal customers, other companies–even competitors, and strong relationships with regional supportive organisations, including universities, all represented a mixture of inspirational resources influencing and supporting the choices made by top leaders' of the four SMEs. This is in line with research suggesting that the rich personal social *network of key interpreters* (Verganti, 2009) that top leaders possess is among the most vital competitive advantage for their organisations, as such relational assets increase their absorptive capacity (Cohen & Levinthal, 1990), which in turn increase the likelihood to recognise and take advantage of new opportunities to pursue.

[43] The term 'act of initiating' is used here to refer to the leaders' actions relevant in setting the ground for new business (i.e. strategic direction).

Act of initiating at the internal level: **shared vision, task motivation and ambi-dexterity**

Mental representations for communicating core values: Top leaders not only were the members of the front-end teams but also were the actual *team-founders* and, hence, they were directly responsible for their composition, diversity and overall management. One common tactic for communicating *core values* (Morgan, 1997) and cultivating a culture with *shared visions* amongst organisational members was through *mental representations* (Lam, 2005) such as *heuristics* and/or *metaphors***.** For instance, at CS2-Glazing the top leader repeatedly described the purpose of the front-end team (which he led) being "*demand creation"* and "*looking out of the window*" (section 5.2.1, pp. 169-0). When the new vision was more specific to the needs of new markets, he adopted heuristics such as; "*being preventive*" and "*strong as steel*" (section 4.3.1.2, p. 144) to describe alternative product design scenarios. In CS3-Brushware, it was about "*business growth"* by being *less traditional"* and *more innovative* (section 5.3.1, pp. 192-3), while CS5-BoPro's leader argued that it was "*more than just pretty CAD"* that differentiates the company from its competitors (section 4.3.4.2, pp. 157-59). Mental representations such as these represent to some extend the top leaders' *personal culture* (Verganti, 2009) and, as a result, it can be argued, a general degree of the organisation's attitude towards innovation. That is, visions that reflect a general appreciation and reward towards novelty and creative thinking may in turn dramatically influence different practitioners' *intrinsic task motivation* (Amabile, 1988) and the act of initiating NPD.

Dominant traits inhibit motivation and creativity: For the intrinsic task motivation and creativity to be positively influenced by the top leader's vision, mental representations are merely reflections of the leader's personal culture and, therefore, relate to personal behavioural characteristics. Accordingly, top leaders who place their personal desires and authority above organisation-wide needs are expected to have a negative influence on other members' motivation and creativity (Crossan & Apaydin, 2010). This is found in CS5-Bopro where its owner-manager had a dominating personality and a top-down decision-making style that almost excluded others from the creative process and seemed to impede achieving a shared vision across the rest of the organisation.

Trusting the champions of new ideas: Another important observation that can be extracted from the AT analysis regards the level of confidence that top leaders from three of the four SMEs (CS5-BoPro was a notable exception) had to the rest of the front-end team members and the potential *champions of new ideas (Patterson, Kerrin, Gatto-Roissard, et al., 2009)*. In general, as project managers tended to vary according to new project needs, so were the new idea champions different across projects. That is, the champions of ideas could equally be anyone from the front-end team, including the company's stakeholders (or simply, the owner-manager). Even in the case where the idea champion was a member of another front-end sub-team (e.g. design team), the *close proximity* (Edwards et al., 2005) and frequent informal interactions with organisational members at all levels (front and back-end) was making the implementation of a new idea a lot more easily accepted by both upper echelons and the rest of the organisation. This was empowered by the top leaders' active participation in the early ideation phases of NPD.

Favouring informal cultures: Motivation and creativity seemed to be further supported by the informal cultures that top leaders promoted in their organisations. This free form of interaction is a well-founded reality of SMEs' life (see section 2.1.3) and one favoured in all four SMEs.

Adaptors versus Innovators: the struggle for ambidexterity: The norm for all four SMEs (contrary to their desire or capacity for innovation) was to reactively invest their time and energy in meeting the day-to-day pressures of the external environment. They were mostly concerned with the incremental development of the existing product portfolio offerings. At the same time, a key challenge for the top leaders of the four cases was to be *ambidextrous;* to find the right balance between being both *adaptors/transactional* type of leaders (with a focus on *exploitation* and doing things better within current norms) and *innovators/transformational* leaders (who favour exploration and doing things differently) (Patterson, Kerrin, & Gatto-Roissard, 2009). The top leaders of the four SMEs exhibited a general positive degree of ambidexterity, as this was evident from their efforts towards both change and innovation. Nevertheless, there were no explicit mechanisms in place to guide their efforts towards achieving balance between the two. Instead, many of the decisions about managing control and creative freedom relied greatly on their gut instincts and personal desire.

Past project failures rendered all four companies' top leaders reluctant to adopt more radical strategies in their offerings to the world (Roy & Potter, 1993). Yet, to be conservative indicated both a sensibility and astuteness as to where their strength lay and what their resources permeated. Therefore, it was not surprising that the necessity to think in terms of safe project and short-term plans was more valued than considering high-risk long-term opportunities. Nevertheless, all top leaders expressed their willingness to pursue more radical innovation challenges as long as the right partner and support was available to them (see for example Appendix 12, p.397).

Over-optimism and past failures; the "Achilles heel" of innovator leaders

While creative freedom and openness to new ideas are crucial to an organisation's capacity to innovate, so the existence of a certain amount of control is needed for the organisation to avoid the risk of being over-optimistic about its own capacity. Balancing the two was amongst the most difficult challenges that top leaders had to resolve. For example, the positive attitude of CS2-Glazing's top leader towards NPD also created a negative impact on the shop floor, where control was favoured more than anything (section 5.2.3, pp. 188-89 and later in section 6.4). Because the production practitioners would often struggle to keep up with the pace of the new projects hitting their posts, it had resulted in both frequent frictions between front and back-end members, as well as shorter development and testing times that increased the risk of project failure. A similar reality was faced by CS3-Brushware's leader, who had realised that the company needed to stop 'spreading itself too thinly' (section 5.3.1, p. 193), a metaphor used to describe the running of multiple projects in different markets simultaneously. In contrast, CS5-BoPro's top leader tactic in order to avoid this threat was to focus on one project at a time. Figure 65 summarises the key roles of top leaders during the Initiation period.

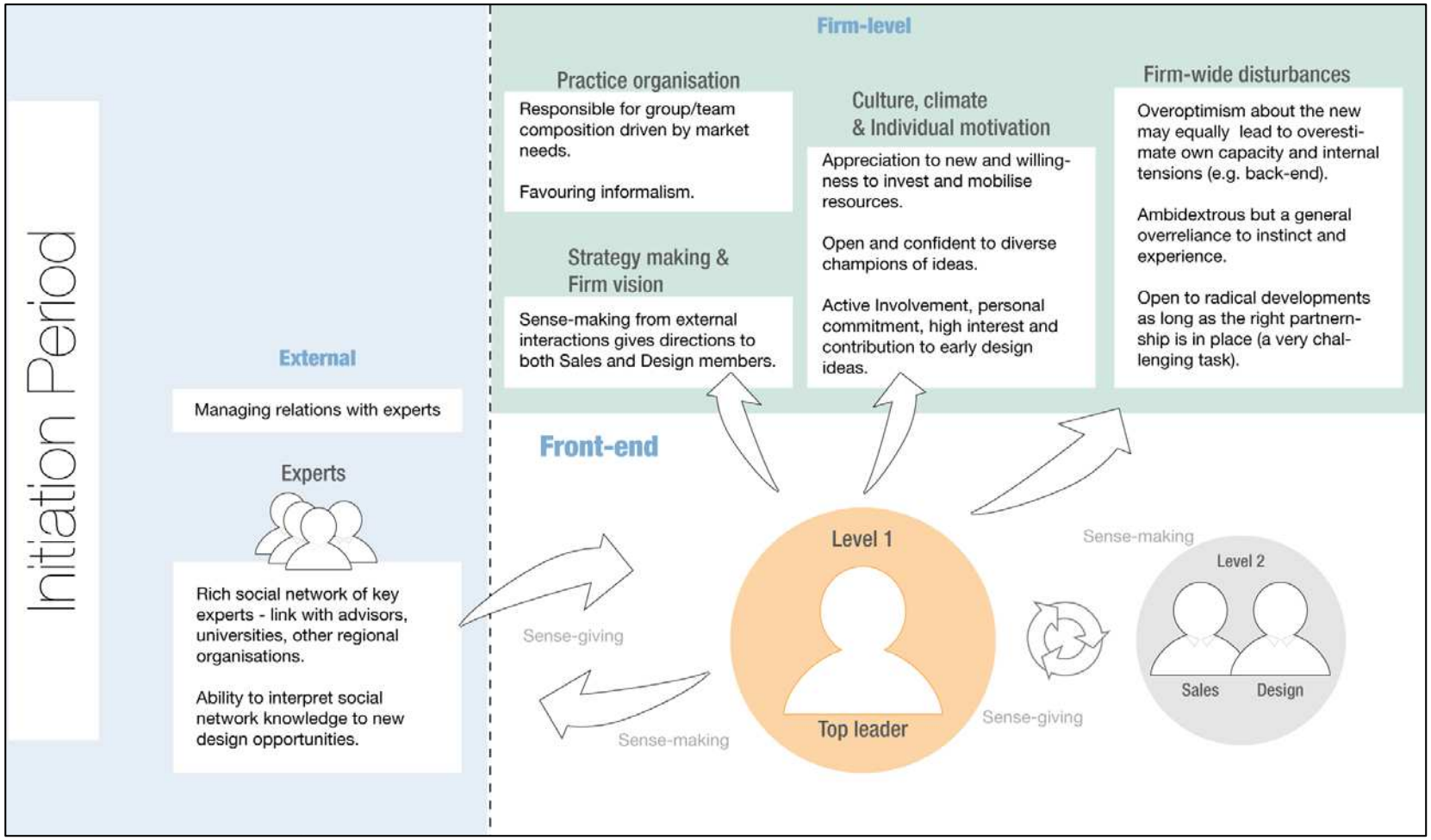


Figure 65. A summary of cross-case observations of the top leaders' involvement in the initiation of NPD

6.3.1.2 Front-end: Level II protagonists

Level II.a – Sales

While upper echelon leaders were responsible for making sense of their external environment and translating market trends into meaningful visions and strategic directions, members of the Sales/Technical Sales (*Sales* hereafter) were primarily responsible for putting them into action. To do so, these practitioners utilised their leaders' insights to help them identify or conceive new product opportunities by monitoring markets and customer needs as well as what competitors do. Whilst Sales practitioners of the four SMEs exhibited diverse departmental *styles*, *skills and expertise*, the *customer-orientated* approach (Molin-Juustila, 2006) was a shared practice and attitude postulated by all organisations. Aspects such as the organisation's structure, type of markets, and the overall organisational culture were key factors determining the Sales style with the leaders being the key influencers of each aspect.

Internal, well-defined and technical-based Sales style

This observation was most evident in the case of CS2-Glazing (section 5.2.1). First, the company's general structure operated by its leader consisted of well-defined teams/departments (functional type of structure) and like all other teams, the Sales team was led by a manager (a senior member of staff in this case) and a colleague. Owing to the company's top leader personal desire, the two parties had a very close proximity as they shared the same working offices. In effect, this promoted a trusting and highly informal team culture, which may explain why it was solely an internal function compared to the other cases. The Sales team at CS2-Glazing was a 'technical-based' one, which served to meet three particular needs relevant to the company's market orientation and their products;

1. *The majority of its customers consisted of more or less technical experts (i.e. architects) and/or other technical experts (i.e. system suppliers) who demanded clear technical explanations of the proposed concept solutions.*
2. *In the new markets the company operated after the strategic change (discussed in the 'A transformational period' section 6.2), new major projects for clients such as hospitals and/or the police were accompanied by added complexities such as the high safety standards and compliance testing which, although a*

central task during the Development period, the front-end team needed to adequately reassure its clients about at a very early stage.

3. *Finally, the new market complexities affected also the way the company had to approach its new customers and the way solutions were being presented to them, that is, they had to be technically feasible and attractive.*

It can be argued that these three needs reflect a reality, which had an influential role on CS2-Glazing leader's choice about the composition of the Sales team. For example, the team consisted of practitioners with high technical competence. Both two members were promoted from their previous role in the Drawing Office (hence their technical fluency) and repositioned to the newly formed Technical Sales team. However, this promotion was based on a general appreciation of their skills and expertise by their leader and less about their training.

CS2-Glazing's Sales team composition was a key competitive advantage to the company for reasons that particularly related to the effective management of the relative complexity of boundaries (Carlile, 2004). For example, the team was able to communicate clearly with new customers (e.g. architects) from different professional paradigms. Their technical knowledge allowed them to both know early whether the project is technically feasible and, second, to conceive very early draft drawings *with* the customers, prior to consulting and progressing further with the Design team. Similarly, new projects could be communicated well with the rest of the internal functions (i.e. front and back-end), at least as far as the technical aspects of a new project are concerned. In addition, influenced by the leader's desire to customer-centred innovation and the company's culture of openness to new challenges, the team was generally less involved with daily orders for existing products, which allowed them to focus on the initiation of a NPD (or new projects).

External, ad-hoc project-based and led by Sales experts

In contrast to the style above, the sales practitioners in CS3-Brushware and CS5-BoPro were a lot more ad-hoc. CS3-Brushware's structure closely resembled a project-based one and had in place two types of sales functions, a) an internal Sales function, specifically dealing with standard orders (traditional side of business) and customer service issues, and b) one 'on-the-road' sales representative who was mostly involved in new projects (specialised markets – see e.g. *New project example: existing / new customer novel solution*, p. 198). In contrast, CS5-BoPro (section 5.5.1) totally lacked an internal

Sales function and relied solely upon externally based Sales agents responsible for receiving customer and/or distributor feedback as well as the typical scanning of the markets for NPD opportunities. In both two cases, the Sales agents were experienced in the particular industries in which the companies operated, although they probably lacked the technical expertise found in the example of CS2-Glazing's team. However, these companies' (CS3-Brushware, CS5-BoPro) customer bases were not as technically orientated as CS2-Glazing's. The lack of technical expertise was counterbalanced by their long experience and attitude and freedom towards new opportunities, coupled with a powerful *customer loyalty* (Rosenbusch et al., 2011) to CS3-Brushware and CS5-BoPro irrespective. In a typical scenario, market insights would first reach the companies' top leaders (both CS3-Brushware and CS5-BoPro leaders were technically competent) or another senior manager (e.g. CS3-Brushware's Manufacturing Director or CS5-BoPro's Brand Manager) who would filter the information and decide the next step in liaison with the top leader. Phone conversations, emails and occasionally face-to-face meetings were the usual means of communication with the external sales agents.

Obscure practices

Interestingly, CS2-Glazing and CS3-Brushware tended to receive new enquiries (mostly for standard orders but could also require a novel response and therefore the initiation of NPD) by people who had no prior sales training, but were technically competent (familiar with the company's products). For example, CS3-Brushware's Estimator, was a key member and old-timer who had also shuffled his position within the company (section 5.3.1, pp. 191-2). His new role was a multitasking type as, whilst an Estimator, he also shared many of the characteristics of the Technical Sales team at CS2-Glazing *without being recognised as that*. His technical background and experience in the production facilities allowed him not only to know the costs and processes needed to develop a new order, but also how to visualise (through early draft drawings) the order into an actual product. More surprisingly, his role could be easily replaced by the company's Engineer, as he was the person to take on this task in the former's absence. During the interview with CS3-Brushware's top manager (MND, see Appendix 13, pp. 419-0), it was acknowledged that the company was looking for a way to better define the nature of the Estimator's practice and had been considering creating a new, more suitable function (e.g. Technical Sales). What is important to note here is that similar *silent practitioners* were felt to be the norm across a variety of positions in all four SMEs.

Tactics for initiating NPD: Reactive vs Proactive

Sales staff in all four cases showed a number of common tactics for exposing practitioners to initiating new projects, albeit without following any specific process. Not surprisingly, all four companies relied a lot on the reputation of their products to attract new business from existing (and often very loyal) and new customers. More than often, the same sources could lead to both reactive and proactive NPDs.

CS2-Glazing and CS5-BoPro in particular initiated many new projects through their presence at exhibitions and events where they would demonstrate the company's product portfolio and meet new customers**.** The technical expertise of CS2-Glazing team, allowed them to spend a lot of time with potential end users (e.g. architects) not necessarily discussing new projects but also exchanging expert knowledge through seminars on fire and glazing best practices. This essentially helped to sustain a community of practice and a social network, acting as a creative resource for potential customers and opportunities. CS3-Brushware shared many similarities with CS2-Glazing in the sense that the company was going through a major strategic change (albeit, at a much earlier level than CS2-Glazing) that focused on managing the company's involvement in new and very fragmented markets. The much needed market insights that could lead to the initiation of NPD relied heavily at first on the top leader's personal contacts (discussed earlier) and, at a secondary level, on the externally based sales agent.

The lack of an internal Sales function at CS5-BoPro meant that the initiation of NPD relied heavily on the owner-manager's personal management of key contacts and the information received from external agents about competition and product feedback from customers and distributors. Both these sources regularly triggered the initiation of NPD, either as a reactive response to competition or customer demands, or in a proactive way through the design team (discussed later). In general, in all cases the NPD would initiate when a new enquiry cannot be met by an existing solution, or because an existing product needs significant improvements. Reactive responses were a lot more frequent than proactive in all four cases.

Nevertheless, proactive tactics to NPD initiation were also evident in all four cases. Whilst the typical way proactive developments initiated was based on the designers' creative approach, the sales practitioners had a key role in this endeavour as they acted as *brokers of the market insights* (and boundary spanners (e.g. Carlile, 2004)) that designers usually guided their creative thinking. Hence, on many occasions, sales

practitioners were in contact with customers and/or other experts (e.g., the exhibition events or CS2-Glazing's seminars for end-users mentioned earlier) they would also try to identify potential gaps in the market or unmet needs that their company could be tapping. These insights formed an essential creative resource, which aided the ideation process and significantly supported innovation. Of course, as mentioned earlier in the CS4-Pharma's case (sections 5.4.1, pp. 208-9 and 5.4.3, p. 222), the transition of one team's interpretation (Sales) to another team (Design) was also a challenging task as it could lead to misjudged risks and opportunities. Figure 66 summarises the key activities associated with the Sales members' role during the Initiation period.

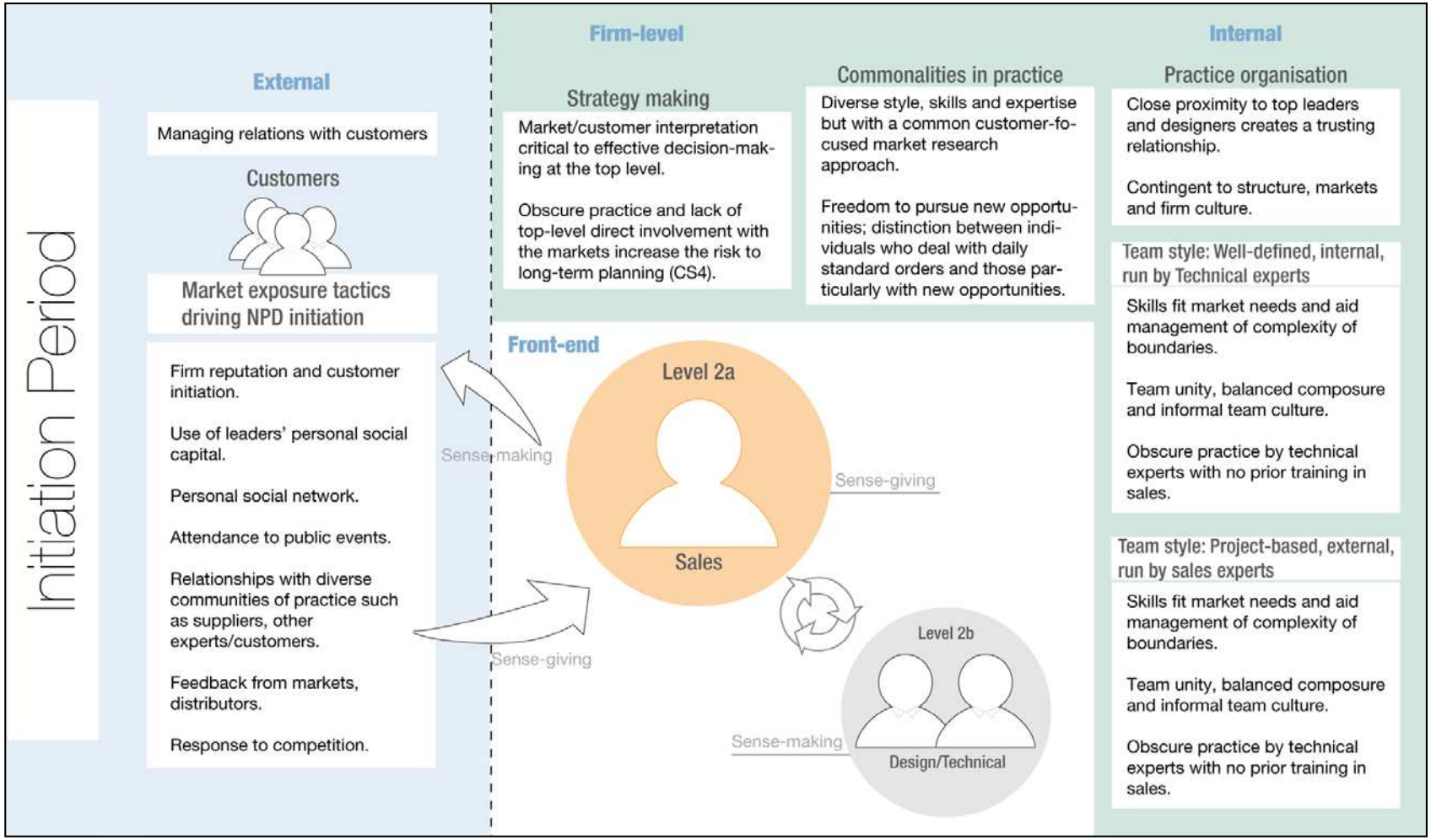


Figure 66. A summary of cross-case observations of the Sales members' involvement in the initiation of NPD

Level II.b – Technical / Design

At the immediate next sub-level were the creative practitioners, with a technical and/or design (Design from now on) expertise. As in the sales function, the role of these practitioners at the Initiation period of NPD varied across the four cases studied. The creative teams were organised into two styles, which were equally distributed in the four cases; a) integrated teams of both technical and design practitioners (CS2-Glazing, CS3-Brushware) and b) led solely by designers (CS4-Pharma, CS5-BoPro).

Technical and design are two related, but still notably different, types of expertise that seemed to offer a certain level of diversity in cognitive styles, experience and problem solving approaches in NPD. Technical practitioners are typically found within most traditional manufacturing organisations, yet as there is no universal definition, the exact roles are expected to vary across organisations. Not surprisingly, at CS2-Glazing and CS3-Brushware these practitioners tended to show a high level of competency, amongst others, in the management of the technical aspects of a new project, and the planning of the development and manufacturing in relation to the companies' technical resources and capabilities. On the other hand, designers traditionally are thought be particularly competent in the creative side of product development, particularly on aspects such as aesthetics, ergonomics and/or a product's marketability (see e.g. Schön, 1983). In the cases studied here, designers were equipped with a distinctive set of visualisation tools they put to use throughout the NPD process and aided both (internal and external) communication as well as the making of holistic considerations about the overall design process. In two cases in particular, CS4-Pharma and CS5-BoPro, Technical and Design were roles fulfilled by the same individual. Essentially, both skills were extremely important in their own respect and therefore complementary to each other**.**

Type A: Integrated Design Teams

Similar to the sales function, one common characteristic of CS2-Glazing and CS3-Brushware design teams was their relation to the organisations' structural style. For example, CS2-Glazing's design team was a well-defined function and specifically composed of a Technical Manager and an Industrial Design Engineer. For this reason, it may be said that it was the most integrated among the four cases. On the other hand, CS3-Brushware's Design team was unstructured and project-based and without

a clearly defined team but rather a bundling-up of the designer with the technical experts, Estimator and Engineer, based on the day-to-day needs, mutual interests and shared working space. Nevertheless, the participative approach and interdependence of these practitioners was the reason for treating them as an integrated design team.

Expert to Novice (and vice versa) learning

Technical practitioners at both teams were also the most experienced, whilst both designers were relatively novice ones. Consequently, team composition served another important need, which was to foster learning between experts and novices. This reality was especially true of CS3-Brushware (section 5.3.2) whose designer was strategically paired with the old-timer technical practitioners who had a deep knowledge of the company's products and had been silent designers in the past.

Aspects such as legislation, safety standards, QA as well as an organisation's manufacturing capacity and so forth, were all vital to the design decision-making process, informing the feasibility of a new idea or a customer enquiry. Such industry-based experience was lacking by the designers and therefore participation in the practice provided important learning. On the other hand, designers carried with them a distinctive portfolio of creative skills which at the Initiation period related significantly to their visualisation techniques that fostered both internal and external communication of new conceptual ideas and solutions.

It can be said that one expert's skills and weaknesses were complementing another's. At CS2-Glazing in particular, the two different experts created a well-balanced and cohesive team structure (Lave & Wenger, 1991). Putting it simply, regardless of the different expertise of the two practitioners, the team operated in unity. To some extent, the same can be said of the CS3-Brushware design team, as the lack of a defined function was counterbalanced by the close proximity and shared practices among the members. However, this fluidity and general lack of coherent structure in the early (as well as later) NPD period meant that some of the roles of the key people involved were less obvious to the company. For instance, during the interview with the company's top leader, the mapping of a NPD project (see Appendix 12, pp. 407-9) made him realise that key people's involvement (hence, the design team's members too) was tacit and ad-hoc. Such informal structures may equally provide an advantage by offering quick reactions and project-based adaptation skills but also a disadvantage as the lack of clarity in the process may also lead to a failure of recording unplanned innovations in

their making. The lack of coherent, explicit processes was most evident during the Development period in all four SMEs and is discussed in more depth there (section 6.4).

Type B: Solo Designers

Design work at CS4-Pharma and CS5-BoPro was practiced by lone individuals. This reality was deliberate (at least not explicitly so, as I argue further) but rather a result of the organisations' idiosyncrasies, some of which related to the 'A transformational period' section discussed earlier. At CS4-Pharma the Design Manager, an expert Industrial Designer, was the only person left in his position after his former design teammates were made redundant following the company's acquisition phase. In the new era, he was teamed up with a technical assistant who had no creative and design input at all. On the other hand, CS5-BoPro's design function was amongst the most impacted by the company's difficulties with retaining long-term staff. As noted earlier, this situation was significantly influenced by the dominating role of CS5-BoPro's owner and expert fashion designer.

As both companies Design experts were high-level managers, they were also involved in extreme multitasking roles. At CS5-BoPro the design expert had no choice but to wear simultaneously different hats; an owner-manager, a technical manager (including managing safety standards, IP rights, materials, technology etc.) as well as the generation of new conceptual ideas. CS4-Pharma's Design Manager experienced a similar situation. This combination between design and management roles meant little time was available to explore new design ideas and hence for the proactive initiation of NPD (and the novelty this may bring). While this is expected since NPD represented a small percentage of the daily business of all four cases, the added pressure of managing multiple and different tasks by a single individual may also explain why organisations that are able to innovate may decide not to (or do so less frequently) in the face of insufficient skill resources.

Collaborative design practice

Not surprisingly, the role of the design teams to the initiation of NPD was central. Whether proactively or reactively conceived, any new ideas or responses to new enquiries were based on collaborative efforts in three cases (CS5-BoPro seemed to be an exception), as design teams were in close proximity with the rest of the front-end members. The typical process involved the front-end members sharing of customer leads and market insights, which the design teams were responding to through the generation of conceptual ideas or concrete innovative solutions. At CS2-Glazing, the company's owner, the Sales team and the Design team members comprised a very powerful internal *bundle of practices* (Schatzki, 2005) at the Initiation period (section 5.2.1). This was evident from the way new projects generally initiated at CS2; insights gained through the market were swiftly disseminated to the Design team to be put into the problem-solving process where new ideas were regularly being drafted jointly by everyone at the front-end (including the owner himself). A less cohesive but still collaborative nature was the design involvement in CS3-Brushware and CS4-Pharma. CS3-Brushware's designer was generally brought into the Initiation period (section 5.3.1) independently from the rest of his team (technical experts) by the company's top managers (Managing Director and/or Manufacturing Director) who together often formed their own bundle of practices. However, during the ideation process, the Designer effectively formed a secondary bundle of practices with the technical practitioners (in particular the Estimator) and developed design solutions jointly (section 5.3.2). On the other hand, CS4-Pharma Design Manager's interaction with the rest of the front-end members (located at the SE site) was also frequent yet not as physical as rest of the cases and quite frequently very autonomous. Telephone calls and emails were the most common means of communication with the front-end members, yet often the ideation process would be undertaken autonomously. Furthermore, CS4-Pharma was also the only case (apart from CS5-BoPro) where the Design Manager claimed to be by-passing the Sales function and liaise with the customers directly in order not to rely on their interpretations about their needs (section 5.4.1, pp. 209-10). Whilst this could imply a certain level of lack of trust, it also indicated a personal capacity and freedom to adapt to different project cases where both distance and lack of technical knowledge of the Sales practitioners requires a different approach. Finally, CS4-Pharma's Design Manager provided an example of his design practice skills when he reflected explicitly on how his proactive design strategy met customer desires by trying to anticipate his/her reactions; first, by designing exactly what they asked, second, what he thinks they actually want, and third, a radically different one as an alternative to the previous two (section 5.4.2, p. 213).

Design's role in initiating NPD: Valued more than in the past

Generally speaking, the role of design team practitioners at the Initiation period of NPD was observed to be highly valued in all four cases. What is interesting in this assertion is that three SMEs (apart from BoPro) had only recently (particularly during their transformational period discussed earlier in section 6.2) began to realise just how important a role design played in their practice. That is, there was a notable shift from perceiving their business as strictly traditional manufacturing to design-led ones. For instance, CS2-Glazing and CS3-Brushware put design at the heart of their organisational practice only after they entered their transformational period. CS3-Brushware's design function was one of its weakest points in the past, something that was evident in the way the company lacked any provisional mechanisms of approaching customers with alternative solutions, should a customer find the initial design solution unfit for her needs[44].

Contrary to typical process models, design practice began at a very early period, even before the Initiation of any new project. In fact, the early ideation period often acted as a determining factor as to whether the new idea/project would progress further as a NPD process. At the Initiation period, its impact was found to be particularly relevant not only to incremental innovations but also in the conceptualisation of new products based on proactive approaches that challenged existing solutions. These approaches were still influenced one way or another from (sales) market feedback, yet they did not necessarily go through a particular customer enquiry (or a customer at all). Rather, new projects stemmed also from the creative interpretation by the design teams of a given situation/need and with the end-user always in mind. Although such proactive tactics accounted for only a small amount of the overall NPD projects, they generally offered the most favourable conditions for product novelty and radical differentiation as well as the possible advantages (e.g. market leader) and/or disadvantages usually accompanied with them (e.g. highly risky, complex conditions, increased failure rates) (Pérez-Luño, Wiklund, & Cabrera, 2010).

[44] From the interview with Sales Manager, Emma

Organisational and external resources influence on design practice

Design practice was significantly assisted by an organisation's resources such as investments in design software packages (CS2-Glazing, CS3-Brushware), the 'one-stop shop' facilities at CS4-Pharma that offered both product and graphic design proposals, as well as tools and training in collaborative techniques such as brainstorming (CS2-Glazing, CS3-Brushware), participative ideas wall (CS3-Brushware), and efforts in mapping the NPD process (CS2-Glazing, CS4-Pharma, CS5-BoPro; discussed again in the Development period in section 6.4.2) certainly aided the creative performance in the Initiation period. New analytical tools were paramount in the design practice of the four SMEs as it allowed them to look at the same problem from a new perspective and challenge previous perceptions of what good design was. Finally, a great extent of these resources were developed or acquired either through direct external support (e.g. universities) or indirectly by industry expert advisors, demonstrating how important this support is to SMEs' capacity to innovate.

Formal project review and decision-making points

A common finding derived from the four SMEs' practices was that the majority of formal management meetings and often, the visible decision-making points were irrelevant to the period of the NPD process. Put simply, formal meetings were in place as part of the day-to-day business of the organisations. These formal meetings were almost identical between the SMEs, although they may differ in terms of content. The decision points driving the Initiation of a NPD process were relatively fuzzy and very often based on informal conversations between the key individuals. Nevertheless, often decisions about pursuing a new development or idea happened during the formal management meetings (Table 8). This was especially true for CS4-Pharma where the decisions for NPD were usually made upstream by the board of directors.

Table 8. Formal management meetings across the four SMEs

CS2 – Glazing	• *Management meetings on a regular basis*
CS3 – Brushware	• *Monthly board meeting* • *Weekly management meeting*
CS4 – Pharma	• *Monthly board meeting (both sites involved)* • *Monthly sales meeting (Designer involved)*
CS5 - BoPro	• *Weekly project reviews* • *Monthly management meetings*

Figure 67 (next page) summarises the Design/Technical members' role at the Initiation period.

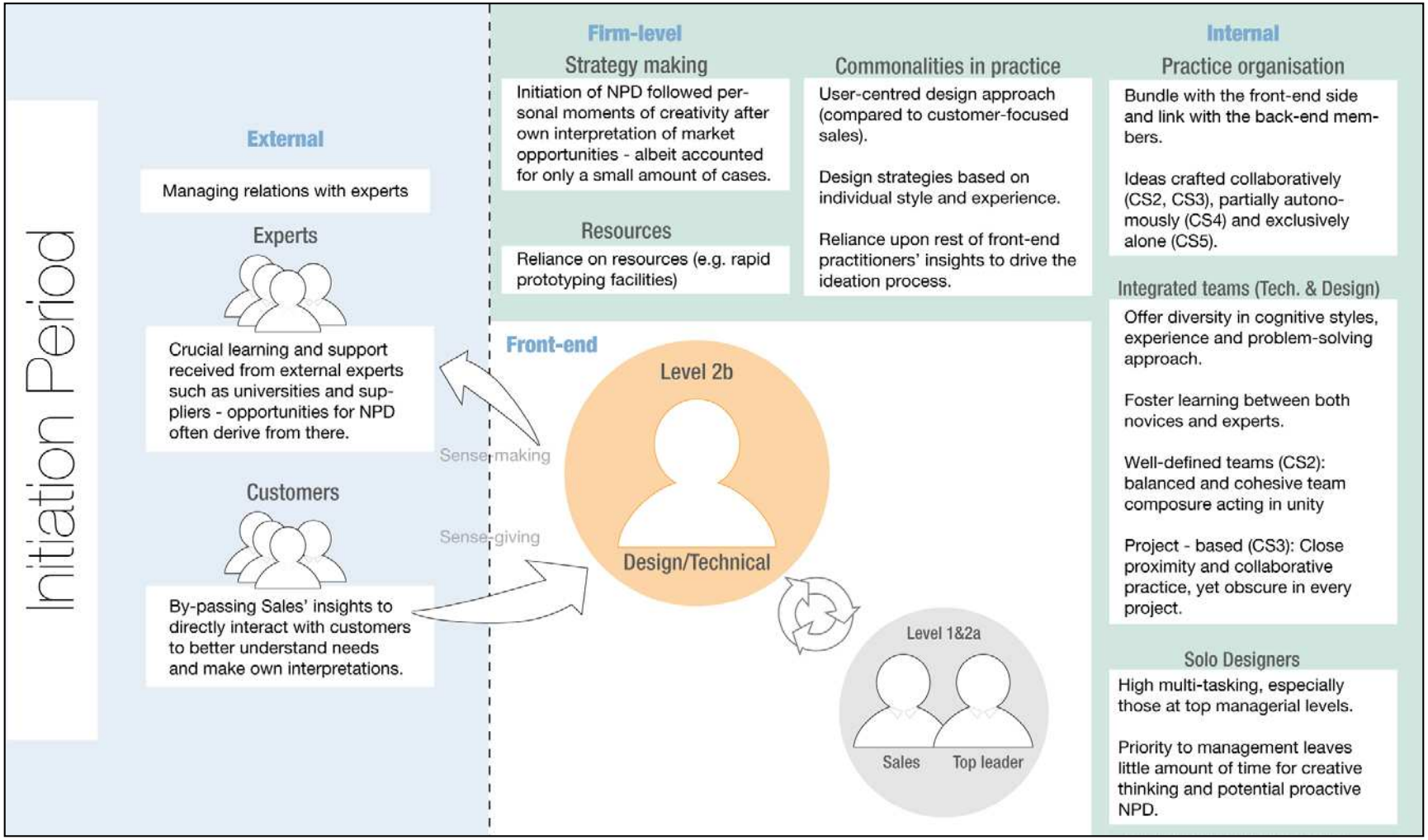


Figure 67. A summary of cross-case observations on the Design/Technical members' involvement at the initiation of the NPD

6.4 *The Development Period: 'Are We Doing the Right Things Right?'*

6.4.1 The period where the old collides with the new

The Development period signifies the transition from the draft, conceptual and unripe period of the Initiation period towards a more elaborative and advanced period of idea transformation to tangible outcomes. This period is the most complex amongst the three (Initiation, Development, Implementation) in that it gradually mobilises the majority of the organisational practitioners. The complexity, however, does not stem as much from the numbers involved in the process as from the multiplicity of worldviews possessed by the diverse functional units present. As the process moves from the fuzzy front-end towards the back-end part of the business, disturbances to the existing norms are an inevitable reality. Whilst during NPD the object of activity is generally the realisation of an idea into a tangible outcome, the day-to-day reality dictated that during the Development period, the teams involved there also need to simultaneously pursue their own objects, the operational efficiency that they are rewarded for. Hence, It was during this period that tensions, incoherencies, politics and negotiations among diverse professionals were most evident, as the new (NPD) collided with the 'old' (daily operations).

The back-end part of the business not only represents the 'old' but is also its vital backbone. When not concerned with NPD, back-end practitioners undertake the day-to-day operational work needed to meet the market demands for existing solutions. This operational, routine-based practice which is crucial to the organisation's survival is also the key object of activity for the back-end teams as they are rewarded on how well and efficiently they accomplish these daily tasks. Planning, controlling, and progress chasing for meeting the milestones are all crucial tasks in the daily organisational life. Mature companies, like the ones discussed here, achieve efficiency by developing well-defined functional routines, an integral and very important element of organisational life (a point covered in section 2.4.4). Not surprisingly, NPD is often perceived as a threat to efficiency as it runs in parallel with standard operations. In doing so, it generates both new problem-solving complexities as well disrupts and adds to the already daunting workload of daily practice. Success in the Development period goes

hand in hand with managing *boundaries* of diverse competence and experience; balancing *convergence* and *divergence* of expertise is the key here (Wenger, 2003). The way the four SMEs were configured to coordinate actions and relationships to match their situational and wider context within which they are embedded is the locus of the following discussion.

6.4.2 Unfolding the practice: A shift from the unstructured towards the creation of customised NPD tools

As with any period in NPD, the process of the developmental work comprised of a non-linear sequence of actions; some tasks were done in isolation from the rest of the organisation, other tasks simultaneously (and collaboratively) by teams of different expertise, while many others were interdependent upon the completion of the work of other individuals before they can contribute to the process themselves. The process was notably complex for an added reason, the general lack of clear, robust structure in their process. Very often, different projects called for diverse project teams, relationships and a generally random order of tasks relevant to the Development period. This reality was exacerbated in companies with more fluid structures in place, such as CS3-Brushware and CS5-BoPro. The 'way of doing things around here' in the four SMEs reflected the informal and team-based cultures that offered a certain degree of freedom to practitioners to cross functional boundaries, which in turn, increased the organisations' adaptability to the needs of the new projects and coordination of internal expertise (Morgan, 1997). However, as in the Initiation period, this ad-hoc and informal way of doing things, especially in the Development period, renders obscure the small-scale innovations derived from spontaneous problem solving. In this way, organisations remain unaware and fail to record just how these innovations originally occurred, which in turn hinder important learning from being developed. For instance, the developmental work at CS3-Brushware was managed by 'ticking the boxes' along the process; every task was completed in the most logical order that the practitioners found fit for the specific project (section 5.3.2, p. 200).

For this reason, all four SMEs were found to be taking drastic actions in improving their NPD process and design practitioners had a central role in this activity. As mentioned in the Initiation period earlier, external support was pursued and enjoyed in most of the cases. CS2-Glazing's novice Designer developed (in support with university experts) a new NPD tool that allowed the people involved to have a structure to follow (section

5.2.1, p. 175). The new tool was thought to provide transparency, guidance and a higher cross-functional involvement in the different phases of the new projects. The advantage of the tool was its flexibility and adaptability as it was constantly being revised to adapt to different project needs. Furthermore, the external support (university and industry experts) was frequent during its implementation as they would often flag and highlight any problematic practices that were found. With a general structure in place, CS2-Glazing was hoping to better record the actions and develop a project document with the history and the decision-making of each project (I revisit this at the Implementation Period in section 6.5). Similarly, CS5-BoPro had found that their developmental work had significantly improved after mapping out their NPD process with the vital support of regional design experts (section 5.5.1, pp. 228). The new step-by-step flowchart type of tool had helped the company to identify early the ownership of a new project and improve its project management by coordinating actions based on the different steps. As noted earlier, project management was one of the major weaknesses in the past for CS3-Brushware and the in-house Designer had been trying to develop a similar tool to guide the teams through the Development period (section 5.3.2). The company had also resorted several times to regional design and other expert organisations to get support for improving its NPD process (section 5.3.1, pp. 195-6). On the other hand, CS4-Pharma invested in the newly hired Site Manager, who had a personal interest in policy-making and deep experience of lean manufacturing techniques. The company had recently adopted and was implementing a revised NPD tool that originated from a totally different industry (automotive) (section 5.4.3, pp. 220-22). Standardised policies offer the advantage of creating a practice that becomes part of the 'way we do things here' of the company, rather than something that lives entirely in the current individual managing a group of people. On the other hand, the adoption of tools and policies that have served larger and more complex organisations well is also a risky strategy and one that must be managed with great care so as not to damage the value of the socio-cultural and relational elements of organisational life.

Finally, and despite the fuzziness of the developmental work, the analysis through the AT model allowed the extraction of a general pattern of progression over a number of common actions. These actions form the basis for the following discussion.

6.4.2.1 Driven by Design and cross-functional collaboration with internal and external experts

Unsurprisingly, a great deal of developmental actions related to design practice. The NPD processes explored in the study mainly concern the generation of tangible artefacts and consequently, form definition was a top priority for the front-end teams. Design practitioners were the only team to be constantly present in the transition from the Initiation (drafting ideas) to the Development period (realising them into tangible outcomes). In general, the design practice in this period involves the development of the final technical drawings in parallel with experimentations and product tests through prototype making. Furthermore, the particular technical needs of the new product dictated the type of suppliers needed to procure the necessary raw (tangible/intangible) resources to build it. This period is also a crucial decision-making point as feedback received from the potential client and/or end-users (who either made the enquiry or were approached with a novel idea) of the more realistic designs can still delay the process by moving to the Implementation period or even stop entirely from progressing any further.

During this work, new bundles of practice are formed and new boundaries are crossed amongst the front and the back-end teams. The technical details of the new product were essential in mobilising the back-end teams who relied on this information to expand their object of activity (from operational to novel challenges) and participate in the process. A common paradox observed was that the design practice in the Development period acted simultaneously as a brokering and a disruptive role. That is, while design outcomes were extremely useful in coordinating actions, the complexity accompanying their novelty also generated tensions between diverse internal and external professionals.

6.4.2.2 Brokering by Design: Critical boundary roles of advanced drawings and prototype making

The development of more detailed product drawings served, among other things, as *mediating artefacts* (Engeström & Blackler, 2005) to alleviate communication barriers at both internal and external levels. The coordination of the design practice at the Development period was closely linked with the practitioners' skills, experience and tools at hand. Similarly, assigning particular tasks to appropriate individuals varied

among the four SMEs and this was generally done informally by the team members themselves as the process progressed (a situation that the companies desired to improve through the tools discussed earlier in 6.4.2).

In all four SMEs, this phase was a joint responsibility of both the Designer and/or the Technical practitioners who possessed relevant technical knowledge and skills with tools such as CAD software. There were some notable differences of personal involvement based on individual expertise and competence. For example, one important tool that was practised particularly by the Designers was 3D modelling, either via sketching or computer-based software such as Solidworks[45]. 3D representations are used as virtual prototypes to allow one to visualise early in the process the form as well as to study the interconnectedness and relationships among multiple parts of a product. As a result, they also offer a significant boundary-brokering role in the Development period as 3D models allow greater participation and sense making by diverse professionals who may have or may not have a technical knowledge. This important practice was lacking in the past from companies such as CS2-Pharma and CS3-Brushware, who did not have the facilities and had been generally outsourcing it. The value of improving design practices was evident in the way it supported learning among both experienced and inexperienced practitioners. The most characteristic example came from the CS2-Glazing Estimating Director's explanation about how 3D drawings had particularly helped his communication with the novice Designer who, while inexperienced, could very quickly visualise and discuss technical details of a new product:

> *"…because of the software investment, as a new product now is developed in a far more professional scale with the 3d modelling […] for example if you don't have the right amount of knowledge, take for instance (the Designer), she hasn't got the experience with making windows but through the software can talk very confidently about what it looks like and which then goes to the factory... that level of information is infinitely better it has ever been."* John, ED

[45] Solidworks is a modelling CAD software produced by Dassault Systèmes SolidWorks Corp. (2014 [Online]).

6.4.2.3 Design requirements and information management.

The development of designs usually ran in parallel with the management of information relevant to the technical peculiarities of the new project. Such tasks were generally managed by the Technical practitioners; for example, at CS2-Glazing the Technical Manager was specifically preoccupied with the management of the crucial safety standards and building regulations, which significantly informed the decisions of the actual final design. For this task, the Technical Manager had to bundle with other internal and external experts to receive the information he needed. At CS5-BoPro the management of technical information was crucial for the success of the entire design process and was a task under the responsibility of the company's owner and design manager. Meeting the Safety Standards was not only a design requirement for CS5-BoPro but was also its competitive advantage and significant product differentiator. Although always driven by the owner, this task also invited the production managers to participate in the process either to provide extra input or to learn. The latter was a common practice at CS5-BoPro who tended to train its staff on the job. Managing such sensitive information was of paramount importance for another reason relevant to meeting industry set standards. For example, CS4-Pharma operated in the pharmaceutical industry and its products had to pass extremely strict safety and cleaning standards in order to be approved and reach the markets.

6.4.2.4 Prototyping: The importance of external relationships with Suppliers

The development of detailed drawings enables the transition of design practice to the prototype-making phase. This phase essentially formed the basis for exploration and experimentation for the Technical/Design practitioners. In general, prototyping and sample making was a popular and highly valued practice amongst all four cases. However, the sampling and testing of an entirely new product idea for the first time is a rather lengthy practice in itself.

One key aspect observed was that this design task depends upon relationships with external suppliers who provided not only the much needed raw materials but also vital knowledge and learning. For instance, in CS2-Glazing the prototyping phase begins at the external level, as the Design team (often with input from the Technical Sales

team) research for the right system suppliers (section 5.2.2, pp. 178-9). These systems are acquired and modified in order to meet the needs of the particular project. In particular, any new projects that initiate proactively, relied on the experimental modifications of existing systems adopted from external suppliers. The new systems would go through several tests to evaluate their 'behaviour' under certain challenging conditions that simulated those of the context in which they would be installed. This phase is also a decision making point, as it helps the team to decide whether the new idea is feasible in the first place and worth progressing further. Suppliers also shared a great amount of expert knowledge and important training with CS2-Glazing's technical and production staff concerning the adoption of their systems (see Appendix 11, p. 389). It is without exaggeration that the knowledge gained from system suppliers represented a key competitive advantage for CS2-Glazing.

Similarly, the sample making of a new product at CS5-BoPro required the creative combination of a number of modular components, often acquired from different international suppliers (Appendix 16, p. 455). Whilst this activity was central to innovation at CS5-BoPro, it was also a task that generated high complexity and uncertainty in the NPD process. The owner-manager (responsible for this activity) needed to be brave to collaborate and communicate her design requirements to suppliers with a very different portfolio, yet with technical capabilities CS5-BoPro did not have. Hence, finding the most appropriate supplier had an immediate effect both in terms of time efficiency and the overall success of NPD. Nevertheless, CS5-BoPro's owner-manager claimed to possess good relationships with some of its suppliers who had been loyal for many years. Through this relationship with its suppliers, the company was exposed and utilised innovative materials for its products (section 5.5.2). More interestingly, the high-tech characteristics of the components (e.g. performance foam-backed fabrics) used to develop new protective vests, offered unexpected opportunities. That is, the company had started to look at ways of repositioning its offerings as 'technologically sophisticated body protectors' and, as a result, to change the paradigm or position the way the company was perceived by its external environment. What was striking about this realisation is that it was also coupled with a high degree of uncertainty as to how best to strategically exploit it.

Overall, both CS2-Glazing and CS5-BoPro had managed to keep strong and positive relationships with their suppliers. On the other hand, CS4-Pharma was experiencing trouble with its plastic suppliers. According to a top manager (Ben, SM – see section 5.4.3, pp.221-0), the reason why the company had bad relationships with its suppliers

was due to the company's small size in relation to its competition. Their problems stemmed from the fact that suppliers preferred to supply large corporations operating across many different industries and this reality made CS4-Pharma struggle to keep up with its production needs (a point revisited again in the Implementation period in section 6.5). Nevertheless, in terms of prototyping capacity, CS4-Pharma was the only company among the four that owned superior technical facilities such as 3D rapid prototyping systems (see e.g. *Scenario 1: 'Capacity is enough, proceed with detailed designs'* in section 5.4.2, p. 214). This level of technical resource in the organisation provided superior time efficiency, as it allowed the Design Manager to quickly develop and test new product samples. Yet, the testing of a new product could be proved to be much lengthier and a more complex task than the design development; one of CS4-Pharma's most recent innovations was about offering novel child resistant packages and the trickiest part was not the design but getting it tested by the relevant user group (children – see e.g. *Scenario 2: Develop first, sell after (Proactive)* in section 5.4.1, p. 207). In addition and unlike the other cases, CS4-Pharma had an added task during the prototyping phase, which was the definition of the new moulding and dye tools needing to be tested prior to the Implementation period. This task was described as amongst the most critical ones of the NPD process and much effort and energy were invested in making sure they were made correctly. Their success relied a lot on external tool makers who not only made the tools based on CS4-Pharma's specifications but quite often would also trial them – a costly activity that the Designer would have preferred to be done internally by the Engineering team. Finally, it is worth pointing out that the role of suppliers in NPD comes at a focal point again during the Implementation period, where raw materials fuel the actual production.

6.4.2.5 Aiding relationships with customers, although not necessarily with the actual end-users

Sample prototyping was a crucial practice for communication with the actual customers and/or end-users. More precisely, all companies were in close contact with their clients/ end-user in order to receive approval of the developing artefact. Hence, this action represented a decision-making point in the NPD process as projects could still terminate if customers were not satisfied. In many instances, the actual testing was being done by the customers themselves (e.g. CS4-Pharma, CS5-BoPro). In addition, samples were often used as a means for showcasing the companies' portfolio and for attracting

potential customers at various tradeshows or other exposure events (e.g. CS5-Bo-Pro). Generally speaking, prototypes were important boundary objects due to their ability to aid the communication with the end-user and receive much needed approval to proceed to the Implementation period. Yet, the customer(s) could be physically represented a lot more differently according to the type of new project under development; for instance, CS4-Pharma rarely had any contact with the end-user for its new packages as they were being used to carry the commissioning companies' own products (e.g. drugs). This meant that the company relied on its commissioners' product testing and end-user feedback regarding product satisfaction. On the other hand, CS2-Glazing's NHS project example (section 5.2.1, p. 171) also depicted a customer-approval process that did not involve end-users such as doctors and patients directly at all, but external contractors who represented the customer.

6.4.2.6 **Managing IP rights**

Apart from being indicators of innovative behaviour, forms of protection such as patents essentially allow companies to transform a new product into a standard development and enjoy a potential market dominance over that product (Bessant et al., 2001). In doing so, it allows them to develop novel iterations to fit new customers' specific needs, and hence, to increase their chances for future incremental innovations. The development of a new product's definition that comes from the design work discussed above, offered the companies the opportunity to consider potential design patents to apply and protect their novel creation. All four SMEs were found to have a type of provision for managing IP rights during NPD. Among the four, CS4-Pharma (section 5.4.2, pp. 214-5) appeared to have the most extensive portfolio, something that its top managers believed to have given the company a key competitive advantage against its competition. In all four SMEs, knowledge about IP protection nested with only a few practitioners, usually the top managers and design practitioners. It was generally a practice that the companies were trying to tackle as early as possible in the NPD process, albeit without a standardised decision-making process. The difficulties attached to the management of IP rights in SMEs related to both the usual high costs and time needed to achieve patent protection, as well as the general lack of understanding about them. The latter is best captured in the following opinion shared by CS3-Brushware's MD; *"when people ask SMEs about their understanding of IP is probably very poor, it is certainly from our experience".*

The majority of companies had only recently realised the value of IP protection and struggled with the design of an effective commercial strategy (see e.g. CS3-Burshware's experience on the subject in section 5.3.1, pp. 197-8). Again, external support was paramount and pursued, yet it was also insufficient. CS3-Brushware is a grand example of an SME who started valuing IP protection almost simultaneously with its desire to become a more innovative business. As it was a new practice, the company had no previous experience and thus external IP advisors were frequently consulted during NPD. However valuable (and costly) this advice was to the company's MD, it lacked real project examples for strategy making suitable to its markets. Hence, the company had no other way but to devise these through 'trial and error' and the experience of its top leader. Consequently, the company was trying to create partnerships between customers and suppliers and reach an agreement based on mutual benefits. Of course, this also meant that the company had to accept and assign the IP rights to its customers and often through a relatively high risk partnership; in the example provided in section 5.3.1, the company's commercial value of the particular IP strategy depended on the customer's willingness to stay loyal and make use of CS3-Brushware's manufacturing tools for any future productions. An obvious risk to this strategy is that there was nothing to stop the customer from resorting to a competitor, leaving the company unable to enjoy any future benefits. What CS3-Brushware's example shows is the complex task for some SMEs to deal effectively with the management of their IP rights. It can be argued, that external support and advice is crucial and appreciated by the companies, yet futile – or even damaging, when not given based on the specific commercial needs of the company in question. Appropriate recording and analytical tools to aid IP strategy making seemed to be generally needed so that vital knowledge about best practices did not remain tacit within only a few practitioners.

6.4.2.7 Impact on the internal level: Fostering sense-making with back-end teams and alleviating novelty's threat to daily operational life

As I have argued so far, advancing drawing and prototype making were primarily developed with the purpose of experimenting and testing novel ideas that originated during the Initiation period and essentially to realise them into real tangible artefacts. The knowledge created from this practice had a brokering role to the companies' external environment (suppliers, customers) whilst allowed them to pursue IP protection.

Along with aiding communication with the external environment, the design work at the Development period (drawings and prototype making) was also a powerful internal communication and tension-relief tool that fostered cross-functional sense making.

One common source of tension at this period of NPD is that between the front-end's priority ('what we or the customer wants us to do') and the Production's personnel ('what we *think* we can do'). During NPD, a clash between front and back-end may be caused by the latter's alienation from the design decision-making process due to being drawn into the NPD process at a very late stage. Many cross-functional tensions stemmed from the inherent novelty of the technical complexities that NPD carries with it and the back-end teams cannot understand the thinking that led to the particular design decisions. Consequently, in this typical scenario extracted from CS2-Glazing (section 5.2.3, pp. 188-9), the Production personnel would complain and challenge the design during its Implementation period and propose less complex solutions. On the other hand, the front-end (i.e. design team) was purposefully avoiding bringing the back-end (i.e. Production practitioners) into the early design phases in fear of stifling creative thinking and innovation by following conventional thinking. Interestingly, the resistance to *new* did not seem to derive from bad quality relationships/interactions among the individuals involved in the process but, rather, it related to the practice's organisation. One clever tactic adopted by CS2-Glazing was to utilise the prototyping phase as a way to tackle similar boundary tensions. More precisely, the design team would meet and informally discuss the new project with the shop floor staff during their time spent at the company's technical facilities, to make the new prototypes. By doing this, the two sides exchanged ideas about different ways of making the product, potential design revisions for improving its manufacture and so forth. In addition, this moment offered the opportunity for the production staff to acclimatize early with what would soon hit their area of practice. This tactic helped significantly to loosen any potential tensions between different functional teams and provide a platform for *learning and knowledge exchange*.

Similarly, the organisation of practice was also the cause of cross-functional tensions at CS4-Pharma (section 5.4.3, p. 219). However, the tactic adopted by CS2-Glazing was not suitable for CS4-Pharma as many tensions were *caused* by the prototyping phase due to the disruption it brought to both human and technical resources. The Design Manager would often struggle to take on board the opinion of manufacturing technicians during the prototyping phase, as the latter were worried about causing a delay in day-to-day production. This of course was a reality contingent to the company's

strategic goals (discussed earlier in section 6.2, p. 249), which related to the cost reduction and improvement of its manufacturing efficiency. CS4-Pharma was trying to tackle similar problems through the process tools and policies that were being implemented by the Site Manager to allow more transparency in every new project stage.

What can be extracted from the two examples above is the contingency of the tactics to tension resolution in the two SMEs' leads to different strategic directions; CS2-Glazing strives for innovation and CS4-Pharma desires improved efficiency. While both organisations require both innovation and efficiency, the former clearly influenced the resolution of cross-functional issues in favour of design work, while the latter favoured a more neutral tactic and is slightly in favour of the technical side. Putting it differently, the best way to resolve such cross-functional tensions in both examples, lies in the hands and the actions of the top managers who were responsible for cultivating a culture of tolerance to the *new* (in CS2-Glazing) or to efficiency to the *old* (in CS4-Pharma).

6.4.2.8 Transition to the back-end side of the business: Structural differentiation and cross-functionality

Progress in design practice enables the introduction of the project to the rest of the organisation and the *back-end* practitioners. This side of the business, albeit somehow aware of NPD (e.g. the shop-floor staff during prototyping), generally lacked any *visible active* participation in the design work. A general awareness was raised during the formal management meetings, yet the majority of insights about what was going on, especially for non-managers, would happen coincidentally through informal interactions amongst the members of the organisation. All four SMEs had in a place a type of *new project review* meeting where the key departments (usually represented by each team's leader/manager) were informed about the NPD and its general plan.

The transition of organisational practice to the back-end, like in the Initiation period and the front-end, was contingent on the *structural characteristics* of the firms; CS2-Glazing (section 4.3.1.3) and CS4-Pharma (section 4.3.3.3) had the most defined structural differentiation, whilst CS3-Brushware (section 4.3.2.3) and CS5-BoPro (section 4.3.4.3) a more ad-hoc one. Nevertheless, the informal interactions between diverse professionals drove the majority of the transition in all four SMEs. Hence, one

way to look at the back-end teams' participation in the Development period is through the relationships between practice (tasks to do) and process (what follows before and after each task). In this way, developmental work can be seen as a pattern of actions and relations between the actors involved.

More precisely, in structural differentiating companies such as CS2-Glazing and CS4-Pharma, when design work reaches a satisfactory level, the Design team's role becomes highly situational; they would intervene again in the process only when their expertise is needed by other members of staff at the back-end or simply to chase up their progress. While at CS4-Pharma project management of NPD was generally led by the Design Manager, CS2-Glazing exhibited a more collective management approach (albeit, still led by the front-end). That is, the small-sized type of the back-end teams (no more than four members each, led by old-timers) and their close proximity, fostered the creation of informal bundles of practice. While the teams differed in their expertise, their dependence upon the work of the others meant that they would all informally interact and cross boundaries with one another at random times throughout the NPD process and whenever it was needed.

Team interdependence can be illustrated well when looking at CS2-Glazing's transition of practice to its back-end (e.g. in section 5.2.2, p. 178-80). In this case, the completion of each team's object of activity represents an approval point between the company and its customers. Initially, the Estimators' team can only enter the process following the final tests and drawings from the Design team. Their object of activity, which is to procure and devise the final price for the customer, is affected by any changes made to the product design. Their work is an important decision-making point as the new product's pricing would determine the projects customer approval. In turn, Estimators activate the members of the Drawing Office who enter the process by standardising the drawings, which are sent to the customer (or other end-users i.e. Architects) for further approval. Furthermore, the Contracts team awaits the completion of both teams work to prepare the relevant project documentation and devise a timeframe of the tasks needed to be completed, which again needs the customer's approval. The work of all these three teams would then drive the Production team's practice by providing them with a) the drawings of the new product, and b) a timeframe and a plan that needs to be followed during the Implementation period. In general, these four teams consisted of dynamic bundles of practices, which interacted frequently during the Development period with the majority of these interactions having a constant flow, yet remaining quite informal.

In contrast, the unstructured process in the Development work during NPD at CS3-Brushware and CS5-BoPro revealed little insights in terms of front to back-end coordination. Fluidity in the practice was the norm at every company in that there was no general model of the tasks to follow. As the Designer's practice at CS3-Brushware during the Initiation period showed (section 5.3.2), the process progresses by ticking off boxes while the relevant organisational members are called in, according to the needs of the given project. Interactions between the back-end practitioners happened on an ad-hoc basis and regardless of the period of the NPD process. Again, the lack of a coherent process and structure meant that much of what is happening in the development work remains obscure. So is also the case of the people who are involved and are often taken for granted. For example, CS3-Brushware's Manufacturing Supervisor was described by one top manager (Manuf. Dir.) as a significant broker between back-end and front-end, yet she was totally absent from the key organisational members pointed to by the company's Managing Director during his interview.

Similarly, CS5-BoPro's front and back-end had no visible transition between their practice as they all shared the same office space and interacted both informally (daily) and formally during the weekly project review meetings. Interestingly, however, the majority of the individuals of the company's back-end were silent practitioners; both the Production Manager (procuring and planning production) and the Manufacturing

Supervisor (responsible for supervising the sewing machinists and supporting production) were actually self-taught professionals. A summary of cross-case observations of the Development period is provided in Figure 68.

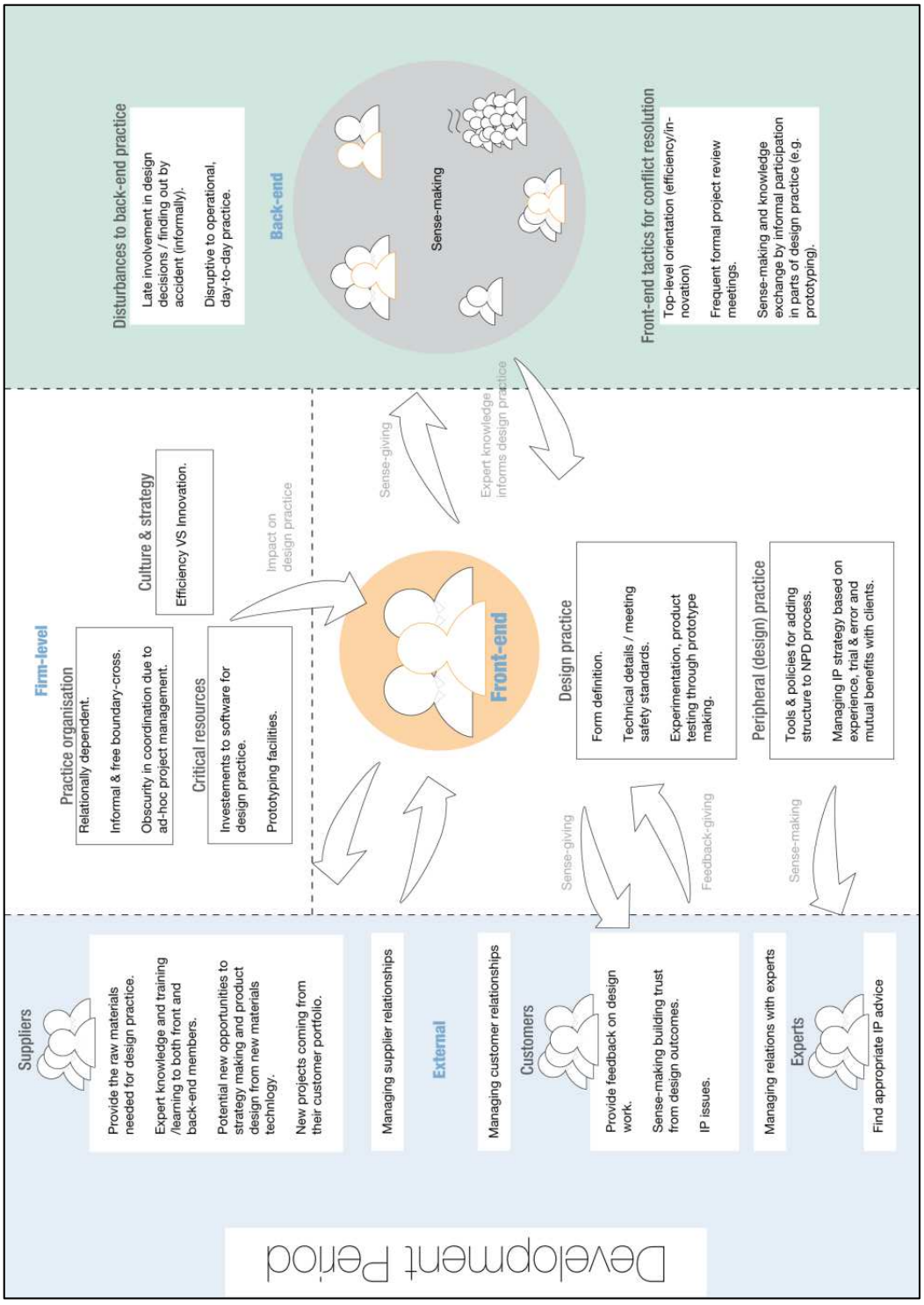


Figure 68. A summary of cross-case observations of the Development period

6.5 *The Implementation Period: 'Did We Do It Right? What Have We Learned?'*

Towards the end of NPD, practice is concerned with the final transformation of new idea into a finished tangible good, that is, the actual manufacturing of the new (or reinvented) product. Much of the work here follows the path set at the Initiation period by the front-end practitioners and which slowly transited to the back-end teams during the Development period. At the Implementation period, the back-end teams' role becomes the locus of practice (in particular the Production side of the business), while the front-end practitioners' participation remains situational. Various phenomena of organisational life surfaced in this period of the four SMEs that can be said to determine not only the success of the overall NPD process but also the broad firms' capacity to innovate. These phenomena generally revolved around the organisation and coordination of complex cross-functional practices, the tensions and corrective actions that the SMEs had put in place (or lacked), as well as issues surrounding the management of critical new knowledge and learning that was produced at the end of the NPD journey.

6.5.1 Social organisation

The four cases exhibited a similar pattern of social organisation and task coordination in the Implementation period. First, this period was centrally driven by the Production experts (manager and/or supervisors) whose main object of activity was the supervision and coordination of the Shop-floor practitioners. As I already pointed earlier (section 6.4.2.8), production experts prior to their involvement on the shop floor bundled with other back-end teams with whom they were co-dependent for pursuing their object of activity. During the production phase, the front-end practitioners possessed two types of situational roles; a) the support of the production process by the Design team members, and b) the progress chase of the manufacturing process by the Sales team members and upper echelons. Figure 69 depicts a visual representation of the back-end member's relationships of the four SMEs.

Figure 69. Back-end bundles in the four SMEs

6.5.2 Sense making of the new project: Tensions and corrective actions

Production experts' interaction with the rest of the organisation was initially concerned with making sense of the new project's specific needs and challenges. For sense making to happen, the Production experts relied upon the information and knowledge of their colleagues who either initiated the NPD or had been involved earlier in the process. As I outlined in the discussion of the activities during the Development period, the most typical friction point of the Production side of the business was against two main aspects; a) the organisation of the NPD process, which placed their role at a very late phase, and b) the general lack of understanding about the front-end teams' design decisions that occurred at earlier phases. Simply put, the late-involvement of the Production practitioners created a general feeling of exclusion from a decision-making process that had a direct impact upon their practice that was evaluated based on efficiency, an endeavour that collides with NPD's inherited disruptive nature. Therefore, by not 'seeing' the early phase of the NPD process, it was difficult for production experts to first, *make sense* of the design decisions and accept them, made by the front-end practitioners and second, to provide expert knowledge about the technical feasibility of a new idea, which could allow the company to terminate the NPD process at an early and more cost-efficient point. For instance, the Production Manager at CS2-Glazing complained about how, at times, the front-end practitioners were making promises to the customers too early and without investing adequate time in product testing first, which put the company at a risk of facing major drawbacks by the time the new project is introduced to the Production site to manufacture. At other times, the opinions of Production experts were received with scepticism at the front-end, as CS4-Pharma's case pointed out, it is as if the former's intentions was to avoid moving away from their comfort zone (and in many occasions, this would also be true). This reality was clearly visible in at least half of the cases (CS2-Glazing and CS4-Pharma) studied, perhaps because of the way the two SMEs were structured (clear functional roles) as opposed to the more ad-hoc style of CS3-Brushware and CS5-BoPro, which hindered similar functional interdependence.

The four SMEs seemed to be aware of these cross-functional tensions and certain efforts to prevent them from happening were either in place or at an early implementation period. The simplest approach was the inclusion of Production experts (at the managerial level) at the various formal meetings (in particular, the new project meetings)

every company had (see Table 8 in section 6.3.1.1). This seemed to be a sufficient tactic to the smallest of the four SMES such as CS5-BoPro and CS3-Brushware, where these frequent (weekly) meetings were coupled with more frequent daily informal interactions owing to the shared roles and working spaces between front- and back-end practitioners. CS3-Brushware seemed to rely on the brokering role of its Manufacturing Supervisor, who provided an informal link between the front and back-end practitioners, or as it was described by a top manager – “the type of person people will go to speak to as an intermediary”. Yet, as I highlighted in section 6.4.2.8, this important role was somehow ‘obscure’ in the process and the lack of a widely shared view by all the key individuals interviewed, gave the impression that this occurred because she was taken for granted.

In addition to the formal management meetings, design experts in CS2-Glazing and CS4-Pharma interacted informally with the Shop-floor practitioners at two phases in NPD; a) early in the Development period (discussed in section 6.4.2.4), and b) during the Implementation period where they oversaw the manufacturing of the first batch and supported the shop-floor with any help they needed (e.g. technical information, resources etc.). Although only recently implemented, these two tactics were found to have generated positive outcomes and helped to resolve some of the issues discussed earlier. It was apparent that the free boundary crossing that the flat structures like those the four SMEs possessed, helped significantly to alleviate many tensions from reoccurring. What seemed to be even more critical, however, is the actual willingness of the front- and back-end to seek co-operation, value alternative opinions and pursue the creation of shared understandings.

6.5.3 **Getting the idea into production: Planning**

As I have pointed out in the Development period section, planning the production was based on a customer-centred plan devised by the back-end teams. Not surprisingly, the success and complexities in this phase generally revolved around time. For example, *procuring and getting the needed required materials on time* was one major challenge for all SMEs, especially when weak relationships with suppliers existed (e.g. CS4-Pharma). However, *making the product on time* is not the end of the process, as *dispatching it to the customer on time* was in some cases another very challenging task and dependent on many different internal and external actors; for instance at

CS2-Glazing, the manufacturing process is interconnected with the majority of the back-end teams, each of which rely on the timely production of the new systems, in order to send them to the client's site. At the site, back-end practitioners (e.g. Contracts team) travel and meet with multiple and diverse professionals, some hired by the client (e.g. contractors) and others by the company itself (e.g. external site managers) to fit the new systems. Hence, it is logical to expect that any delays in the actual production would have an impact on the coordination of this complex process and, as a result, pose a major threat to the project's life. Managing the Implementation period is as crucial as the Development period; while the latter is about 'making something that works', the former is about 'getting it to make money' – an endeavour that partly relied on the timely production and market launch.

The often unavoidable delays in the manufacturing process generated a certain amount of internal tensions, typically deriving from clashes in priorities. The most frequent clash was between Production and Sales experts' priorities; the former invested their efforts in building the new design based on efficiency and robust manufacturing techniques, whilst the latter was concerned about meeting the demands of the customer upon the products' timely dispatch. Interestingly, both sides were under pressure to meet the plan and both felt that their needs were not being understood or appreciated by the others and vice versa. In some cases (CS5-BoPro, CS3-Brushware) such frictions may be attached to the general lack of knowledge about each other's' expertise (e.g. sales with no technical training and vice versa). On the other hand, even those companies who possessed technically fluent practitioners (CS2-Glazing and CS4-Pharma) would not avoid such frictions. One observation extracted from CS2-Glazing was that the two sides' friction resulted from their experiences; for instance, it was the norm for the Sales practitioners to not interact with the Production members, other than to chase the production's progress. Production members would receive their interest with suspicious as it was mostly linked with a negative feedback, such as a customer's complaint about not meeting a delivery schedule, and a lot less positive feedback that could be used as a motivational reward to the Shop-floor's hard work.

6.5.4 Novice Integration

The integration of new personnel to the 'way we do things here' culture of the four SMEs was generally done through a *novice to expert cultural assimilation*; the newcomers would pair with old-timer experts and learn the job through observation and trial and error. CS2-Glazing considered the newcomers also as sources of new knowledge; as the Technical Manager argued (see Appendix 11, p. 395), the Design team was trying to utilise new manufacturing techniques that newcomers brought with them. For CS5-BoPro, this tactic defined also the basis of the general hiring approach; the company employed individuals with none or only a basic-level of technical knowledge, which they then trained internally concerning the particular products the company manufactured. At CS4-Pharma, technical experts were being trained for the needs of a newly introduced function (Continuous Improvement) as part of the company's cultural change (discussed earlier in section 6.2.2, p. 251). In general, all four SMEs were found to adopt similar training tactics by repositioning their internal old-time experts to fulfil the possible lack of, and the need to, introduce a new organisational role. Yet, in companies such as CS5-BoPro, the frequency with which staff tended to leave the company, had a deterring effect on the top leaders' willingness to invest resources for new staff learning development (a point made also by Abreu et al. (2009, p. 110) albeit in this example the firm's sector is thought to be irrelevant to this specific issue).

6.5.5 End of the NPD journey: Management of new knowledge and customer feedback

NPD journeys can be said to successfully terminate when the products reach a happy customer. Satisfied customer feedback was pursued by all four SMEs, and it was an important 'end-point' in that the NPD is not finished unless the new product is accompanied by user satisfaction.

All four SMEs noted cases where customer feedback regarded complains about faults and/or issues about a product's design. For instance, CS2-Glazing had examples of projects were the new systems encountered issues during site installation which were novel and therefore could not have been anticipated earlier in the process. Usually, negative customer feedback led the companies to inform the relevant key individuals (through a similar front-end to back-end process) and re-initiate a secondary corrective

development process. For CS5-BoPro (section 5.5.3, pp. 236-7), the negative feedback could equally lead to a total termination of the product from the market or to redesign and re-launch it as an entirely new or an upgraded version. Other times, NPDs ended up ‘orphans’, in other words, they never reached the customer (or markets) for some reason. CS4-Pharma approached these cases as opportunities (section 5.4.3, p. 222) which drove the initiation of an entirely new NPD, often through incremental design modifications offered to new customers. To some extent, negative customer feedback about final products, whilst normal even with the best companies, also reflects a general challenge for SMEs in relation to best design practices. All four SMEs were very conscious about their design weaknesses and there was evidence of efforts in developing better mechanisms to guide the process and the complex task of understanding and screening customer needs early in the process (see discussion in *Design’s role in initiating NPD: Valued more than in the past***,** p. 276).

6.5.6 Managing new knowledge: tools and accommodation

Arguably, every NPD journey has an inherent relationship to *newness*, which means that many of the actions involved (and discussed in this chapter) had never been practised before. At the end of such journeys, outcomes are far richer than what were originally anticipated; along with the production and launch of the new product to customers/markets, comes the new knowledge, new skills and new routines that derived from the practice. Capturing and managing these important immaterial outcomes of the NPD journey represents a critical practice and competitive advantage for every organisation. The four SMEs exhibited both common and diverse approaches to managing their newly created knowledge.

6.5.6.1 Project memories

A common practice of all four SMEs was to retain a project file, which stored all the information relevant to the project, such as; technical details, drawings, costs, quantities and so forth. More importantly, project files stored detailed information of the day-to-day actions and the project points where decisions were made and the reasons that drove these decisions. In this way, the four SMEs had a protective mechanism (to some extent) should a key person leave the company, as this system would allow a new member to be assimilated.

6.5.6.2 Using what is available

Despite the use of the (more formal) project memories, the informality of the practice in all four SMEs meant that part of the project information could also be traced back to the day to day communication mediums of the key members. One such tool was the emails that were not used only for communication reasons but were effectively information-storing devices. CS4-Pharma was a great example of this practice owing to the fact that the two key members driving the NPD process were interacting from different geographical locations. What can be said about this notion is that, despite of the use of standardised tools, practitioners are also likely to use tools that they have available, rather than to search for tools designed for a particular activity.

6.5.6.3 Sharing tacit knowledge through accommodation

Regardless of the effectiveness of mediums such as project memories and emails in storing, sharing and promoting a newcomers learning, it can still be expected that a great part of *wisdom* sit tacitly with the practitioners involved throughout the NPD journey. To some extent, all four SMEs were vulnerable in managing this important resource, especially when such key knowledge was possessed by only a few. For example, CS3-Brushware's knowledge in managing IP rights sat only with its Managing Director; similarly, CS4-Pharma would have tremendous difficulties if it needed to replace its Design Manager, whilst CS5-BoPro was depended for almost everything on its owner-manager. Sharing this knowledge across other key members is generally a challenging task and companies who fail to do so are exposed to risks such as the loss of important knowledge should a key member leave the organisation, it being 'leaked' to competition, as well as impacting the ability of the company to build organisational memory.

Documenting the NPD journey, like the project memories described above, were a step towards handling these risks. Some companies were also trying to develop a space for knowledge sharing and learning through socialising tactics. For example, all four SMEs ended up their NPD journeys with a formal project review meeting where the key individuals sat and shared their experiences. For CS2-Glazing (section 5.2.3, pp. 188-9) the end of the NPD journey was an opportunity, rather than a risk, to managing knowledge. First, the new project review offered its members the opportunity to alleviate tensions and mutually learn from each other's experiences. Members of the

front-end (usually the Design team) met with the Shop-floor experts that were involved in the particular project and by sharing their experiences, learning was aided through shared communication. Through this tactic, the company was able to identify new manufacturing techniques, which, in turn, increased substantially its chances/capacity of introducing process innovations.

In general, appreciating the value of storing and reflecting project information was, like design's role, a recent change in attitude of all four SMEs. They all seemed to be a lot better at capturing new project information, which at least protected their day-to-day operation even after a key person decides to leave the firm. Although recent, this new attitude reflected an effort to shift from solely relying on an individual's knowledge and expertise, towards the generation of a value model that may utilise past projects' knowledge, and through an interrogative process, to analyse core versus marginal values, which can then be applied to either improve efficiency or drive the development of novel outcomes. Of course, design research and practice can have an important role in the development of appropriate tools, through a vicarious collaboration with the organisations and according to their socio-cultural and relational idiosyncrasies. Cross-case observations of the Implementation period are summarised in Figure 70.

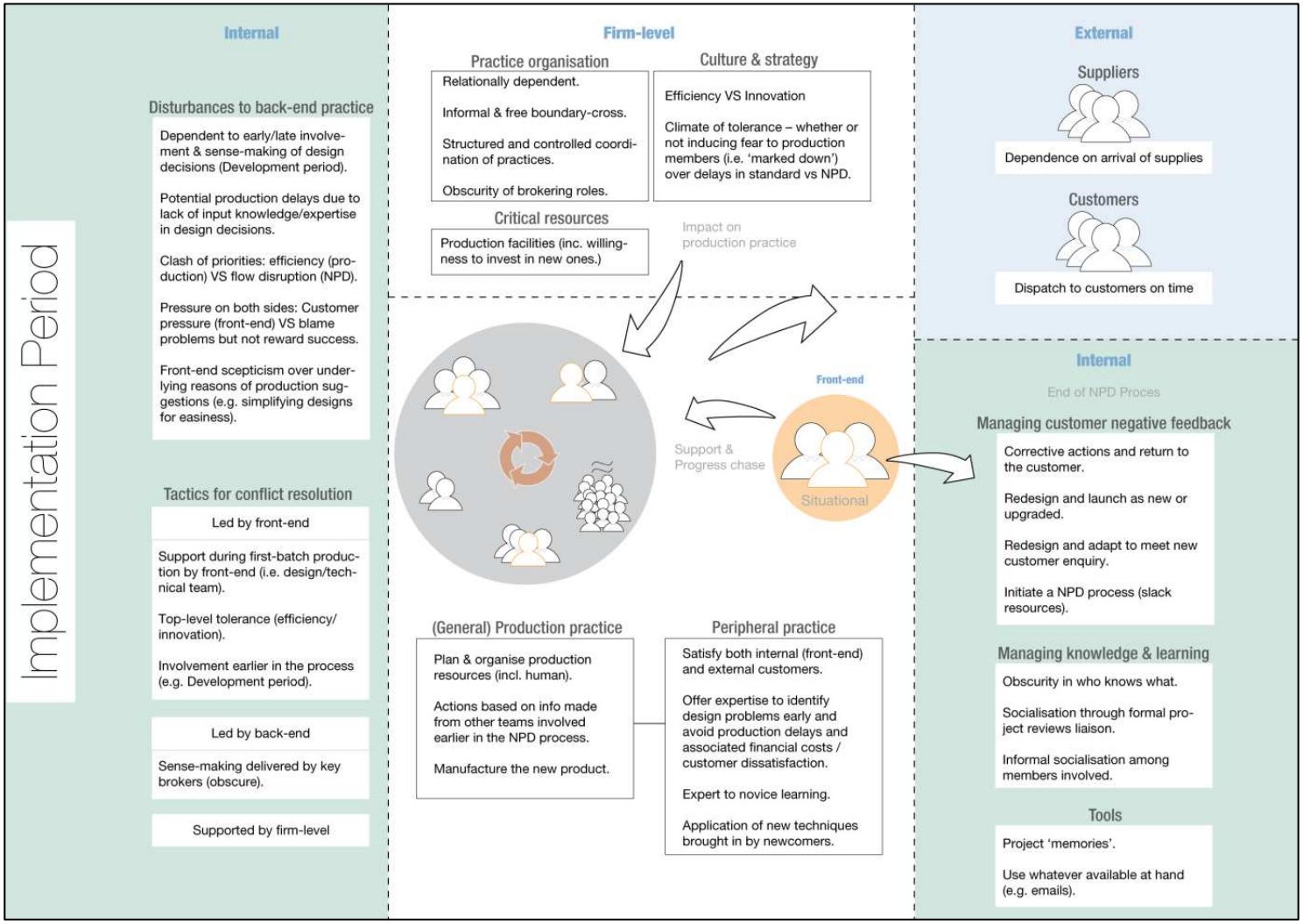


Figure 70. A summary of the practices involved during the Implementation period

Chapter 7.
Conclusions

7.1 *Introduction*

There are several existing approaches relating to the study of organisational practices and the phenomena that are said to promote or hinder agility and innovation potential. There are notable differences in their focus, scope and concepts while lack of consolidation, alignment or relevance to real world cases. Prior research in this area has assumed that a company's agility and innovation potential can be objectively explained by looking at critical factors such as peoples' skills (e.g. leadership), organisational resources and capabilities, or its external orientation. However, these variance-based approaches are generally discussed in isolation from the dynamic contexts where they emerge. As a result, they fail to provide a holistic view of the phenomena that promote agility and innovation. Through case studies that explored NPD from a multi-level, integrated approach, this study has provided a rich description of relational dependencies between phenomena that often remain 'obscure' in day-to-day practice, and related them to industrial practice.

7.2 *Findings*

This study has identified a number of key phenomena with compelling evidence for their occurrence in manufacturing SMEs and for their recognition as key contributing aspects impacting long-term, business-wide agility and innovation performance.

7.2.1 Recognising organisational identity: The important role of a company's transformational events

The transformational period (section 6.2) was found to include various (internal/external) influences and (shock) events that led to changes at both the internal (e.g. ownership, teams, culture, resources) and external (e.g. markets, support) levels of the firms. A close look at the historical events and cycles of qualitative transformation provide key insights of the phenomena that have shaped the most current forms of organisational behaviours and attitudes and have placed organisations on certain path dependencies that drive their decision-making and problem-solving approach. These precipitating events were found to have a variety of causes, often operating in synergy, that make firms realise 'it is time to renew';

- *Negative forecasts and/or personal aspiration (e.g. CS2-Glazing, CS4-Pharma).*
- *Earlier innovations that either failed or were too costly –time and money wise (e.g. CS3-Brushware, CS4-Pharma, CS5-BoPro).*
- *Motivated by non-innovation reasons such as staff training and renewal (e.g. CS4-Pharma).*
- *Upgrading office and factory facilities (e.g. CS3-Brushware).*
- *A deteriorating financial health (e.g. CS4-Pharma).*

While evidence from the case studies pointed to idiosyncratic journeys towards firm transformation, they also demonstrated patterns of events that led them to certain periods of transformation and renewal and which can be extracted, compared and analysed (one such example can be found in Figure 62, section 6.2.1). Generally, the findings highlighted the important role of the Transformational period in illustrating the companies aspirations of 'becoming' (Tsoukas & Chia, 2002) and their struggle to find a balance between changing and retaining the existing value unharmed by the new practices.

7.2.2 Aspiring innovation: The key findings of 'doing the right things' at early phases (Initiation period)

With regards to pursuing innovation making, the study found that sources driving NPD varied widely and although one may distinguish some key drivers, there was no single model or pattern of innovation making prevailing. For example, the initiation of NPD across the four cases was driven by;

- *Individual and team creativity,*
- *New or existing customers,*
- *Suppliers,*
- *Other external experts, agents and universities,*
- *Internal needs and/or as a response to environmental conditions (threats/opportunities).*

Nonetheless, case observations pointed to the characteristics and organisation of practice of the front-end members and the way these related to the organisations' external environment.

One key characteristic of SMEs practice was their inherited customer/user-centeredness; considerable effort and time was put into keeping close contact with the end-users and existing or potential clients in order to make sense of needs and opportunities, and build sustainable relationships of trust. In turn, sense making gained during these activities was critical to the sense-giving circulated to the rest of the organisation. Sense making at the early phases takes place at two levels of the front-end teams (section 6.3.1);

- *The first level is concerned with the companies' strategic thinkers i.e. the top leaders (section 6.3.1.1).*
- *The second level with the practitioners that possess sales and design/technical expertise (section 6.3.1.2).*

Organising for empathetic relationships with end-users: top-level active involvement

Unsurprisingly, top leaders played a crucial role in these early phases and impacted in both positive and negative ways the organisation's agility and innovation potential (see Figure 65). These ways generally relate to;

- *Top leaders' personal management of a rich social network of experts, aids a first-level sense making of the markets they operate. Yet, this social capital remains a very personal asset that is not widely shared across the rest of the organisation (section 6.3.1.1, pp. 259-60).*
- *Top leaders' sense making of market intricacies not only influences the strategies and corporate visions put into the organisation, but also enables them to know how to best organise front-end practice in such a way that meets those intricacies (section 6.3.1.1, pp. 260-1).*
- *Top leaders' personal and active (or lack of) involvement in the early phases determines the level of openness and confidence to champions of new ideas and as a consequence to the general climate in the organisation to innovation practices (section 6.3.1.1, p. 261).*

Close proximity and collaboration between sales/marketing and technical/design bundles of practices

Evidence from the case studies showed that practitioners at the front-end of the business consisted mainly of Sales and Design/Technical experts, whose practice was highly collaborative and characterised by a relational dependency (section 6.3.1.2).

- *Their collaboration acted as second-level sense-makers (utilising top leader's sense making of markets to understand user-needs) and sense-givers (translating insights into designs and communicating them to both customers and other members of staff).*
- *Companies with technically adept clients particularly benefit by in-house sales members who are also design/technically competent (e.g. Technical Sales) (p. 264). Their ability to construct and offer early design concepts (often in collaboration with the design experts) allows them to bridge boundaries of expertise, build early customer-empathy and offer realistic solutions that meet a project's technical complexities. On the other hand, organisations with less*

technical-orientated clients rely upon extensive market knowledge from their sales practitioners (pp. 265-6).

- *The close proximity between Sales and Design teams meant that technical complexities are being addressed at very early phases, before even initiating an actual NPD. However, issues could arise in the transition of knowledge/insights between one team to the other and the occasional misinterpretations of customer needs/opportunities. In some instances (e.g. CS4-Pharma, p. 273) design experts would by-pass the sales practitioners in order to gain a more accurate sense of the customer's needs. Designers' sense making at an early phase is critical in their ability to share meaning with the back-end practitioners at later periods of the NPD process (section 7.2.3).*
- *Companies with externally based sales personnel (often commissioned) rely on their loyalty and desire to identify new opportunities (pp. 265-6). While adaptive, managing this type of personnel obscures clarity about who knows what and who is doing what.*

Building relationships with the right partners or external support critical to SMEs initiation of NPD

Evidence from the case studies provided rich examples of the critical role that activities in the external environment play for the agility and innovation potential of the four SMEs (see e.g. section 6.2.2, also Figures 65-7). More precisely, it demonstrated the diversity of tactics employed to access external knowledge. These included:

- *External consultants, personal contacts, and strategic alliances with suppliers.*
- *Project-based and/or long-term collaborations with universities and academic experts.*
- *Attending industry exposure and university or other regional support associations' knowledge-enhancing events as well as informal meetings and discussions with subject experts.*

Furthermore, it was found that relationships with the external environment in the early phases are crucial for other reasons that are not necessarily about the creation of new products/systems. More precisely, communities of practice and informal networking with clients/experts outside of new project scope (e.g. section 6.3.1.2, pp. 267-8) provides SMEs with vital knowledge and creative opportunities that may initiate the development of a new idea in the long term, not intended for the same clients/experts.

Finally, collaborations with partners and other industry experts provided SMEs with a certain level of confidence and willingness to persuade more radical developments that they would not risk to pursue on their own (discussed in section 6.3.1.1, p. 262).

7.2.3 Managing the development process: Findings about 'doing the right things right'

Evidence from the case studies illustrated how success in the Development period (section 6.4) goes hand in hand with the ability (or lack of) managing the boundaries of diverse experience and competence at both the internal and external levels of the organisations (see section 6.4.2). One particular advantage of the informality and 'ad-hocness' that drives day-to-day practice in SMEs is that boundaries between teams of diverse expertise are being crossed freely and this creates bridges that connect their practices. This fluidity enables people across different departments to know (often by word of mouth) when a new project initiates before it hits their desk. At the same time, however, the lack of a certain level of structure obscures the way projects are managed and knowing who does what, how, when and why. Finding the right balance between convergence and divergence and dealing with conflicting priorities amongst diverse bundles of practices is most crucial during the development period.

Managing the multifaceted phase where tensions, incoherencies, politics and negotiations among diverse professionals take place as the 'new' (NPD) collides with the 'old' (daily operations)

Findings from the companies studied identified designers and technical practitioners as the key protagonists of the Development period. Design practice not only drives the process of getting the technical aspects of the new project right but, more importantly, design outcomes such as drawings and prototypes work as boundary objects that provide meaning (sense-giving) at both the internal and external levels of the organisation (section 6.4.2.2).

Paradoxically, however, design practice during the Development period acts simultaneously in a brokering and a disruptive role (section 6.4.2.7). That is, while design outcomes are extremely useful at coordinating action, the complexity accompanying their novelty also generates tensions between diverse internal and external professionals.

Conflicting needs or priorities of practitioners often manifest at this period as the inherent uncertainties of the new project generate disturbances to the efficiency-led daily operations of the business. Disturbances are often exacerbated by the lack of early involvement in the design decision-making process of back-office practitioners, in particular the production personnel. A common observed scenario was the notion of design/ technical practitioners operating in isolation from the back-office members during the creative process. This practice allows them to work without having to compromise novelty in favour of 'easier to make' design solutions. Yet, at the same time, this isolation impedes the sense-making of the people who are called to manufacture it in the later phases. A number of tactics were observed as ways of alleviating such tensions (section 6.4.2.8);

- *formal weekly project meetings which integrate all functional team leaders, and*
- *the use of specific phases such as during sample making as opportunities to invite participation and knowledge/opinion exchange between diverse firm members.*

Balancing beneficial fluidity and damaging unstructured-ness

In all cases studied, it was evident there was a need to add more structure to the NPD process to allow transparency of the actors involved, guidance and higher cross-functional involvement during the different phases of a new project (see e.g. sections 6.4.2 and 6.4.2.8). Such tools are advantageous when they are frequently refined in order to allow flexibility and adaptability to different project requirements. SMEs were found to be trying to develop such tools either through in-house practitioners (e.g. designers) or resort to outside experts (e.g. design-led university departments and/or external design agencies).

Managing relationships with suppliers

Finally, relationships with suppliers were found to be a key determinant and an area of weakness impacting the Development period (section 6.4.2.4). Companies benefit from their relationship with suppliers by receiving expert knowledge and technical training of bespoke products/systems. On the other hand, the majority of the companies studied expressed a notable weakness with managing their relationships with suppliers. Among the most recurring issues impeding SMEs' relationships with their suppliers relates to the fierce competition derived from larger organisations.

7.2.4 ‘Did we do it the right way? What did we learn?’: Findings from the Implementation period

Key findings around the Implementation period (section 6.5) revealed two central phenomena; a second round of tensions and negotiations between front- and back-end practitioners and the case of managing what has been learned to inform future practices.

Managing new tensions and clashes between front-end and back-end

More precisely, new clashes in the NPD process during the Implementation period stems from the conflicting priorities between efficiency-seeking production personnel and the customer-satisfaction-seeking sales experts (sections 6.5.2 and 6.5.3). It was found that while both are under pressure to meet the milestones agreed with the customer, there was a lack of shared understandings and appreciation of each other’s pressures to meet their object of activity.

Using ‘failed projects’ as opportunities for incremental innovation

Occasionally, the NPD would terminate prior to full-scale production for a variety of reasons and end-up as ‘orphan’ projects (section 6.5.5). Evidence showed that companies benefit when approaching these cases as opportunities rather than catastrophes; incremental improvements and appropriate design revisions are put in place in order to redirect the offerings to other customers or markets.

Managing new knowledge and learning: A shift from individual reliance towards a value model

Evidence from the case studies (section 6.5.6) reflected a general appreciation in storing and learning from the experiences gained during NPD, although in varying degrees of robustness and effectiveness in each case. This reality further reflected the organisations’ recognition of the necessity to adopt/implement new practices that will enable them to remain agile and competitive. In their journeys to become more contemporary and relevant to their markets, the companies were found to be moving away from conventional reliance upon individual knowledge and expertise towards more integrated practices. The ultimate goal would be to generate a value model that may utilise past projects’ knowledge and through an interrogative process, to analyse

core versus marginal values, which can then be applied either to improve efficiency or drive the development of novel outcomes.

Finally, end of project reviews were used to invite participation among all organisational members and to exchange ideas and experiences which in turn led to the identification of best practices that informed future projects. Yet, it was also evident that companies still employed whatever tools they have at hand; communication tools such as emails between the people involved in the project were perhaps the most common knowledge storing and sharing devices in the cases studied.

Further general findings included

- *Recognition and effort to change and renew traditional manufacturing practices in the last decade (albeit in varying degrees) in order to remain relevant to their markets (section 6.2).*
- *The findings of the data demonstrated the growing role of design as a central part to organisational renewal with the employment of design graduates, experts and/or external design consultants (section 6.3.1.2, p.274).*
- *Efforts to protect intellectual property (IP) have considerably increased, albeit strategic decisions are hindered by the occasional struggle of SMEs to find advice from external experts that are appropriate to their idiosyncratic needs and not based on a general prescriptive formula (section 6.4.2.6).*

7.3 *Implications for Theory*

The phenomena impacting the agility of SMEs and the innovation potential presented in this study do not consist of new concepts in their own right. Organisation performance, agility and innovation have been previously studied extensively in business and management research and have produced a broad and well-established literature. However, as previously noted, the conventional variance approaches found there, are generally discussed in isolation from the dynamic contexts where they emerge. The theoretical contribution of this thesis is the consolidation and investigation of the various terms and concepts from a multi-level, integrated approach that aligns together variance, process and practice-based theories. This devised research methodology enabled the construction of a more holistic picture of organisational phenomena that often remain 'obscure' in day-to-day practice.

7.3.1 **The importance of obscure practices**

Existing research in design, innovation and organisational analysis have previously discussed the existence of phenomena that remain hidden, invisible or silent within organisational practices. The argument goes that these phenomena are often overlooked, unrecognised either because there's a certain level of tacitness, people are too involved and activities are too familiar or the metrics used to measure them are not sensitive enough to capture them. The problem with such terms is that they imply a deliberate action – as if someone deliberately concealed his/her actions as not to be seen/found by others. This begs a fundamental question; how can something be hidden or invisible, yet suggesting that it should be made visible? For invisible ultimately implies that there is no way for it to be found, hence one cannot do much about it.

A key contribution of the work presented here is that it goes on to discuss the importance of 'obscure' practices that affect the successful outcome of NPD activities. Although the study provides evidence of complex phenomena that often take place 'under-the-radar', they were not hidden but *obscure;* practices whose significance is difficult to understand, recognise and hence are underutilised because they are not articulated explicitly from a holistic point of view. The study therefore proposes that substituting illogical concepts such as hidden and silent with pragmatic terms such as obscurity essentially helps connect theory and practice more effectively in this context.

7.3.2 On the three-level conceptual framework

The three levels that construed the conceptual framework – individual, organisational and external, have been well researched and documented previously. A lot less has been done with regards to how the three levels interact and influence each other in the process of developing new products. Empirical and anecdotal literature in business and management research has used a variety of terms and definitions specific to the research tradition of the researcher. Yet, this study has found that there is considerable conceptual overlap and has aligned the various concepts into a multilevel conceptual framework. It is worth mentioning that the framework did not attempt to provide an exhaustive list of concepts found at each level but to specifically bring into attention the usefulness of looking at each level's relational dependency. The framework is flexible enough as to be tailored and iterated according to the researcher's enquiry.

7.3.3 On the NPD process model

The same stands true for research in the NPD process and its management where an abundance of important studies, models and tools exist, yet in isolation from the level-based phenomena that emerge there. The relatively simple NPD model (Initiation, Development, Implementation) adopted by this study served as a 'framework for thinking' (Tidd & Bessant, 2009) rather than a descriptive or prescriptive representation of an ideal NPD process. This approach provided the study with enough flexibility to adapt its enquiry to different organisational contexts. Moreover, it allowed research to, first, identify key phenomena that emerge at different phases in the process and, second, to reconstruct the actual process according to how the companies experienced their NPD processes.

7.3.4 On the choice of Activity Theory as an analytical model

The choice of adopting the theoretical lenses of Activity Theory (AT) for the analysis of the NPD processes of manufacturing SMEs was found to be very useful. In particular, the AT model provided a platform through which multilevel phenomena can be recorded, extracted and analysed in such a way that the richness and depth of the dynamic contexts where they emerge can be considered. The study's approach consists of a methodological novelty in the way AT was applied as a model of analysis.

Of course, it is important to appreciate some of the implications to this study identified regarding the chosen theoretical model of data analysis. Studies of AT application have been traditionally concentrated around education and learning and more recently in human-computer interaction (HCI) (e.g. Kaptelinin, 2012) and service design (e.g. Sangiorgi & Clark, 2004) as it particular addresses questions of "what are people doing?", "how are they doing it and with whom?" amongst others. In relation to this study, AT has not been previously adopted by another study from a similar approach, that is, to investigate agility and innovation by analysing NPD activities of manufacturing SMEs through a multi-level, integrated approach. This methodological novelty was approached by reviewing literature that seemed to offer a close resemblance to the needs of this study (discussed in section 3.2.1), albeit still with differences to their purpose and context of study.

7.4 *Application in Practice*

Despite much empirical and industry attention, there is still frustration among SMEs leaders at the lack of recognition of the idiosyncratic and emergent challenges they face in order to maintain relevance to their markets. To help achieve the conditions needed to be agile and innovative, many theoretical models, tools, services and policies both from academia, industry and government bodies exist today. Yet, the majority of these are based on prescriptive guidelines of 'best practices' that are divorced from the complex dynamics of SMEs practices, often characterised by 'obscure innovation', operate serendipitously and/or without recognising the actual outcomes and the members involved in the process. If businesses do not recognise or underutilise their own capabilities (or lack of them), perhaps it is because these capabilities remain so engraved in the day-to-day practice and not articulated from a holistic point of view. If this is true, then new approaches are needed to better explicate the contextual, situational and relational phenomena that impact on SMEs' practices.

The case study findings have several practical applications:

First, they provide real world examples in the SME context, providing specific, comparable insights of the multifaceted and collaborative practice employed by SMEs with diverse business models and product portfolios. These examples bring into focus the inherent challenges companies face when managing the obscurity of their practices.

Second, they demonstrate how a multilevel design-led approach may provide manufacturing SMEs and design strategists with non-prescriptive tools to assist the maintenance of agility by recognising and understanding the potential of obscure innovation practices. This could be especially valuable for organisations such as SMEs who operate with few resources and need to leverage their company-wide capabilities not by obvious prescriptive means but by better planning and reviewing their organisation's practices.

Third, they provide strategic design researchers with key insights into some of the complex phenomena manifesting across multiple levels that need to be considered in the study of any type of organisational context.

Fourth, the findings demonstrated the value of methods used to understand practice between business strategy management (variance-based) and strategic design (process-orientated). The conceptual distinctions achieved here may enable a clearer understanding of today's expansive role of design, which suggests that its ethos and approaches are particularly relevant in strategy making and as a way of making meaning out of complex problem spaces.

7.5 *Limitations and Recommendations of this Study*

7.5.1 Scope and depth

Like every piece of research, this study has certain boundaries and limitations in its scope and depth which attempted to address the question at hand. The study has achieved in answering that which it originally aimed to do, that is, to explore how New Product Development (NPD) practices in small and medium-sized manufacturing enterprises (SMEs) are influenced by *obscure* practices, deployed to meet emerging challenges that enable SMEs to remain relevant to their markets. Of course, it is sensible to ask and identify the gaps which might be presented in the model from reviewing the findings.

With regards to the contributions themselves, further details can be found in the original references from which the various categories were derived. For example, the importance of cross-functional collaboration in the innovation process is well researched and documented (see for instance in section 2.2). Much less has been done to consider the 'obscure' innovation practices that take place in the day-to-day practice and during the NPD process.

In exploring the innovation practices of small manufacturing organisations, the study focused on the NPD process which was organised based on three general periods; Initiation, Development and Implementation. Each period explored a number of activities that were based on the information given by the participating companies and their members. A detailed and systematic exploration of every single activity in this complex process, including any secondary ones and/or those that were not described by the respondents, were beyond the scope of the study. This point is being addressed in section 7.6, which is concerned with future work.

Representations of the NPD processes and activities taking place there are true, at least from the researcher's point of view. That is, statements about the respondents' practices were not based on 'objective truths' but rather had a subjective manner and were dependant on numerous influences. In this regard, Baumard (1999) pointed out that respondents may perceive the interviewer as an 'intruder' of their personal domain (emotional, cognitive, connotative, sensory and imaginary) and hence express only what they feel is appropriate and in accordance to their beliefs about the interviewers

identity and/or intentions. As the author further notes, the reality expressed by the respondents may also be 'incomplete' because they 'forget' – because either it is simply about the past, or because they intentionally edit their memories to fit in accordance to what pleases them or feel they ought to say. Consequently, particular care was taken for both the recording and analysis of the interviews, especially when contradictory viewpoints where expressed. In general, the respondents statements were taken at face value and were not interpreted for hidden realities based on unvoiced contradictions or motives; to do so, would require a very different methodological approach from the one adopted here (and presented in Chapter 3).

Although the case studies sought rich data and valuable insights about the NPD practice of manufacturing SMEs, their analysis did not seek to identify new phenomena but rather to confirm those identified in Chapter 2 and to highlight how their relational dependency influence agility and innovation. Whilst this was the actual aim of the study, it is sensible to note that the results may not be covering completely all possible phenomena.

7.5.2 Limitations of applying AT model retrospectively

The use of Activity Theory as a model for analysing NPD activities has its own limitations. First of all, the AT model does not offer coherent guides to its 'correct' application. Further, AT proponents suggest that the model is most effective when being adopted on a longitudinal basis and through an Action Research (AR) technique because it allows one to observe activities in a much deeper and detailed manner. One such characteristic approach can be seen in Engeström (1999) where field observations of team meetings and interactions at work provided "very detailed data-driven analysis of the discursive processes, practical actions, and mediating artefacts that are employed in the step-by-step production of an innovative solution or idea" (p. 377). For the reasons described in section 3.2.5, the study abandoned the idea of an AR approach and devised a methodology that sought to study organisational practices from a retrospective point of view.

The study also acknowledges the complexity and uniqueness of the context of investigation, the NPD activities, where phenomena may be changing at a fast pace and often in an unforeseen manner. This has an impact on the usability and effectiveness of

any theories applied as their usefulness may only be proved when eventually placed within a methodological framework (Bjork & Ottosson, 2007, p. 196). To this end, the study devised a research methodology that emerged as the research context and relevant phenomena became clearer and led to the design and development of a card tool, tailored to the study's specific needs.

7.5.3 **Pytheas tool**

The use of 'Pytheas' is not without difficulties. The maps that are built may become complex and making a judgement of what connections of interrelationships really matter can be a daunting task. In contrast, the maps can also be too simplistic at times in their final outcome. So far, two main reasons have been identified that affect the successful utilisation of 'Pytheas'.

First, 'Pytheas' has been designed to primarily assist the researcher to conduct qualitative interviews in a short period of time and not to be a means to an end. While the mapping exercise is a relatively easy task, it still requires a disciplined researcher to effectively orchestrate the process in order to avoid ending up with both messy and poor understandings of a situation and make potential implications more difficult to see clearly.

Second, while the use of the different activity categories and definitions of functional positions are one way to prevent this problem, in reality, these definitions where found to vary amongst different organisations, even within the same industry (manufacturing). For instance, early versions of the card tool included 21 key organisational roles but during its application for the case study research, there were 21 new roles emerging through the process (Appendix 20).

A way to tackle this issue is to avoid relying solely on the visual outcome but to be knowledgeable as to what it is that the investigation attempts to 'surface' and provoke it through effective probing techniques. Yet, this might be a challenging task if no prior experience of the context in which the tool is applied exists. For instance, in this study, prior experience with the industry and manufacturing SMEs was thought to be vital, especially with regard to the first visit in which a potential company's owner (or key manager) was to decide whether to participate further with the study or not. Hence, it

was decided that during the first visits to a new company the researcher was accompanied by one member of the supervision team who had a long experience and expert knowledge consulting similar organisations and practices. In doing so, the researcher was immersed in an experience-based learning process which allowed expertise to build up through an 'novice to expert' model (J. S. Brown & Duguid, 1991).

A significant strength of the Pytheas card technique is that it helps to holistically cover a wide range of topics surrounding social practices and organisational activities. However, the way it was used in the study did not allow the investigation of individual phenomena in great depth. This may be achieved only if it is used specifically with this aim in mind. Hence, the contents may be perceived as incoherent to an expert's view in any of the areas explored. Furthermore, although the study strived to develop an effective and robust tool, its state had purposefully remained at a prototype condition in order to allow flexibility in its application in different contexts. For example, the use of blank cards for editing purposes during case study research, enabled the tool to be relatively adaptive to the specific context that was employed and avoid possible critique for errors of omission (Moultrie et al., 2007). Finally, whilst it is likely to receive fair criticisms, the depth and content of Pytheas as a research tool was adequately consistent with the needs of the study; to surface 'obscured' patterns of innovation practices in manufacturing SMEs in a form that provides a playful, non-threatening and relatively fast way to data collection.

Ultimately, the Pytheas card tool was applied in five SMEs (one of which was a pilot case – see also 7.5.5 about choice on sample size), which was felt to be sufficient to corroborate the effectiveness of the research approach and its potential usefulness. Additional case studies may have been beneficial, yet it is expected that in this case the findings would have not pointed to more fundamental concerns.

Finally, the Pytheas card tool was designed to be specifically applied in Small and Medium-sized companies, which are typically actively involved with the design and development of products, services or systems. During its application, it raised questions as to whether the tool was capable of being applied in different contexts and types of organisations.

Yet, Pytheas has been designed in such a way that allows it to be revised based on the characteristics (functions or roles) of the organisation in question. What ultimately changes is the type of questions and responses of the individuals constituting a given

organisation. Although it was out of the scope of the study, one limitation can be said to be the lack of adequate time to first, develop a more standardised tool and second, to apply it in different contexts in order to validate its generalizability. However, the tool's ability to be applied to different business contexts has been partly achieved in professional design practice outside the scope of this study (see section 7.6.2).

7.5.4 Usefulness of the mapping representations

On their own, the visual maps produced by the Pytheas card tool reveal very little, yet they can be powerful when the researcher probes and respondents reflect through them. Generating visual cues in order to enable reflective discussions was the main goal of the mapping exercise. Enabling the reflective discussions, however, is a much more complex and slower process, which ultimately affects the overall duration of the mapping session. Whilst the tool is an effective way to extract rich data in a relatively short amount of time (around 30 minutes per person), there were cases where mapping interviews were a lot more lengthy (60 minutes). Overall, the time it takes to complete a single mapping exercise varies and depends on two issues; i) the time allowed by the organisation and, ii) the actual engagement/interest of the participant. Time constrains posed by the organisation has a negative impact mainly for the researcher as it places extra pressure and effort which can result in limiting the depth of the questions being asked. Similarly, the participant's engagement with the mapping exercise influences dramatically the duration of each session. In cases where strong engagement occurred, the overall duration usually prolonged exponentially as deeper reflection took place and richer data was recorded. In contrast, case respondents with lower engagement with the interviewing session, reflected considerably far less 'revealing' data.

The value of visualising processes and activities has been well documented in industry and academic literature and it is recognised as one of the key virtues of designers (see e.g. Stevens, 2009). However, the post-processing and visualisation of the interviews of the SME members' personal realities were only conceptually conceived by the researcher to report the data back to the companies prior to any critical analysis. The schematics were not designed with an ideal format in mind, neither was the scope of the study to test their actual effectiveness. This point is further addressed in potential future work on the tool in section 7.6.3.

Finally, the study acknowledges that the interpretation of the collected conversations was crucial and had to be done with great care to not be affected by the researcher's personal viewpoint. According to Miles & Huberman (1994, p. 8) "if researchers use few pre-established instruments, it will be difficult to separate out "external" information from what they themselves have contributed when decoding and encoding the words of their informants". One way this study sought to deal with this issue was to make use of video/voice recording tools during interviews in order to generate a more accurate understanding of the collected data.

7.5.5 **Sample size and choice**

The study initiated a total of ten (10) visits to chosen SMEs based on the criteria presented in section 4.1. These visits concern the particular stage in the research process, where the study invited various companies to participate. In most cases, the first visit involved an in-depth unstructured interview with the owner or another key member of the organisation followed by the use of the Pytheas card tool. It was during these visits that decisions were made, either by the researcher or the company representative, about whether to proceed further with the study or not.

Eventually, from the 10 organisation visits, only half of them agreed to progress further with the study. Certain efforts were made in order to obtain the best possible insights about the reasons why these companies decided not to participate further in the study. The reasons for withdrawing varied depending on the specific situation. For instance, at the very early phases of looking for potential companies, a visit was made at software developer SME, which the study eventually abandoned as it did not meet the final case study criteria. In two other cases (Manufacturing Service and Lighting Manufacturing companies), the CEOs decided not to proceed further because the benefits were unclear at the early stages and feared that the study would disrupt valuable time from their staff. In yet another case (Horticulture Manufacturing), the study decided not to continue further after the first visit for reasons relating to the difficulties of communication with the company (the CEO could not be reached after numerous attempts by email and phone) as well as because questions were raised in terms of appropriateness of the company to the study's goals. Finally, one case (Filtrating manufacturing company) was found after the first visit to be a considerably larger size than the study's criteria.

Because the sample size was relatively small, it means that the study cannot make gross generalisations about all SMEs. Yet, this is not necessarily a faulty approach of this study; rather it reflects the extent to which the companies chose to take part in the study and the interest in the approach both the participants and the researcher had about it. Table 6 in section 4.1 lists the total number of case studies, distinguishing the completed cases via different colours in their 'status' (green for completed and red for failed).

7.6 *Further Work and Recommendations*

Typical to most research, there are a number of questions left uncovered and several new ones raised by this study. Therefore, further work necessary to address these might be achieved by:

- *Returning to the cases studied in order to feedback key insights and validate them, revisit the areas where these insights originally manifested, identify potential changes/improvements that may have been put in place and examine different business processes of value.*
- *Exploring other types of organisations such as different size, different industries (e.g. service based, not-for-profit) and different maturity level (e.g. start-ups) or different geographical locations.*
- *Investigating a broader sample through the Pytheas card tool to validate its usefulness and develop it into a standardised service tool for application in industry.*
- *Adopting longitudinal and action research methodologies.*

7.6.1 Return to the cases studied

With the deep understanding gained from the analysis and comparison of the four manufacturing SMEs, there are several benefits that could derive from revisiting them.

Feedback insights and validate them

All four SMEs expressed their interest in the initial findings of this study as were depicted by the visual schematics reported back to them. The maps allowed them to review and reflect in both personal and collective manner their roles, relationships and activities within their organisation. These maps, including schematics of the NPD processes could be further validated and initiate further discussions/reflections, develop useful perspectives and generate potential insights from comparisons to other firms' practices that could eventually lead to their own practice improvements. Most importantly, feedback of key insights derived from the analysis and comparison of the data could serve as a reward to their willingness to invest their invaluable time to participate in this study.

Revisit areas of interest

One of the main findings of the case studies is that the organisations' practices demonstrated examples of 'obscure innovation' and lack of awareness of both innovative outcomes and the members involved in the 'making' process. It is reasonable to suggest that a natural next step would be to explore this phenomenon further in order to bring more clarity to the reasons that lie behind this. While the purpose of this study was not to intervene or suggest best practice, it is worth considering the possibility of revisiting these companies with a view to provide specific recommendations and possible improvements to their practices.

Identify changes

At the time of conduct, all four cases were found to undergo several changes and transformations to their practices. Therefore, it would be useful to revisit each case in order to examine potential changes to their internal and external practices.

Examine different processes

The study particularly focused on the activities and practices in relation to the NPD process, albeit other processes were also recoded (e.g. IP strategy making, managing supplier relationships, HR and training practices, customer services) but not examined in much detail. It would be interesting to apply the study's approach to different business processes that are less understood but could equally prove critical to the organisations' agility and innovation potential.

7.6.2 A broader sample: Explore other types of organisations

A fundamental goal for research is to create generalizable knowledge; however research with large samples is often very difficult to accomplish in practice as it runs into practical, financial, and personal problems (Cobbenhagen, 2000). The choice of Glazing, Brushware, Pharma and BoPro were selected based on their size (SME), their involvement with the creation of tangible outcomes (i.e. manufacturers) and their willingness to participate with the study. Moreover, the study deliberately chose SMEs with diverse business practices, business models and product portfolios to explore how the phenomena in question manifest across such companies. Of particular interest to the study, it also consisted of the fact that all four SMEs manufactured their products/systems in the UK and had to make them relevant in the market through design and agility.

However, the study could have equally focused on organisations of different size, industry, maturity level or geographical location. The benefit from moving to different types of organisations is twofold. First, it might provide further validation of the usefulness of the multilevel, integrated approach to the study of specific cases. Of course, it is possible that the insights gained from variations between organisations could result in different versions and the necessity for different approaches to study specific organisational practices. Second, it could perhaps demonstrate the study's relevance within the new organisational forms and business models in emerging markets (such as creative start-ups, software and application developers for smartphones, financial services and so on) that are currently at the centre of attention for their potential impact to economic growth.

Recently, the tool was applied in two different organisational contexts during professional design practice, one of which concerned a multinational large pharmaceutical organisation. In this particular design research project, the tool was applied as a method to map and visualise the practices of diverse scientists who had recently formed a new innovation team. In order to meet the project's needs, the tool had to undergo a number of revisions in both its design and approach. The former concerned a change in the job roles printed on each card in order to create familiarity with the functions relevant to the specific industry and which were very different from the manufacturing sector. Similarly, as the project had different goals from this study, the approach adopted a number of different probing questions in order to collect relevant data. Nevertheless, the Pytheas card tool retained its core process-mapping technique throughout the project, which ultimately maintains its adaptability and resilience across different organisational contexts and project requirements, as tested to-date.

7.6.3 Improvement of the tool to accustom different contexts

The present study combined elements of design research and qualitative practice-based research methodologies, which resulted in the development of a process-mapping card tool that aimed to explicate and visualise 'obscure' elements in the innovation practice of organisations. Perhaps a more action-orientated, participative approach would allow the researcher to actively participate and observe the practices and therefore record and analyse phenomena at a greater depth. Doing so, would allow the improvement of the practices in question through the application of the tool on a regular basis, whereas knowledge and insights would be occurring inductively through the process of application and refinement (Moultrie et al., 2007).

The tool was developed specifically for the investigation of NPD practices and therefore it was designed with this need in mind. However, the implications of this study provided rich insights of business-wide phenomena that pertained across the whole organisation. A personal interest and ambition would be to look at future work across a broader basis of the method's and tool's application in organisational contexts.

Therefore, further development of the tool could potentially broaden its applicability to different contexts and processes by incorporating elements from contemporary design research techniques such as customer journeys, service blueprints and user personas (e.g. Tassi, 2009 [Online]). Other potential applications of the tool could be

about exploring opportunities space by drawing on groups of peoples' profiles and cross-collaborations between 'people with similar open mindsets and/or 'people you want to support/reward'.

7.6.4 Changes to the methodological perspective

As noted, the study collected insights from real world cases using a retrospective approach, that is, the events and phenomena took place in the past and were based on the accounts of the respondents' memories. New research should aim towards longitudinal and participatory action research methods in order to address the fact that practices, goals, strategies, plans, tools, change constantly [and are] evidently time-bound (Cobbenhagen, 2000). A more evaluative study could be carried out in order to identify any changes in the practice within a longitudinal period of time as more attention can be devoted to innovation processes in this way.

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Appendix.

LIST OF APPENDICES

Appendix 1.
Pilot Case Study Report

About Mobility Ltd.

Number of Interviewees: 4

- Calvin – CEO / Managing Director (CEO) (In-depth & 'Pytheas'),
- John - Operations Manager (OP) ('Pytheas'),
- Kevin - Development Manager (DM) ('Pytheas')
- Breen - Tech Sales (TS) ('Pytheas')

Mobility Ltd. is a small privately-owned electronics manufacturing company which specialises in the design, manufacture and distribution of equipment for visual and hearing impaired people. The company has been developing new products based on existing technology, by applying them in new ways so as to be more user-friendly and inclusive to less able-bodied users. At the time of the study, Mobility employed 14 staff in total. The company's senior management team consisted of the CEO/MD, an Operations Manager, a Development Manager, a Sales Manager and a Finance Manager. The rest of the staff consisted of a Technical Sales officer, the Shop-floor operatives, a Technician and two Administrative Assistants.

Getting to know Mobility Ltd

The opportunity to meet Mobility was presented after the company had been in contact with the Centre for Design Research (CfDR), Northumbria University regarding possible opportunities for future collaboration between the company and the University. This study was introduced to Mobility via an email sent from the CfDR's Design Manager to Mobility's owner-manager, Calvin. An invitation was sent to the researcher to attend a future meeting between CFDR's Manager and Calvin at the company's offices. Eventually, the meeting involved Calvin, the CfDR's Manager, the researcher and a member of his supervision team*. The discussion during the first meeting primarily scanned potential opportunities for collaboration between Northumbria University and Mobility and although it was not driven by the needs of this study, helped the researcher to construct a general outlook of the company's practices. The explanation of the study was eventually introduced towards the end of the session along with a brief description of its importance and relevance to Mobility.

A follow-up email with relevant information attached, was sent in order to provide a further description of the study, including the research process guide and a list of the suggested benefits from participating in the study. This was followed by an informal conversation with Mobility's CEO, Calvin, where he agreed to participate in the study. A new meeting was agreed for the purpose of conducting an in-depth interview with Calvin about Mobility's innovation practices.

Since the study was well in its early stages of data collection, it was pointed out to Calvin that Mobility was a pilot case study on which research techniques would be tested. The study was organised in 2 phases; the first phase was about gathering both general and in-depth information about Mobility's innovation practices from the point of view of the company's owner. In addition, one goal of the interview was to identify other the key members of the organisation to conduct new interviews with them. The second phase was a follow-up study, which involved semi-structured interviews with the identified key members. During the interview with Calvin, it was mentioned that the second-phase interviews would adopt a totally different approach as a new technique was being developed. Eventually, the proposed research

process was agreed by Calvin and initiated Phase 1, which involved two subsequent visits to the company's offices.

Interview with Calvin, Mobility's owner-manager

For the first in-depth interview with Mobility's CEO, Calvin, the study reviewed and revised a number of questionnaires that had been previously employed by relevant studies reviewed in Chapter 2. This draft questionnaire became a set of 30 questions in total, divided into 3 parts:

i. Information about the company (13 questions),
ii. Information about the company's performance (1 question), and
iii. Information about management of New Product Development (14 questions).

Part I: Information about the company

The first part was concerned with gathering insights about general characteristics and espoused beliefs and values of the organisation, as seen in the eyes of the company's owner. During this phase the study was able to collect general information such as the size, type, sector, product lines, and market segmentation of the organisation. In particular, during the discussion about market segmentation Calvin highlighted an important characteristic of the organisation as it revealed not only 'what' was its market but also 'who' were the company's external resources;

> *"We deal with all government local authorities throughout the UK, which is over 200 separate councils. We also deal with private individuals directly. We do some exports, we do some trade selling and in fact we sell to anybody. But, the majority of our business (about 80%) is to local authorities."*

The discussion then moved towards the organisational structure, the various functions and the people involved in NPD. Along with the verbal description of the way the company is organised through its functions, Calvin also provided the research team with a copy of the company's formal organisational chart.

Part I concluded with a question about the role that design plays in the organisation as well as how design practice is perceived by Calvin himself. For this reason, Calvin was asked to choose one of four statements that best described the activities of the organisation;

- *'Our main activities are related to design' (e.g. design, design promotion, design support, design policy, design education, design consulting, etc. whereof innovation may be one aspect)*
- *'Our main activities are related to innovation' (e.g. innovation promotion, innovation support, innovation policy, innovation management consulting, etc. whereof design may be one aspect)*
- *Both statements are equally true*
- *Neither statement is true*

Interestingly, Calvin's response was that 'Neither statement is true'. He argued that while the company generally did those things, the design function had been the

responsibility of only one employee. Furthermore, he claimed that the company was not actually innovating because the technologies applied to their products were based on existing ones. Calvin then explained that due to the demands of the market they are operating in, it would have been unrealistic to have both state of the art innovation (technology) and sustain the prices involved with this. According to Calvin, the organisation operated within a mature market and focused at applying existing technologies to the needs of less able-bodied people such as the hearing impaired. Nonetheless, Calvin noted that he considered design to be an important function, while he defined it as;

> *"…the whole product, it's not just the electronics, it's the ergonomics, the packaging, it's the whole product, even the product name as well. It encompasses everything."*

According to him, Mobility struggled to integrate a better use of design in his business due to the lack of time resources accompanying the company's small size. Mobility focused particularly on the design and development of electronic components as this was the organisation's key competence and it was a practice done in-house. However, they would often consult external design agents for the development of both ergonomic and packaging designs, which were seen as enclosures to the developed electronic design.

Part ii: Company Performance

The second part was about rating the company's performance on a scale 1 to 5, based on the turnover, turnover growth, profit, profit growth and export – all of them against competing organisations. However, Calvin suggested that information about competition was scarce and therefore he did not know how well or bad they were doing. He also described Mobility's condition as rather static in the last 3 years in terms of profits, with a small amount of turnover and turnover growth.

Part iii: Management of New Product Development

The third and final part of the interview explicitly focused on the management of the NPD process and attempted to extract insights about how the organisation usually goes about it. The information sought during this phase was most valuable for the purposes of this study because of the high-level of reflective engagement by Calvin. The discussion around the creation of new products led to a number of key insights such as; the ways practice was organised within Mobility, where the ideas for new products were coming from, the different stages and the people involved during the design and development process, as well as the attitudes and issues experienced along the way. These insights are organised hereafter according to the NPD process model devised in chapter 2.

Initiation period: Close involvement with end-users sparkle new ideas and NPD.

According to Calvin, new product ideas would normally initiate from his personal actions and involvement in the marketplace. Calvin spent much time with elderly people listening to their problems and what they have to cope with in relation to various everyday tasks. Insights gained from this activity would turn into ideas of how to improve them. Calvin kept a large list of contacts ranging from local authorities, charities, deaf clubs, and various other user groups. In addition, he is personally doing product demonstrations as well as providing product training to

end-users. The close proximity with the end-users allowed Mobility to develop an iterative design process through which products were being tested and evaluated by them (Development period). Their feedback was crucial for the transition of a new product idea into the Development and Implementation periods.

Generally, Calvin described two central approaches to initiating NPD:

i. Externally – Mostly reactively by talking to the customers and responding to "can you do something like this" type of enquiries and,
ii. Internally – both reactively and proactively based on improving or making a cheaper version of an existing product in the market (production cost and market price-wise).

In both instances, the design process focuses on incremental / improvement product development. Essentially, Mobility was trying to get a technologically 'complicated' product down to its simplest function and, in doing so, to remove the technology learning barrier that senior citizens often struggle to cope with;

> *"A lot of elderly people would love to use a mobile phone but they can't because they are too complicated. So we take a complicated product and make it simple for them"* Calvin, CEO

Therefore, the idea was that simple things could improve user experience by removing unnecessary features, improving screen readability, having extra volume and make a mobile phone more accessible to older people.

Furthermore, Mobility was looking at specific markets and questions existing everyday activities, based on the needs of its end-users' needs. For instance, questions posed by the company ranged from; 'how do the hearing impaired people listen to a doorbell?' to; 'how can listening to television coupled with new services such as satellite, broadband and so forth be achieved in a more efficient manner?'. As Calvin further added *"… it's all about application, it's thinking about those things".*

Development period: new members' integration to the process, prototyping and outsourcing product design

The next phase following the identification of a product opportunity is about involving more staff in the process. Occasionally, Calvin would maintain informal discussions with his Management team (e.g. Kevin (DM) and/or one of his Sales team) concerning Calvin's product idea and asking whether they may have had a similar demand from their market sources.

Kevin (DM) deals with the technical side of the new idea i.e.; design an electronic circuit appropriate for the particular function. At this period, the company would be looking at their own technical capabilities for designing an electronic solution and decide whether to progress further with the new idea or not. Only after Calvin and Kevin decide it meets their technical capacity would the company begin dealing with the design of the product's 'enclosure'. In other words, a great deal of the product design was perceived as the final touch of the new idea – as just an ergonomic enclosure that merely fits the electronic components within it. The actual design of the enclosure would be either done internally or externally, depending on the level of sophistication and costs that the company desires to spend for the final product.

Prototyping is an important activity for Mobility and mainly involves the design and fitting of the electronics into an enclosure. Yet, prototyping is normally done through SLA models, which are ordered externally from specialised companies. The prototypes would then be tested and taken to the potential customer for evaluation. If the customer is satisfied with the result, the product development progresses to the final production (implementation) phase.

Implementation period: price factors determine manufacturing location, project management issues due to lack of structures and the role of external support

The actual manufacturing of a new product is either done within the UK or sent to the Far East (e.g. China), depending solely on price factors for the injection moulding tool. At this point Calvin would consult John (OP), who is responsible for ordering products, parts, and talking to the suppliers of the various components. As mentioned earlier, the production line does not start until the first working samples have been tested and evaluated (often more than one time) to make sure the product works as intended.

Meeting the set time targets during the development and production process has been a struggle for the organisation in the past. Calvin has personally attended several regional training courses on how to improve the process, yet he was struggling to implement new practices because of the lack of financial, time and human resources;

> *"It doesn't matter, you can take all the advice you want from hindsight, but you have to come here and implement them and if you are an engineer you have also other jobs to do and time goes out the window. If something goes wrong with the piece of production machinery, then one person has to look after that as well."* Calvin, CEO

Calvin also noted that the company had realised its need to grow, otherwise the company risked its existence. Improving Mobility's NPD management by adding more structure to the process is typical advice for SMEs. However, adding structure to the existing ad-hoc process through standardised tools such as Stage-Gate was seen as a threat to the company's flexibility and acts as an undesirable bureaucratic mechanism;

> *"Things like this are good for the big companies where you need to tell a lot of people the same thing, in a small company you don't because very often you go and talk to somebody and you cover the subject* [with] enough people that need *to know."*

Appendix 2.
Sample of Interview Questionnaire Used in Pilot Case Study

Interview Questionnaire for Pilot Case Study

Part 1. Company Info (relevant characteristics of the firm**):**

1) *Name of organisation:*

2) *What kind of organisation do you represent? If more than one category applies, choose the most characteristic one.*

3) *What sector are you in?*

4) *What is your market segmentation?*

5) *What are your product lines?*

6) *Please indicate the number of staff employed.*

7) *Please describe/map your product development team structure and key cross-functional team collaborations.*

8) **In general, which statement best describes the activities of your organisation?*
   - *'Our main activities are related to design' (e.g. design, design promotion, design support, design policy, design education, design consulting, etc. whereof innovation may be one aspect)*
   - *'Our main activities are related to innovation' (e.g. innovation promotion, innovation support, innovation policy, innovation management consulting, etc. Where of design may be one aspect)*
   - *Both statements are equally true*
   - *Neither statement is true*

9) *Do you consider design to be important?*

10) *People associate design with different things. What is the first thing that comes to your mind when you hear the word 'design'?*

11) *Which are the most serious barriers to the better use of design in your company, if any?*

12) *Have you ever employed professional design consultation in your company?*

13) *What are the reasons for use or non-use of professional design expertise?*

14) *(If employed) What are the tasks being/been performed by professional design staff in the NPD process?*

Part 2. Company Performance:

Could you please rate your firm's performance over the last three years against competing firms? 1 to 5

- *Turnover*
- *Turnover Growth*
- *Profit*
- *Profit Growth*
- *Export*

Part 3. Management of NPD

1. *In the past three years, the products created by your firm were in general similar to designs already put on the market by competitors or original in the sense of being truly different from designs developed at an earlier date by competitors?*

2. *Please briefly describe the stages of a typical new product development process from initial concept to final production.*

3. *What factors might trigger the identification of an opportunity for a new product?*

4. *Are you familiar with the results from major academic studies?*

External influences e.g. shifts in legislation, regulations, new materials, technology and global trends influence the direction and flow of a design process.

- *How is this data gathered and fed into the process?*

Information flows and dependencies

- *How is knowledge captured and shared among individuals, teams and departments?*

Testing and iterating – the design process is a series of stages where the testing of ideas occurs. Lessons learned, and new evidence and challenges impact on the process direction.

- *How does this level of insight influence the dynamic of a process? How are key changes communicated to those involved?*

Touch points

- *Where do those involved in the process come into contact directly or indirectly with the market?*

Research - involving the user in the process has been defined as one of the key triggers for creativity.

- *How are the needs of end users identified and fed through the process?*

Tools and Methods:

- *Do you use any kind of NPD tools? If yes what are the NPD tools that are commonly used in your company?*

- *What are the benefits and shortcomings of these NPD tools?*
- *What characteristics of a NPD tool affect your choice of usage?*
- *What other factors affect your choice of NPD tools?*

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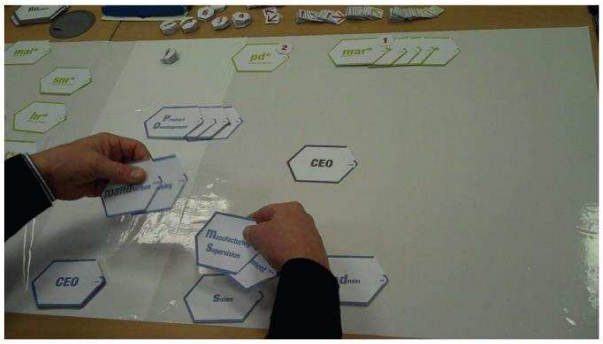
Appendix 3.
Pytheas Card Tool
Trial at Mobility Ltd.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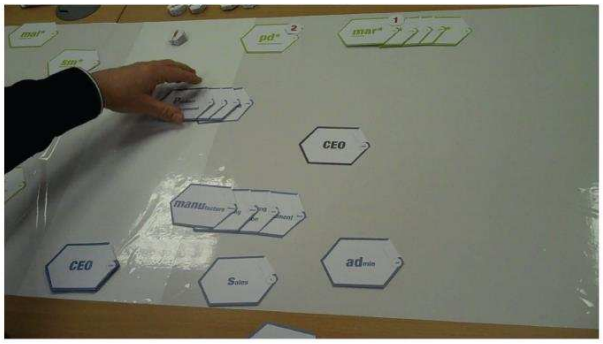
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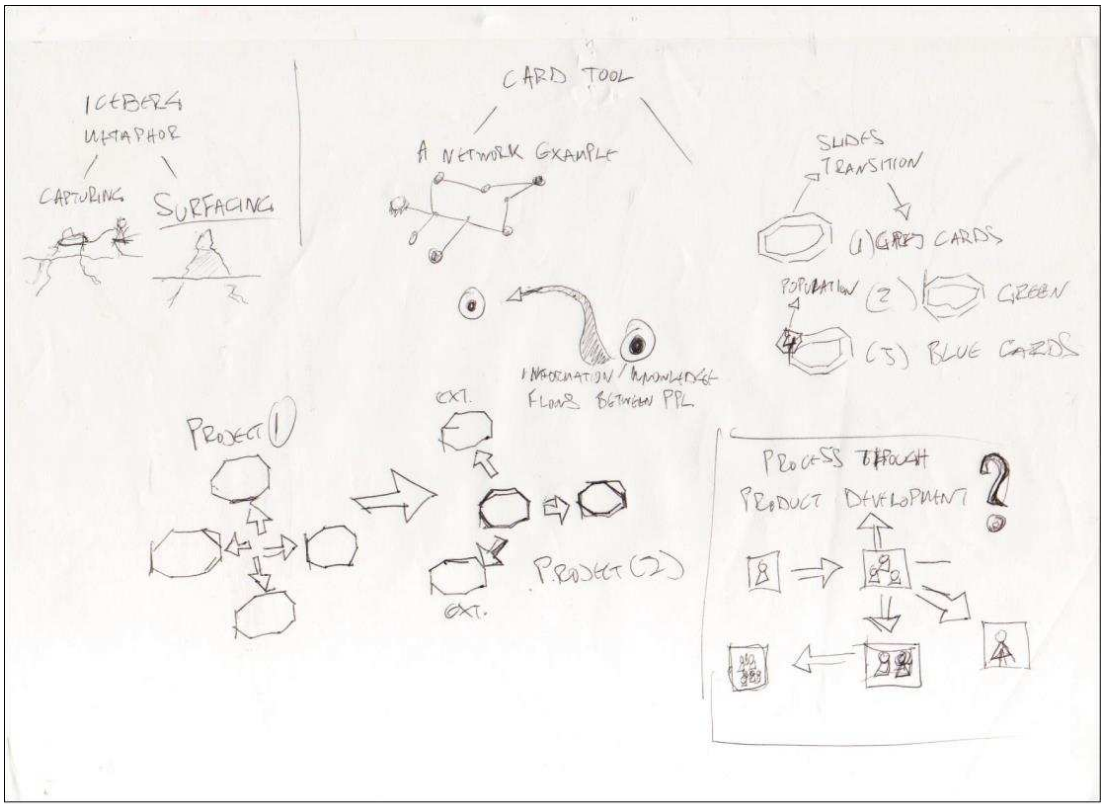
Appendix 4.
Pytheas Early
Sketches and Designs


ICEBERG
METAPHOR
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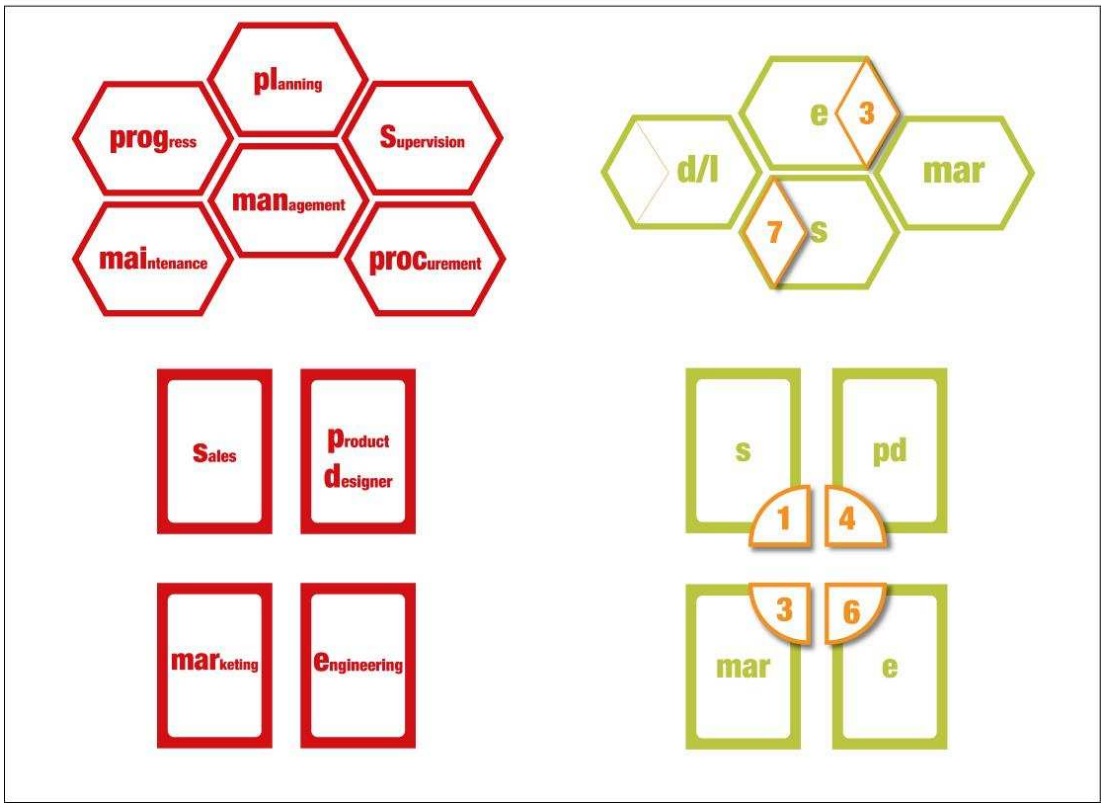
A NETWORK EXAMPLE
SLIDES
TRANSITION
(1) GREY CARDS
POPULATION (2) GREEN
(3) BLUE CARDS
INFORMATION / KNOWLEDGE
FLOWS BETWEEN PPL
PROJECT (1)
EXT.
PROJECT (2)
EXT.
PROCESS THROUGH
PRODUCT DEVELOPMENT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Appendix 5.
Meeting with University Business Expert about Pytheas

Meeting about the card tool with P.W. – Business School, Northumbria University 18-11-09

-

Attendees: Emmanouil Chatzakis and Neil Smith (Supervisor)

Topic of discussion:

i) Introduction to research undertaken by EC
ii) Introduction to the card tool methodology for future case study research.

On the 18th of November 2009, a meeting/interview with PW from the Business School, Northumbria University, was conducted by PhD candidate EC and 2nd supervisor NS. Having a conversational nature, the aim of this interview was to briefly discuss about the research undertaken by EC and further, to gain more insights and advices by an industry expert, upon the applicability of the card tool methodology and the handbook to it, developed for future case study research.

Overall, PW's feedback was extremely positive for both the areas of investigation during EC's PhD and the value of using the presented card tool as a methodology for semi-structured interviews during case study research. A number of suggestions were made, regarding both the use of the tool and the information/design of the current handbook. Points to take into consideration regarding the information/design of the current handbook mainly focused to its attractiveness in relation to the industry. It was mentioned that the current guides are confusing, threatening and challenging due to its layout and information included to the introduction. It was advised that the information should begin through a set of statements such us "would you like to learn how...?" in a way that almost forces a reader to say 'yes, I would like to know'.

Furthermore, issues by PW mainly focused upon the immediate next stages following the use of the card tool, that is how the data gathered will be analysed, evaluated and reported back. EC responded that at this phase is still under consideration and not decided yet. It was further commented by EC that

> *"The aim is to try and see if there's any sort of patterns that emerge… if we set up a hypothesis , we would be looking for similarity and difference, and different sizes of organizations… what we would be looking to do is to pick out then hopefully some of those businesses that appear to fit a model of similarity, and maybe start to analyze those more... and maybe looking what they've got in their product or service catalogue or whatever their business is about...And so we probably go to a second stage, where we use this to get a* ***cloud of data...*** *the analysis of that data we're not sure how we interpret it yet, not because we can't do it statistically, but because there may be a better way of mapping out and thinking about what is it...*

because we are trying to look at the way people co-create and how they do or don't co-create.. So what we are hoping for is that we start to see some identifies, and then we got to think about pulling more complex mapping and more interrogative inquiry into these businesses."

PW commented to this view by suggesting that ;

"This could be for me followed up and looking upon particular individuals 'this was your map'. I think for a PhD we have to being to explore why you're seeing it this way, why are those gaps over here, here is a risk there... but I think this playful (card tool), it is not risky, I do not feel I'm disclosing too much with this... I can keep a lot of thoughts to myself, it's very quick to use and I can imagine myself doing this in minutes...but I'm not disclosing much of myself, it feels no risky and that's what I like about this."

Meeting highlights:

"It is a diagnostic tool, **looking at relationships in a company, who we have relationships with and how strong are those.** "

How to get to the organization? How to attract them? What is it for them?

- *Current handbook to the card tool is quite confusing, and threatening and challenging.*
- *The right set of statements should be: '**Would you like to know how your designers work together?' , ' Would you like a tool for analysing relationships in your organization?' , 'would you like to know how your people network in your organization'? ...almost forcing them to say yes to those questions in a way of saying 'yes I would like to know how we...!'.***
- *"I'm really interested in this, and it will only take me 10 minutes!". And maybe you could run it all here (at the University) and get them out of the organization.*
- *What we are really keen is to do it with companies that have made their first enquiry at the University.*
- *If we build an expectation we overbuild something in the end of it... then we could spoil potential future collaboration or development to that, as if we trying to tell them too much. So **it is about managing expectation.***
- ***Following the package sent to an organization (**this is what we are trying to do, a little bit background of the project space and then something that*

describes a methodology and the 'would you like to know' statements), needs to be followed up is by the researcher making a personal visit to each company prior to anything happening.

- *It is about data collection methodologies.. it is how we start to create more interrogative analysis.*

- ***What** we are interested in **is the immediate impact**, who do I work with, who I am managing my day with alone*

How to evaluate/analyse the data collected by the card tool?

EC/NS: The analysis of the stuff we ended up with, is something we still thinking one another. The aim is to try and see if there's any sort of patterns that emerge… if we set up a hypothesis , we would be looking for similarity and difference, and different sizes of organizations… what we would be looking to do is to pick out then hopefully some of those businesses that appear to fit a model of similarity, and maybe start to analyze those more... and maybe looking what they've got in their product or service catalogue or whatever their business is about. If they look like they are effective in their business, then it's a case of 'is there any correlation between the way the activities of that business operate, that is integrated' .

And so we probably go to a second stage, where we use this to get a **cloud of data...** the analysis of that data we're not sure how we interpret it yet, not because we can't do it statistically, but because there may be a better way of mapping out and thinking about what is it... because we are trying to look at the way people co-create and how they do or don't co-create..

Are we setting up a model where we know certain businesses are driven from the top-down, therefore the creative push and the developmental push all comes from a key person...or is it a collaborative engaging, co-creation within that organization.. So what we are hoping for is that we start to see some identities, and then we got to think about pulling more complex mapping and more interrogative inquiry into these businesses.

PW: I mean this could be for me followed up and looking upon particular individuals 'this was your map'.. I think for a PhD we have to being able to explore why you're seeing it this way, why are those gaps over here, there is a risk there... but I think this playful, it is not risky, I do not feel I'm disclosing too much with this... I can keep a lot of thoughts to myself, it's very quick to use and I can imagine myself doing this in minutes...but I'm not disclosing much of myself, it feels no risky and **that's what I like about this**.

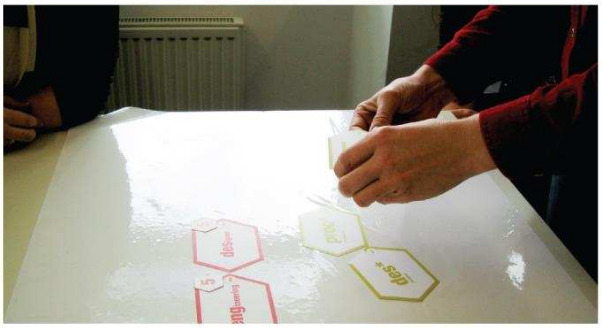
EC: I can report it back to stakeholders and ask whether they want further information to go back there.

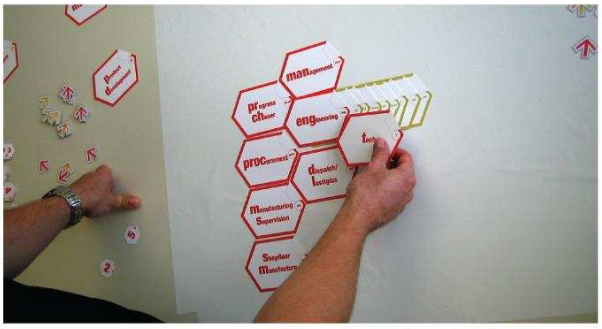
PW: For me that takes out away from the individuals, at this stage... eventually, you may go back and repeat this in an organization, and begin to look into individuals, begin to look at short of scales, begin to look at the whole relationships that people have, but I think if that was 18 months down the line you would build 18 months of trust within that organization and I think the length of the PhD do not allow this, it's not the first step, you give a snapshot how the organization works.

Potential Issues:

- *One issue is "I suppose the fear if I was for example a designer, I would be thinking* ***'who's knowledge is this'****, I've got this tacit knowledge that I actually would like to retain, so there may be a fear within this that sort of says 'hmmm are they trying to soak everything from my mind, my way of working'... There is a debate about organizational knowledge,* ***is it knowledge belongs to the organization or not?*** *I think there is an issue there that you need to think about.*
- ***Also there is an issue of how to report it back without exposing the participants' knowledge (who said what).***
- ***Possible solution:*** *people actually know who co-operates with, it is an information already there that you actually formalise it... I suppose it needs to be a statement that I think it should be coming from the Managing Director or the CEO, who will say this is not about targeting, this will be about looking at maybe what support needs to go into certain individuals who feel for various reasons isolated.*
- *What happens if people decide to opt out? Are we going to allow people to opt out? What safeguards are there for individuals, how will it be reported back and who will be reported back? Another issue is that if I was a participant, I would like you to report it back to me after analysing it ' this is how I've interpreted', that would provide a safeguard.*

Appendix 6.
Pytheas Trial
with University Peers



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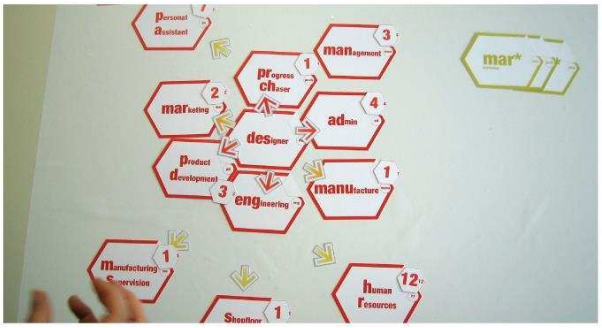
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Appendix 7.
Ethics Approval Form

'Application for Ethical Approval of a Design Project'

School of Design

Title of Project:

Capturing Invisible Wisdom in Design Practice: An exploratory research study of the tacit decision-making within the design process during New Product Development in Small & Medium-sized Enterprises.

1. What are the intended uses of the project if a physical product?

Investigating practices

Who are the intended user group(s)? SMEs

2. Project Leader: Emmanouil Chatzakis

3. Who else will be involved in the project work?

Supervision team

4. Location(s) of project activity: UK

5. Will human participants be involved in using, evaluating or testing a product? Yes

If so what is the nature of that involvement?
Interview based.

What tasks will participants be asked to perform?
Discussions about participants' own practice.

Is any training necessary? No

Will subjects be asked to endure any discomfort either during or as a result of their participation? No

Does participation in the project require subjects/participants to suffer any form of psychological harm, e.g. humiliation, embarrassment? No

6. What particular ethical problems do *you* think there are in the proposed project?

It is possible suggestions related to incremental changes in participant's process or practice to generate stressful reactions.

And what measures will be adopted to protect the participant(s)?

Participants will be informed and asked to agree with the aims of the study, what to expect from it and what is required from them.

7. How will the consent be sought from Participants?

Participants will be informed and asked to agree with the aims of the study, what to expect from it and what is required from them.

Will participants be briefed?

Yes

8. In the case of trials, which involve physiological intervention, e.g. product use, exercise, has the University Solicitor been informed? N/A

9. Payments:
   (a) Will any payments be made to volunteers? No
   (b) Will participant's out-of-pocket expenses be met? No
   (c) Details of financial support for the project including individual or commercial sponsorship.

The project is sponsored for the first year from One North East via Single Programme funding.

10. Anticipated dates of the proposed project:
   (a) Start: April 2009
   (b) Finish: March 2012

11. A summary of the proposed project. (Maximum length 150 words).

This research study aims to gain better insight into the way that the design decisions influence the new product development processes within different organizational settings, structures and motives in SMEs. Initially, it aims to conceptually integrate the "invisible wisdom" in decision-making perspective into the NPD process. Second, it aims to enrich the theory and practice on NPD in SMEs by creating a refinement to current understanding of the opportunities,

risks and challenges of the integration of the "invisible" decision-making concern in NPD. Finally, it aims to provide a better understanding of the dynamics of micro, SMEs, to think more strategically about design methodologies for improving design practices in micro-businesses.

12. Have you read and understood the School of Design Ethics Statement, in relation to this project? YES

13. Have you complied with the Design Ethics Guidelines within the Design Ethics Statement, in relation to this project? YES

Staff Only.

1. Has the applicant completed the above form to your satisfaction? **YES**/NO
2. Is there a threat of unethical change from the proposed process? YES/**NO**
3. Is there a threat of unethical change from the proposed product? YES/**NO**

Signed…….. Date 30.09.09

Dr. Kev Hilton

Dr Erik Bohemia

1 May 2012

Appendix 8.
Sample of Consent Form

Video and Voice Recording Consent Form

You have been invited to take part in a research project recording, which will be dealing with a personal interview regarding your everyday activities within your working routine, with a focus on the product development process and the people you are interacting with during these activities. The interview will be adopting the use of a card-mapping tool that indicates the various organizational positions in which you will be probed to answer questions of 'who', 'when', 'what', 'how' and why' nature. The sessions will be based on your premises, fully video recorded through a camcorder and post-processed for two main purposes: 1) the creation and report of schematic representations of the individual's daily activity routine and the company's informal structure and processes, and 2) the transcription and application of the interview's outcomes for the support of the research project, including the final thesis and possible academic papers on innovation and product development in small organizations. **The outcomes of the interview will remain fully anonymous (coded) and known only to the participant and the researcher unless otherwise stated.**

Please initial all of the following that you consent to:

The video and/or still snapshots and/or audio track can be used in a presentation such as academic and/or professional conferences etc.
Please initial _____

I would prefer to have the opportunity to be debriefed and view and/or listen to the recorded excerpt(s) where my comments have been included in the final production in order to be happy for them to be used.
Please initial _____

Future use and/or edits of any visual recordings (video or still images) used for the purposes of the study should be filtered and/or masked in such a way that the environment, my face or voice will not be recognisable.
Please initial _____

The video and/or audio track can be used as part of the research project described above, with no particular requirements as far as it remains anonymous.
Please initial _____

My individual outcomes (visual map and comments) can be shared internally amongst other organisational members, including the CEO and/or other colleagues who may request so.
Please initial _____

I have read the above description and give my consent for the use of the video recording as indicated above.

_____
Print name

_____ _____
Signature Date

Contact Details: Emmanouil (Manos) Chatzakis (emmanouil.chatzakis@unn.ac.uk)
Telephone number: 07842913495

When complete 1 copy to be kept by the participant, 1 copy for the research file.

Appendix 9.
Sample of Feedback Form

Name: [redacted] **Email:** [redacted]

Background /Training: **Position:** M.D.

- **What do you think worked well about using the card tool?**

  Very clear visual presentation of key areas of communication/interface.

- **What do you think did <u>not</u> work well?**

  N/A

- **Did you find it useful? If so, in what ways?**

  I will use it in discussions with my Management Team to highlight areas of improvement.

- **What was it about the use of cards as an interview method that particularly appealed?**

  Very visual and easy to understand.

- **Do you have any advice on what could be further improved?**

  N/A

- **Is there anything you'd like to mention that you haven't had a chance to write about already?**

  Not sure

(please, use additional documents if necessary)

Appendix 10.
Sample of Glazing
Case Study Interview (1)

Name: CEO

Timespan	Content
0:01.2 - 1:00.0	EC: What is your position? MD: I am the owner, the Manager Director. EC: How long have you been here and how long do you own it? MD: I've been in this company for 8 years and I own it for about 3 1/2.
1:01.1 - 9:30.0	Parallel Activities MD: I get involved on everything, obviously. *Management***:** I've got a structure there, I've got a senior management team that reports to me, and a secondary management team and then the rest sp I set that structure up so I've got now about 7 people reporting directly to me out of 50 that we work here...**that's the way the pyramid works.** *Admin***:** General administration is something I'm heavily involved with, the administration works within the company, intracompany, and outside as well in the way we relate to the outside..just today i tried to change the format of the quotations we use for the customers, we change the focus of it.. *Design***...** EC: Are you an active designer? MD: No, but in terms of what we do, and what the product will look like, I do get involved, yes. *Human Resources*: everybody that joins the company I know who they are and why we've brought them in. *Product development*: Because my background is in Sales and Marketing I'm heavily involved in the front-end of the business, If I have a lean somewhere that would be towards the front-end customer, I call it 'demand creation', and part of the demand creation is the PD...We continually creating new products, there's an example of what we are developing now; one of this is Police cells and Police custodial work, it is a big market for us, we don't have a solution for it so I am driving that, I'm getting customers coming in, I'm getting people coming in to give us advice when we are ready to move into that and part of that is to tell us this is the size of the market, this is what we have to do and now here are the products we need...and this is how I am involved in the Design site to say this is what I think the product needs to look like. ...the problem is being in a small company someone like me you get involved with everything... I've worked for very large organizations as well where the MD's role is more specific, but

	here you tend to do everything. *Planning*: production-We have regular production meetings ii) in terms of the logistical planning, iii) payrol payments, supply payments, any type of planning. *Finance*: the team is directly reporting back to me, at the moment I'm heavily involved because the business is going through a downturn, now is peaking up.... *Manufacturing*: everything we are doing out there in terms of manufacturing I'm involved with the process, the layout of the factory and heavily involved in it as well, because when we changed from the steel production to aluminium that fundamentally changed the layout of the factory and i was involved in all of that. *Production Engineering*; In terms of the tools and machines that we are using, yes i certainly do that because I have to approve all that. - depending on the price of the tooling, if it costs for up to 500£ i do not get involved, if it costs over that then the Production manager will come to me and ask me to get it, if it is a simple one then I will just say get it, if it is a 3k-4k then I will say 'why do you need it?' *Marketing & sales*: My background is in Sales and marketing so I'm 100% involved there. *Dispatch & Logistics*: The Logistics department reports directly to me *Procurement, Tech., IP, Contracts*: All reporting back to me. *Drawing Office*: efficiency is important there and before we were using pen drawing but now we are using computer software, not o nly simple CAD drawings but I get heavily involved in the resourcing of our Design team in the drawing office. It has changed fundamentally the last 8 years and one example is 8 years ago to do the turn over that we do today would have required about 10 people in the Drawing office, today we are doing the same turn over with only 6. It's not that we are working harder, it's just that we are now using computer software and has increased our efficiency. That is a very important part of the business.
9:45.8 - 31:31.4	*Interactions* **MD gives his personal philosophy of the way things should work** Not because of my background in Sales and Marketing but having me as a Manager Director for many years in different companies I fundamentally believe that any MD must be focused towards the front-end of the business... even if the background is finance, even if the background is manufacturing, they must focus on the front-

	end of the business which is the customer and sales and what I call demand creation...I've worked for a substantial American corporation with 30.000 employers and i went to a seminar at Chicago and that's exactly what they said, the room was full with 300 MD's from around the world and they said 'you're all different with different backgrounds, only 30% of you coming from Sales, the rest you have totally different backgrounds, and there is nothing wrong with that...but the problem is the finance people think that I must focus on Finance, IT man thinks I must focus on IT...it is the comfort zone.' What they said is that it's fundamentally wrong because now you've moved into a position where your responsibilities are for the whole business and one thing that affects the business more than anything else is the customer**.** That is an American approach but an approach that i believe as well. And that suits me well because of my background and in every company I have worked i was doing this thing, what I call 'looking out of the window' because I look at the market and then look at the customers…it's market first and customers second and this what I do in this company. This has fundamentally changed this business, totally. To give you an example; when I joined here it was a fire glazing company...all we did was fire glazing and we did that for many many years. But when I went out to the marketplace and visited customers and spent a few weeks looking at things... what the company then said is, what you have to do is spend your time with the departments here, spend time with the design office, spend time with contracts office, spent time in the factory to get to know the business etc. etc.' And i said 'No, I'm going to spend one day to say hello, that's Monday, and Tuesday, Wed, Thurd, Frid, I'm going to be outside because I want to find out what the marketplace is...and I actually did that for about a month, spend one day here, 4 days out. From that I found out that we had a very big fish in a very small pod…which is good and bad. The bad news is that we couldn't really increase our market share because we were already dominant in that marketplace and the worst new was that the pond was getting smaller. And we couldn't do anything about it. So being there for a month and reporting back to the main board directors that the business didn't have a future, which wasn't what they wanted to hear...they said 'No, we've been in this market for the last 10-15 years' and I said 'you will stay in the market probably but you won't be turning over 5-6m£, my forecast is that in the next years it will drop to maybe 1m. You will still be the market leader, but the same big fish with a smaller turnover... .... so as a result of that I said we need to go to other markets urgently, what we make as steel based products, so why we can't use this offering (strong as a steel) and make security glazing, we were using fireglass in which prevents fire, why can't be put to a window to stop an attack? Seemed an obvious thing to do...the company then said 'oh we did this kind of job once and…that was it', i said 'what happened, was it good?', they said 'we don't know, somebody asked us to make it and we did and that's it'...

	2003 - extended to fire and security glazing, focus on what customer wants. 2005 - Factory changes followed due to the need to start manufacturing the cheaper and lighter aluminium instead of the heavier and more expensive steel that were using in the past. That brought further changes to the company, as the aluminium made customers demand for new and different products... Also, working with Aluminium had to push the company to bring in some new equipment, yet it required reduction on the human resources compared to the steel work demand. [EC comment: Chris had to buy the company as he couldn't convince the parent company to make such an investment. They now turn over more aluminium than steel. For MD that little pot of history tells him what an MD's position should be - constantly look at the marketplace, keep asking the marketplace, what the market is doing and secondly what the customers within that market and ask them what's happening and they will tell you etc] EC: It's interesting to see how your personal culture, beliefs etc. affects the directions of the company. MD: Part of my job then is to take Sales and Tech Sales Director and say 'you are focusing on healthcare, so, off you go...and he (Jason) focuses there and chases all the projects in healthcare. And looking at other markets like the police cells etc. At the same time while you're doing all of that, you have to keep all of this going as well (the business)...because the production guys said 'we can't keep up', so we had to invest more in machinery and they said 'look, if we're going to make more of those we're going to need some new kit' and I would think then 'do we need to make more of those, is the market going to ask more of those?'
31:32.4 - 34:43.1	*Mapping session restarts (he looks at it as steps according to priority)* *Marketing*: in terms of the priority, marketing is...I want you to understand that it is not marketing as for literature etc... but it is the Market, the market is number one..and to me Marketing and the market are 2 totally different things...so the market is where I spend most of my time. After that, is a matter of looking at the technical aspect of it... *Tech*: first of all, technical development.. to look at the market and say 'okay, I now understand the market, I know how we're going to tap it... technically, do we have products or systems to supply it? If you don't have that, then that's the end of it, you're going to be looking to another market. Then when we find that we can technically supply the product, then everything comes into place... *Tech Sales*: because then we look at the Technical sales (&Sales) and how we're going to sell it...actually....

	Management: If Marketing is the number 1, and then we see that technically is feasible, then Managing the business would be the next in terms of priority... *Manufacture*: obviously how we manufacture it is important as well. *Procurement*: how we procure the materials for it. *Estimators*: How we will estimate it... *Drawing office*: Finally draw it...drawing the detail of it. *Contracts team*: they will fit it together... *Finance*: and the last one would be Finance. And these are the main headings.
34:43.1 - 48:07.4	*Frequency* (he places the arrows and then EC asked to provide some further information on the 'why?') MD: Fundamentally, because I've set my team up, there's myself and my senior operational manager team to run all of these individual functions for me...and then when that's been set up, the functions that change the most are these (Marketing, PD, Management and Tech sales). The rest don't change very much, certainly not on a daily basis, not even on weekly basis, maybe on a monthly basis. Once you've done what is necessary (e.g. get the software running for the drawing office, or establishing how you run the maintenance, how you manage your team, how we do the training for the contracts team) then it's a case of …doing it. It becomes a lower priority. The hard part is making the product, how it looks, how it functions etc. and that takes a long way... Functions such as Procurement, Estimators etc. are only at some stages involved, and when they're done then that's it.
48:07.4 - 49:47.1	*Quality* MD: None of it is poor. The best communication is between Market – Product Development - Management - Sales because we meet quite regularly, there is a constant interaction and feedback going on - we don't have much of formal meetings because we cannot wait for them to happen in order to work. The rest of them becomes a function of time...because you cannot commit the same amount time to the 4 main departments and do the same with the rest. It's quite hard to say, because there is less communication here, but the quality is very good.

Appendix 11.
Sample of Glazing
Case Study Interview (2)

Name: 3- Technical Manager

Timespan	Content
0:00.0 - 6:45.0	EC: What is your position? TM: Technical Manager EC: How long have you been working here? TM: 2 1/2 years EC: Can you please choose what other activities you are involved with? TM: I guess Technical Manager comes with Management. I also got Design... In some instances I'm involved with Manufacture but...that's mainly because of my versatility of my background... EC: Yes, but are you involved with this activity here? TM: At the moment... No. EC: That's great, however we should keep it strictly on your activities, as your skills are not relevant to this exercise. TM: - Engineering... - What about adding one more there...so... there are standards and things that we have to adhere to...so everything that is Manufactured here must be manufactured to the British Standards here, or at least try to be. So, I am responsible for the upkeep of the British standards and also that they are up to date, they're current... EC: Do you see this as separate activity or as part of a function? TM: It is part of a function…but it's strange, I'm not sure how I would call it by itself. EC: There is no reason to complicate things so it's better we keep it as an extra activity on record. EC: Can you please talk to me a little bit about these activities? TM: As far as the Management is concerned, we are looking at the Management of, not only people, but information as well. So I guess what I said earlier about the British Standards and building regulations etc…that would fall onto that...because it is managing information. Not only that, we have Systems Suppliers, there is information such as manual for products, publication manuals, that sort of stuff.

	And also management of people, I'm overseeing things [the Designer] is doing, she is sort of within my team - as I see it - and she always comes to me first before we go all together to the Director who does all the Management. Design: Obviously, part of my role is R&D and part of R&D is the design process, or designing new products for a new development that has been going through. Product Development: Heavily involved in that, taking into account market driven demand, which we get from the Sales team - people who are out and about visiting architects, clients and main contractors and then putting those forward as a, first of all proposal for a product, seeing the longevity of the product - how long we get, how many sales we get, what sort of return we get... ...And part of that goes to the Engineering, we are looking at how things work, how we can make things work, any processes that we need to look at - not only for us in the Technical Department but also for Production... EC: The manufacturing? TM: Yes, so we are looking on any tooling they might need , any engineering skills they might need to manufacture the potential product driven by R&D.
6:54.3 - 20:07.3	EC: Brilliant. Could you please now choose from the Blue cards the people who you interact with? TM: It would be Technical Sales and the Sales as well - those would be reporting back to us for the market demand. We've got the rest of the Management team. We liaise with all of the Management team to make sure that everyone knows what's going on... Shopfloor Manufacture: any new products that we come to a fruition if you would like, would be an essence of me or [the Designer] and we would go to the shopfloor and oversee the manufacture of the first 2 or 3 ones, checking for any potential faults etc... also help out on other things such as manufacturing difficulties; so if one of the fabrication guys has a problem with the way something is made or they need a special jig or tool, we can go look at that and see if there's any new processes that we can use. EC: Could this also stop you from the development of a new product, in the sense that you get the response of 'we can't do that'? TM: Yes...what looks good on paper not always works out in the workshop, which we discovered in the recent years so...getting samples made, getting the opinion of Shopfloor staff, it all helps.

	Estimators: They will get inquiries in from main contractors, architects... the Estimator might not know if a product that the architect or client asked for is possible. For example, fire aided products, the glass screen of this sort of structure (shows a screen there)..um...you're limited to how big you can procure the glass and test the sizes... EC: Isn't this relating to the manufacturing? TM: Yes and no, because the glass might be manufacture to, say, 2x3 meters, but this particular fire aided glass has only been tested to a size of 1x1.5 meters, therefore you cannot go over that size although it's physically possible to go over this size, it hasn't been tested to allow this size. So therefore you need to supply the product to the tested size, not what the manufacturing size is. So again, we are looking at fire tests reports been carried out by third party companies and looking through again and managing the information, is it feasible, is it possible and ultimately issue a certification for that product will it work. Procurement: To some degree, when we are working on a job through R&D, what we are looking is how cost effective it will be, therefore we go to the Procurement - they are just the next department - and ask them to go out for prices, they check prices from different companies for the same product and see who is the cheapest, but not only that, but who has the best product, the best lead in time, that sort of stuff. Marketing: We work with Marketing, although a fairly new department as it was part of the Sales in the past – [the technical sales director] was part of both Sales and Marketing - now it has been taken from him and [CEO's] wife now looks out the Marketing for us... so any datasheets or brochures that we sent out for our products need to have the correct information in them so the Marketing department will come down to us and ask 'is this correct?'. QA: To some degree we do some QA...that's mainly on the anti-vendings' domain, where he's contracts director, he looks after the QA so he goes through ISO 9001, procedures etc., EC: So how does this relate to your work? TM: It relates in a way that...the ISO 9001 has a certain process that we need to follow and that's when we get audit to Don... so a third party will come and audit our operating systems. EC: How do you find this? TM: Um…I don't have much involvement in it. What I have to do is, again the Management of information, I need to demonstrate that what we make is to a current standard and also any test reports,

	any products we have are all in-date and still available. EC: Do you find this as an unnecessary burden in your workload? TM: No, I think it is important because without that sort of push behind you to get you to do it, I think a lot of other things would fall back and then we would end up with out of date information... it gives us an idea of how the market is changing and what the markets' expectations are... you need to develop a new window for a new environmental specification and we kind of turn around and say 'well, we don't know what those are', so the QA is a good way to keep us up to date. Systems Suppliers: Purely from my point of view, I get technical information from them... they normally have project-specific solutions that are not necessarily given through their brochure or their standard information, so if we have a problem or something unique on site we can approach them, ask them if they've done something similar or done it before, and then normally can give us a project solution. They also give us the training that we require for their systems...so any new product that it relates they will issue us with a system manual and then if needed they will give us some training just to show us how things go together etc. Product Development: It falls under the umbrella of what I do, so new products again going back to Sales and Tech Sales and those guys driven from market needs... but Product Development can come from any other department as well; we've got people from Shopfloor coming through and saying 'we've got a new process, can you see if it is feasible?' or how about 'I've just made this window and I've used this handle...but can I not use this handle and use this instead'? ... so you're getting a constant feedback from other people Admin: What we have is a receptionist, through which we can issue visitor notifications so anybody coming in comes through the reception making you feel good etc etc.
20:07.4 - 27:46.9	EC: Can you please show me the frequency of the interactions? TM: The Estimators tend to have a good insight knowledge of the products we do and what we offer, they have a good technical understanding because they are working on the products everyday so they tend to come to me.... they know everythjing about the product, how much it is going to cost... Dispatch & Procurement is much less because it is very easy to find out i.e. from the internet, this sort of stuff...only if I'm stuck of time I go to the Procurement as they may have access to certain discounts of supplies. System Suppliers: I don't speak to them on a huge amount basis because we've got most of the information to hand ... Marketing: It's only very rare to be called upon technical

	information because what we do with Marketing in the data we sent we only sent minimum of the information which then prompts the client to get in touch to find more about the product and how will it suit their needs. Sales & Tech Sales: We've got more frequency purely because my department is run by these guys and these guys influence what I do... so any new products that they are going out talking to people and new products that they can see potential or feasible to do... Management: Similar with them, we liaise with them on a regular basis, as much as I can to find out what's going on with certain jobs, particularly the drawing office I would imagine as well, they call me as well. Shopfloor Manufacturing: I've got a regular basis but not as much as frequent as the others...they tend to take along quite nicely but we have the odd thing where is my background which was from manufacturing of this particular product for a number of years, my insight into that helps out new processes they might have which I might have tried them in previous projects. Product Development: it's very frequent, it's me QA: It's frequent as about once every 3 months.
27:46.8 - 32:43.2	*Population* Shopfloor Manufacturing: 30 people EC: Do you deal with all of them? TM: I'm talking to pretty much everybody, I need to talk to them to find out if they got a new process and this sort of stuff... people are joining from different companies and we can learn a lot from different people and how they used to do things differently. Admin: 1 Management: 7 Estimators: 3 Dispatch / Procurement: 2 System Supplier: 11(varies) Marketing: 1 Product Development: 1 Sales/ Tech Sales: 2
32:43.2 - 49:04.7	*Quality of communication*

	Shopfloor Manufacture: Communication could be a lot better...I think the guys, particularly the fabricators could do with a bit more product training and a bit more product knowledge... I also think that we don't liaise with the Shopfloor as often with the knowledge of the new products we are developing...that has become apparent. I think that's because they don't see the product development process going through and they can't understand why we've done one thing when it might have been easier for them to do something else. For instance, we used a different type of lock which is difficult to install but the reason we've done that is because that's the only lock that would fit within a section of the specific product...or it may be the fact that this particular lock in that door has been specified purely from the client, he won't accept anything else so we need to make it work. Yes we can make it easier for them but we have our hands tight we must do it. Admin: it's not perfect but it's neat enough, it's simple. Product Development: Because [the Designer] is relatively new in the business in terms of the products that are out there (regional systems supply stuff), still learning processes and small engineering things, so the communication could have been better, so if I say I need a 3.1mm 'something' she might look at me and think it's 'Chinese'. QA: Decent communication, although it could've come sooner, a bit of notice would be nice. Estimators: One of the guys tends not to speak to us. I think that's because he pretty much knows what there is to know, but sometimes you can't get caught out, you just offer things that we can't do or can't certify. Another one...it is difficult to get information from them... I've been to the Estimators' position and I know it is very difficult to get things from your head, what's going through the estimation process, so you are trying to make good pallet points of why things are done the way they are. The Estimator Manager is very difficult to communicate with, tends to go off on a tangent and explain things that don't need to be explained for the particular problem he has or the solution is looking for...quite difficult to understand...so I think it's more of a personal level on those rather that the department. Procurement: Communication is good, in certain ways, the guys themselves good to talk to, they understand products and items but the way we do things here If I wanted to buy a list of items to make something, would have to put together a parts' list, which is basically an excel spreadsheet with the list of the parts, roughly what quantities they come in... although I know it is reasonably to communicate that much of information, the parts list itself it's quite difficult to navigate around so for me, I've been here for 2 and 1/2

	years, and I am still learning how to use these parts list and how to issue them because you have to go through a specific issuing process... It was developed by the Procurement department in the early days and it has become a product that only the Drawing office and the Procurement know how to use. If you were to ask anyone else in this company on how to order things or how things are being ordered no-one would know, I don't know myself either. System Suppliers: Fairly decent communication because they have a good knowledge and I speak to the right people and departments, so I get the answers I need. Marketing: Although it is very new department, communication could be improved upon purely... it's strong to say but some knowledge can't be dangerous….we need to get more understanding on the products into the marketing department for them to understand what not to put in. Tech Sales: Good communication, although not the best, it's not as frequent as it should be as we only get caught on when there is a new product and any requirements...it's good but it could be improved upon...again, probably more inside knowledge, not individually parts but as a whole... what we tend to find because this department here works close with this department here (sales, tech sales - Tech) everything goes on this little area for the product development, and all of the other departments tend to skip around - they know something is going on, they know something's being developed, and it's only when we spit out to the other end that 'tada, this is the product'... so maybe getting other departments involved in the development process, I don't know how... Management: Nothing's perfect...There is a bit of a culture here that if you haven't received an email then you won't going to do anything about it…you'll hear this from a lot of people, there is a culture of a lot of emails...'so have you done this Martin?' -'No... did you send me an email?', -'well you should've done!', that sort of thing. It's people blaming emails rather than... I think we lack of an actual physical communication to use emails and that creates problems. EC: Do you think that is due to the location of where your desk is compared to others, say the management team? TM: No, not at all, this could happen even if a manager is sitting next to me i.e. the Drawing office manager sits just over from me, and next to them is the contracts director, then just around the corner is the commercial director, so there's only the Tech. Sales Director and the Managing Director on the 1st floor... but we also have phones for example for internal communication but sometimes as well is time consuming to write emails...I think speaking to people it would be more effective, which I'm trying to do more. They only downside is the recording of the events. But quite often verbally communication should be just enough.

Appendix 12.
Sample of Brushware
Case Study Interview (1)

Name: 1- Managing Director

Timespan	Content
0:00.0 - 2:44.0	[MD begins with an informal conversation about the company] ....Investing something, as an organization, whether will be some relatively straight forward training or some consultancy or capital spend...new premises, whatever it is. Generally speaking, I can find some organisations within the North East of England that is willing to help us...and I think that's one of the real benefits of working in the North East - because there is a massive amount of business supporting out there. But you've got to understand it, because it is... it is so complex, and it's taking us years and years to figure it all out and we're still not there yet...I'm having a few key contacts within particular organisations, and I speak to other businesses that have contacts within those organisations that are to the same standards as the ones we have so that's...but you've also I guess got to have the desire to go and find it as well - a lot of businesses can't be bothered...um...you know, or they've had a problem in the past, having grants turned down and they've said 'alright, that's it, I'm not going to bother try again'. But I have to say, we did alright (laugh of joy). I've got no complaints there... But it's interesting what you're talking about because as a small business I'm not too concerned about formal structure...of course it's important and i want to make sure that everybody has a clear role, and has the opportunity to develop within the organisation but... the sort of things you're talking about - the informal relationships, the unseen lines of communication, that's what gets things done in our organisation**...**and at the moment we do not have formal product development process...and yet we can still develop products. Now, we have identified that we're not doing it quick enough and we're not doing it well enough, so we're trying to change that at the moment. But we still do it. So, the kind of things you're talking about - DO interest us, and we're going through a business growth plan ourselves at the minute...and we're looking at...trying to...um...almost re-organise our business, but not quite, more along the lines of realigning our business with the needs of our markets and the needs of our customers without damaging anything we've got at the moment...we've got a lot of strengths as a business but there are certain things that we don't want to do so we want to try get those things out of the existing team, if you like, by assigning responsibilities -knowing who's got what, knowing who gets on with who, all that sort of thing.
2:44.1 - 3:43.4	I am interested to have a go (about the card tool) before I can commit for other people in the business. I think I understand what you are doing. EC: In a way, what it offers is also what you would like to do...I'm

	sorry, are you the owner of the business? MD: Um, no, it's a family business, I am one of the shareholders, but the business is entirely owned within my family. EC: What is your role in the organisation, are you a director? Managing director? MD: I am the Managing Director. EC: Great, so to get to my point, this is in a sense something that you might have liked do - sometimes, more than often, some people would like to do this sort of work and identification (of the structure and people) and, perhaps, you think 'oh, I don't have enough time to do it'... MD: aha... EC: and what it also offers is something that you would be doing yourself, and i offer to do this myself instead. Not of course to replace your role, but to offer something that will be of a value to you. EC: I think this is what you were also amazed about [another case], because he was neutral people just opened up 'this I what I do, I don't want to do this...' and then, this is where the reveal was, because it wasn't a formal internal process... We are not looking to find good things or bad things, we are not trying to judge if something is good or not, it doesn't matter at all, [the card exercise] tries to probe questions while someone is reflecting to what he/she experiences in the everyday routine. We try to probe the questions while doing it [the mapping] so we try to get this knowledge you have inside you but no-one ever asked you, so you probably knew it but no-one have asked you 'why or how it happens, how do you do that'...so we're trying to do that and then feedback that back to you and say, alright this is what we see and this is really left to your decision on whether want to change something or anything else...whatever you want to do with the data is entirely up to you...it's really about reporting back what we got.
5:20.2 - 9:49.0	EC: I suppose, I don't know much about ...I obviously know about the industrial product side and the conversations on going with...but could just briefly give us a snapshot of what the sort of constitution of the business is and how much of it moves into retail and how much of it moves into contract... MD: Yeah, absolutely...Well, we see our business as three parts, although we run the business as one...So we have one Sales team, we have one production team. But we think of ourselves as three, I'll try to explain this; we do a large range of products which are

	used to clean and used to paint with. So it's more janitorial type products, sweeping brushes, paint brushes, that sort of thing...and that is I would say just less than half of our business...and that is industrial products which is pretty much all going to end up being used by someone who has paid to use it. So, very very little of what we do ends up available to the public. There is bits and pieces that kind of do end up in sort of smaller decorating things like that but generally speaking the things that we sell are being used by professionals...and we sell that product through distributors...so we've got probably 20 key distributors around the country who they then sell it to the end users. They usually group it together with some other products as well, for a particular market. That's what we are calling our 'cleaning & painting business'. That's what traditionally our business has done for ever. You know, we were set up 158 years ago to provide the sort of janitorial products to heavy industry and that effectively is what we are doing now although it's not the heavy industry, it's much smaller industries. So, that's only half of our business. The other half of the business is made up of another 2 things, and this is more specialist bespoke work, we've had a lot specialist bespoke work. It's all the things that we make to order for our customers and quite often we are involved in that design process as well...and we break that part of our business into 2; one is the pipeline maintenance industry and we separate that because is so big for us**,** that is nearly part of our business as well. So, we design and manufacture brushes that get used to clean and also to inspect other gas pipelines...and we sell these products around the world. The bit in the middle, the bit that left is all the other specialists that we do and that is not industry specific at all - so we do brushes that get used in industrial processes, so we might do a roller brush that gets used in the Nissan factory down the road...we do products that gets used in agricultural processes, marine processes, all sorts... but it's very very fragmented - what brings it together is it's all specialists, the sort of engineering brushware but it's not a market, it's lots and lots of markets. So, that's really the three parts of our business...it's all industrial but very very different. So the cleaning and painting is high quality janitorial products that we sell from stock, so if you are my customers you would order this from us today and you will have it tomorrow. We then have the technical products which is basically any specialist work we do and any industry in the world, that's all made to order and then we do the pipeline work which again is specialist technical but specifically for that one industry...and we integrate ourselves into our industry so we are members of Traders Association, we got 7 hours shows and that sort of thing...and build relationships with companies such as IPP.
9:49.1 - 13:49.3	EC: Have you ever considered the sort of heritage value? And doing

	things that are more...I've just had popping in my head an idea… They are companies in London which are looking for people who can help and they make home wares, they make things that people buy...they take very ordinary products and they add value. I was wondering that there are things like the green issues, using green materials, there are things as heritage and values about quality...I think there would be people that would like to talk to you... I just wonder if you have ever thought of that sort of sector.. MD: Um...a little bit...we have doubted with it but we tend to focus on the industrial market because we find for a business of our size there is more value in it. When you go to the consumer products tends the volumes tend around POP...that door thing you talked about (EC's earlier example) I've got one in my flat I know exactly what you're talking about ...so the consumer products we've been involved in that type of thing with in the past few times...so we've been involved, we've helped set it up, we've done the design and then it was outsourced to the far east and we thought 'oh well…we didn't get much with that...' So...we could be more I guess commercially astute to the point that happening but ...you are absolutely right, there are opportunities that...one of the things we found as a business is that we are not actually saw of opportunities, in fact we spread ourselves a bit too thin, we're involved in so different markets that we end up just being reactive, so we wait for people to come to us and that gets us a certain amount of development and growth and have you, but really what we would like to do is focus on particular markets that we are already established in and really get to know them, really understand them and then develop product specifically for them…and that's kind of what we've done on pipeline side over the past couple of years, we've put a lot into that and we've made a lot of inroads, and we've probably got another 3 or 4 industries that we could the same with, before I would need to then do something that I know nothing about. So...I'm not against it, and i think that if we had the right sort of partner to work with then we would certainly be very interested and talking to them. But we are also a bit mindful we spread ourselves a little bit too thin at the moment.
13:50.4 - 14:29.7	But you are absolutely right with what you said in terms of that things are changing, you know, and things that were offshore now are coming back and there is you know, people investing in sustainability and ...um…I was a little bit concerned during the recession because that seemed to go out the window, you know... people were no longer investing or buying organic tomatoes because regular tomatoes are cheaper, and I thought 'what's happening', but it does seem it drifted back a little bit and people are prepared to pay a little bit more for something that it maybe has less environmental impact.
14:24.7 - 18:17.6	[EC: This is one of the reasons for wanting to study Brushware.]

	MD: Definitely, and that to be honest is one of the reasons that I am always keen to listen to this kind of opportunities because it develops relationships between us, and we are a small company with huge organisations such as yours... EC: What is the size of your company? MD: We have about 30 staff. So I guess we are in the loop with opportunities so, yeah, absolutely, we would be delighted to talk about it. EC: Great, so would you like to have a try we the cart tool now? MD: Yeah, let's do this. EC: I like how you have the space here open to the factory (talking about the board room that had a big transparent glass display overseeing the whole factory from above). MD: Yeah, well you're talking about business that is constrained by its premises and we worked in a certain extent and when the opportunity to move and rose a few years ago, we felt 'we don't get this opportunity very often, let's make a really good job of it...", and we've probably spent a bit more time and effort than any other business would- but because we are a family business we spent much time with..."let's really make a good bracket set in this place" It's raised again in terms of our perception of ourselves, to be honest, because...there's nothing wrong with our old place but it was an old building and the windows leaked and the roof, we were replacing the roof every couple of years etc. Whereas now we don't have any of that and we just really focus on running our business and we got a pleasant place to be, so it really worked... EC: So, where were you in 1951? MD: In Sunderland, in the east end of Sunderland.
18:17.6 - 23:35.3	**Card session starts** [EC explains about the use of the cards. The cards were spread on the table and CEO card was pre-selected and positioned at the centre of the table.] EC: So, could you please talk to me a little bit about your role and also what else you are involved with. MD: Okay...Well...the way we work as an organisation is - I work very closely with a very small senior team…so, working with myself, we have my colleague who is our Manufacturing Director, our Sales

	Manager, and my father who is Financial Director. So, the 4 of us affectively run the business, between us...and although we have formal roles within the organisation, there is an element of, you know, people picking up things because they hit their desk first and just get on with them...and...We are now at a point where the business on a day-to-day level runs quite well without any of us...so If no one's turned up, the business would open up, would start, it would run, it would take orders, it would do Design, we would manufacture, we would dispatch...and it would've run for probably quite a while....but we find we get ourselves involved now is trying to improve the business, trying to develop things or getting involved with new customers, new processes...um…trying to pick up problems that are in the existing business and - although we have a very good process to put a problem right, we find that if we just leave it it then becomes a recurring problem - so we would get involved and say 'come on guys, let's sit down and let's get at the bottom of this' and then this doesn't happen again. That's kind of what we do as a Senior Team. EC: Great...Would you like to talk to me about your parallel activities? MD: Well... Okay then I'll just start with this side...Yes we have a Sales Manager, but there is also some customers that I look after personally, so couple of key accou8nts that I would manage…and also I get involved with new business development...so quite often being involved at the start where we pick up a new contact or a leading, I will be involved in overseeing them and presenting what we can do as an organisation and that will then picked up by the rest of the business. *IP*: That is one of the sort of official roles within the business, so I manage all of that...It is not something that we particularly savvy (appreciate) a couple of years ago as a business but as we do more Product Development it's something we had to learn...and at the moment most of the knowledge is with me on this, but it is something I am looking to share with other people in the business. *Product Development*: This is something that we really try to do over the last couple of years, to try to make it a bit more structured within the business so... what we've done is we've gone out and spoken to a lots of people, advisors, universities, other companies, design network north, design council, lots and lots different organisations and we've also tried to develop a few products as well…and I've been involved in some of those directly. *Marketing*: This specific sort of Marketing for any particular group of customers or market that we are into tends to be handled by the Sales team but what I get involved in is in the sort of group marketing, promoting with companies a whole, things like PR, website development, stuff like that...

	Management: The business does work well without the senior team but inevitably we do get involved in certain elements of management.
27:00.6 - 31:15.6	**Interactions** MD*Pointed out the distinction between existing and new product development prior the mapping. MD: There are 4 areas that I think they cover about everything that I get involved with... Manufacturing & Product Development: they are the same person...working with our Manufacturing Director but he's probably picked up the most product development in the last year or so… Sales: it is headed by our Sales Manager, so I liaise with her on a daily basis about developing the Sales, not so much a day-to-day but where we are going with it…and I also get involved in some specific customers as well. Finance: is headed up by my father and he keeps us updated with the numbers...we do a lot of project work and he will keep us right in terms of making things stuck up and give us the node if we spending too much time or only on a particular project...
31:15.5 - 34:18.6	Frequency: Yellow with Finance, Red with Manufacturing and deep orange with Sales EC: could you please explain why it is like that? MD: Because...most of the things that I am involved with the projects are around Design, Manufacturing and Sales... and yes we have to keep an eye on the finance but that might be every two or three days…although I do speak to my father every day, formally we will be discussing it only every couple of days…whereas with the others I talk every day. EC: How do you make decisions on the stock control…you know, the levels of stock..? MD: Um...that's a good question...On the pipeline side, the technical side it's…there is no question to ask because it's all made to order so...as soon as we finish we don't stock anything. On the cleaning and painting side/...um…it's something we are spending quite a bit of time at the moment because the only brief we have given to the production team is 'don't run out'. So...

	because we were on a situation where we were running...Our offer is to sell from stock…there are plenty of cheaper suppliers out there but we sell on a service basis so we need that stock availability...Now, we found that we were running out of stock on a regular basis so we said to the production team 'Look guys, don't run out, that's all you need to do, don't run out, we will finance and cover the costs of the stock, just don't run out'. And they've done a good job, they changed their production systems and they build the stock up and generally speaking we dispatch most of our orders every single day. Now, we hold, we probably holding a lot more stock than we need because if you think about - all we actually need is the amount of stock for that particular day...if we were to replenish our stock on a daily basis you only need to hold one day where the stock ...in reality we probably got 2 months' worth of stock in the shelf... so we got in that position where we're not running out so we've said to the production team 'right guys, done what we have asked, fantastic, now let's start scaling back...we don't obviously want to run out but what we would like you to do is to reduce the amount of parts and value we've got in infantry...so we have a look there at the moment.
34:18.6 - 37:39.3	EC: The other thing considering, things like sustainability...your traditional offer of a cleaning product, do you...have you thought about the sort of ethical accreditation, the whole idea of where you seat by using renewable. MD: We have, but to be honest at the moment there is no pressure in that marketplace...on the industrial site anyway...to be doing anything like, to be perfectly honest. However, we do think that this will change...so it is on our radar but we haven't done much with it yet. EC: I was wondering...I can see from the map that it's you and three other people you are involved with, that makes you 4 in total...what is happening with the rest 26? MD: The Sales and Manufacturing have each a team with them. EC: How many in the Sales team? MD: There are 5 in the Sales team, including [the Sales Manager] and 22 people in the Production Team (he counted the people in the factory by counting first how many are in the other functions). EC: Right, so the rest 26 people are actually those within the Sales Team and the Production Team. MD: Yes. EC: Right...so is the Manufacturing Director also supervising the production team or is there a Supervisor there?

	MD: Yes, there a Supervisor as well. EC: But you don't have anything to do with this person. MD: Not directly, but yes there is somebody who runs production and there is somebody who does some Maintenance and Engineering but they all report to [the Manufacturing Director].
37:39.3 - 41:33.1	**Quality** MD: Yeah..I mean... Although these are the people that I am working on a daily basis, I also work with, you know, I'll speak to someone of the Sales team directly, I'll speak to some of the product team directly, depending on what project I am working on...but in terms of the communication with these people we all sit in the same office, it's open plan so ... EC: so it's quite consistent, yeah...So what arrows would you use to describe the quality with these people? MD: Okay then...I think I probably work closer and better with [the Manufacturing Director], than I do here and here (Sales and Finance) but there is not much in it... EC: If you were working on a special product, say you were working on something related...it is picking up on what you said on where you then would manage it, you know, you've made that client relationship...when would you typically hand that project on when it goes to production…how would you network that? Or would you follow that through the shopfloor? MD: It's…it's... [looks rather confused now]. It's very different depending on the situation...we don't...because we trying lots of different things at the moment we don't have a standard procedure...so...there's a couple of projects at the moment that I am leading on, new pipeline projects, so we've got one with the existing customers where we are developing a new product, so I've managed the project, I've liaised with our Designer, I've liaised with the customer and I've put all that together... We've got another one with a new client where we are doing the Project Management side of it, signing confidentiality agreements but I've got one of our Sales guys doing the day to day speaking on the telephone...but equally one of my colleagues could be doing one of those roles as well...it's kind of...on the pipeline side I tend to lead, I'm more involved in that industry, but some of the other industries it might be more likely that my colleagues deal with these projects. EC: Would still be working through [the Manufacturing Director] on that, or would you on sometimes don't...

	MD: I would be keeping [the Manufacturing Director] in the loop but quite often I would work with some of his team.. EC: That would be worth mapping out!
41:35.1 - 54:12.1	**Different project - Another Scenario** MD: (shows a mapping exercise they had done internally) That is something that we were mapping out the other day and this is looking at picking up a customer on the pipeline side…these are all the things we do at the start the new business stuff and then these are the stuff we do when it becomes a regular business, regular client of ours...and mapping that out all the different aspects of it...but what we have realise is that there are not necessarily consistencies, so i might project manage one and then we might get another one and one of my colleagues are project managing that...so...I mean it's a very similar thing, I guess yours is a bit more sophisticated than our post-it notes but ...it shows that we are in kind of similar lines. EC: When you get to this point , so you are going through a strategic product development, how are you managing the assets of IP...are you actually, um, you're working on a problem space in the organisation, will you be actually looking to own the IP around the innovation...? MD: Er...if you were to ask that two or three years ago I wouldn't know what you are talking about...and nobody in the business would have no understanding of Intellectual Property and we didn't care. It's now on our radar , it's on...we got much much more understanding on Intellectual property and the thing...I don't know if you have talked with other SMEs, but when people asking SMEs about it their understanding of IP is probably very poor, it's certainly from our experience...But now we got the understanding but what we don't have is effective ways to deal with it...Where we try to work out with our customers and our suppliers for that matter, is on a partnership basis, so we will sit down with them, what's important to them, what's important to us, how can we both benefit...and if that means that they want to own the IP or we own the IP we just do what's best for that particular project...so for example I've got a new…sorry an existing customer now but we are developing a product for and although we are co-inventors of this we have agreed upfront that we're going to take the IP because we want to patent it, we want to take out patents so that we can develop similar iterations for other clients...now we've had that quite discusses with the client and they are very happy they assigned us the IP…but equally, if that customer was to say 'look guys...', and this happens, there are companies that they have policies that they must own the IP, you can't get around it...fine (laughs positively) You can have it... as long as we know that. It's when you're trying backdated then it doesn't work.

	EC: but would you try and use that IP then to create a strategic link to that business MD: Yeah, I mean, if they had to own the IP we would have to look to commercially a little bit different, how are we going to protect our investment...so for example, we did one with another pipeline client, they wanted to own the IP, fine, we did all the design work but the way we handled it is...we bought all the tooling and cost it in the job...so although effectively they own the IP, they can buy it whenever they want, but we own the tooling so they will have to then get a lot more tooling needed, so... we took a commercial decision and we thought actually, they can have the IP but we are going to manage it in a different way. MD: What's interesting actually is ...having just gone through taking lots and lots of advices on IP, I found that getting good commercial advice on IP is a very very difficult thing to do...if you go and see IP specialists and they will stir it down the root of patents...but the example I was just given you, it was a commercial decision, let the client own the IP and we will manage it a different way...that sort of stuff is very difficult to find examples of that and get businesses to talk overly about it so there's definitely something missing in terms of business support in the area around good practical advice about IP...that doesn't go and say 'spent a lot of money on the patents', because that's the general advice you get…that's not always what you want to hear. EC: How are the decisions made about the IP? MD: ....we try to understand it at the very beginning of the project, because if you don't it at the beginning it turns into a mess...We have learned that well. We're going to have these discussions at a very early stage, as soon as a new idea, project or something comes at the table, it will be on our agenda. But we don't have a fixed route that we will have to go down, we just have to understand what our needs are, what our clients, or our suppliers because it equally could be - we had recently where we had a new machine commissioned and the machine manufacturer wanted to own the IP for the machine so we had to make the decision, you know, is that in our interest, what the implications...and in the end we were happy for them to have it. It really depends on the specific instance. EC: My curiosity revolve around the people who you would seat together and have a dialogue and decide about it? MD: It would be these people (showing the people in the initial map)...I would probably take the lead, so i would be involved in the discussions with the client and then I would report back to these guys and I'd say 'okay, i think we should proceed this way'...and

	most of the times they will say okay, fine. In some cases they might asked questions that I haven't thought about, but generally speaking we are very very flexible on our IP, and all I am concerned at the moment about is raising the knowledge in the business so we at least know where it seats. EC: do you formally recording any sort of design file, why or how you have come to that decision? MD: Not yet, not yet...but i mean we really just start to build up a bit of a portfolio of IP in terms of we got a couple of patents now, we've got couple of trademarks, we got design rights and things like that ...so we just starting to build that up, but to be honest it's not enough to worry about it…but you are right, there are certain things that we need to start thinking about...one of the things I'd really love to do is putting a bit of IP strategy together...not to say 'we must own IP or we must collect it' you know, because I think a lot of businesses are doing this, they are collecting it...but an IP strategy should at least have a way of recording where it seats.. MD: yeah, we have started to understand it now...we are able to go in and look at a particular situation and have an idea about how it might progress, from experience... but when we started doing this couple of years ago we didn't know…you know, we just had to try it and be prepared to make a few mistakes.
54:12.3 - 1:03:13.9	Back to the mapping: MD: Because of the way the business works, we can map this in lots of different ways for lots of different projects... EC: it would be good to see one though, as the example you mentioned earlier. MD: Yeah, we could do this...I've got one in mind where we are about half way through it, existing customer came to us with a problem and we were developing something bespoke to them, we're going to own the IP, I'm dealing directly with our guys, i'm not speaking to [the Manufacturing Director] and [the Sales Manager] directly, I would speak directly with the people that we're doing it...um...I'm the customer...so yeah we could map that out if you want. Mapping starts: So, on this particular project...Although will keep them informed... We got a Designer...So the people that i would deal with internally within the business is the designer and one of our sales people...it's one of the sales guys that he is actually on the road. He is external, not employed by the company, he is an agent but he represents the company so we effectively treating him as a member of the

	team while he is not technically employed by us. So, I'll liaise with those people and also the customer, we're just looking internally here [MD asked about if it is useful to use a customer card as he is involved with him - EC didn't have one and a blank card is used to create a new one.] And specifically on this project I'm also taking some IP advice (external) - (a Blue cloured card of IP was missing and it was replaced by a Green with the same name) So, I'm about hal way on the project and these are the people that I have spoken to so far so...I went initially to the customer with the sales person, we went together, to talk to them to say 'look, we think we've got an idea you might be able to help you with a particular problem, listen to the problem in bit more detail, I then took some IP advice based on this particular issue, and then brought the designer into the loop - this Designer had already come out with the particular concept that I was talking about - so this was an ideal opportunity for him to get his product commercialised, so he was very very keen...we got an IP agreement settled, we did an undisclosed agreement initially, we then presented the concept to the customer, so then it was actually the designer and the sales that went and presented the concept to the customer, loved the idea...then we got them to sign a contract, assigning any future IP to us and then went down with the design process. So we are now at the point where we are prototyping, so we have agreed the design, that's gone to prototyping, and ... EC: Who is doing the prototyping? MD: This guy (points at the designer)... he is organising this within our existing structure so he would gone speaking to Procurement, he would speak to Engineering, Manufacturing...so he is pulling that together. He doesn't have a lot of experience on that side, so then I'll get involved there if I need to...but effectively they like to organise themselves at the moment. And then, we will issue the prototypes to the customer, the customer is going to test them, and if they are happy with them, effectively then they would raise an order and then this team disbands and it just goes through the business as a regular order. **Frequency:** I'm speaking with the designer all the time, I'm speaking with the customer reasonably frequently and really the Sales i just copying him in the email so...At the beginning we both went in because is

	his customer but he was then happy for the project to be handled in house…so he started it and then he will probably get involved again when we are the point where we have agreed the designs, customer needs to order them and okay, let's get a contract drawn now, agree on prices, so he'll come back… Designer: We brought him specifically for this project [and he's fully employed now].

Timespan	Content
0:00.0 - 9:02.7	...We don't have the experience to hand that over yet... so we need to try a few different ways of doing this...I guess having a little bit of a feedback loop to see what has it worked what didn't, there's plenty of projects picked up that was fizzled out so we're going to have a look at them as well... EC: Have you not thought of something like these mini knowledge-transfer way to get someone, if there's enough evidence of projects that help with that and help to sort to create a resource of a database... MD: Yeah...we have actually...a lot of the advice we got around product development - because the thing we thought we haven't got is, we haven't got a process, we haven't got a process in our organisation...and a lot of the advice we got was 'get a KTP', get somebody in to come in write us a process, manage it - a bit like Tom did in the IPP?...and we thought ok, well that's fine, but that's going to take a bit of time to build up ...I think what our current thinking is that we want someone, somebody in our organisation who has the experience, who doesn't to have to build it up relatively freshly, he can also say 'well I've done this in 10 different businesses, let's hit the ground running and.'..you know... So I think our thinking at the moment is to spent some more upfront and bring some expertise...some experience and expertise, rather someone relatively junior that could build that up over couple of years. …we've picked up a reasonable amount of knowledge on the way that ...I think if we brought somebody in couple of years ago then would've been steamed rolled with their way but i think we are now savvy enough to be able to ask the right questions... [Then it was kindly requested for a second meeting to be taking place with other key staff members. MD was asked which ones the research team would like to meet.] MD: What is interesting about it is ...I'm fascinated by the way I'm looking at that (pointing the last map) there that effectively we have outsourced the whole thing there... EC: But did you actually know that...?

	MD: No, we didn’t realise that we had done that no...Didn't realise we done that no... EC: That's where value is... we don't telling you much but sometimes but that might give you a process method...if you think that this actually is cost effective, if that delivers . MD: It might give us a project yeah... EC: ...rescaling that, thinking about how you create that as a relationship...Seems to me what you're gaining is a strength because you have someone as a external agent in terms of Sales that will start to probably put all sort of other pushes in terms of...you know...'here's a company reactive' if he's gaining better business out of that relationship... MD: He's delighted with that yeah... EC: then it's what else he can be doing thinking about as a proactive play within the organisation.
9:02.7 - 12:22.5	**MD: It's very similar to what we've been trying ourselves so... Do you mind if I just get a photograph of that, that's helpful to me!**

Appendix 13.
Sample of Brushware
Case Study Interview (2)

Name: 2- Manufacturing Director

Timespan	Content
0:02.0 - 7:06.8	EC: can you tell me about yourself, what is your role and background? Background: Engineering Position: Manufacture Director I was an apprentice when I left school and I worked at a company for 21 years before I left...spent 3 years at a company at Tyneside before coming here... This was really the difference because it's all, it's more Manufacturing than Engineering and [the Managing Director]'s probably...you've seen what we do...We would be classed more Manufacturing than Engineering... and having an Engineering background helps because some of the things we are trying to get involved through product development needs a little bit of an engineering. One of the things that we do lack I think is a bit of engineering knowledge within the business. Because we are a very traditional business and being traditional means that a lot of the people that work for us have worked for the company for a lot of years...so we've got probably 3 or 4 people that have worked for the company for 30 years. We only employ 20 year people so... EC: Do you consider this as being problematic? MND: Um... it can be a problem, it can be a good thing.. It's a good thing because you know, the culture of the company is a culture where people want to work for the company, they want to stay here they are pretty comfortable...and being comfortable also means that we haven't got over the years, we haven't developed the skills we need to develop…you know... the modern type of skills.. I think my first impression of the company when I came here was that we are very old-fashioned...and [the Managing Director] actually started around about the same time as me (huh?) and i think we've tried to make the business a little bit more modern...but...I think we're at a point now where if we want to move... I think we've done well in the time, you know, sort of been in the business, but I think that if we want to move on we need to start bring-in a few different skills into the business. EC: so, do you say that this is a point that the company needs a change? A time that you want to move towards renewal or…? MND: Yeah... we are looking to be a bit more innovative because we have been so traditional that the brush industry itself is a traditional industry… they 're not an innovative industry...and we want this

	opportunities for us if we can be innovative brushmakers, there's opportunities there because not many people are...if we were, I don't know, if we were an automotive you would have to be innovative to be successful, but brush companies tend to don't have to be innovative...they can make a living doing what they do. EC: From my point of view, this sounds very interesting because you normally see family based companies and their legacies keep going...In our time it is almost nostalgic to find businesses like this in our corporate constructed world, in a way. And I am very exciting to be here and seeing this happening here. But I also understand that the history bounded in this company might also be an 'innovation blocking' reason. MND: To be fair, [the Managing Director] is the 6th generation coming to the business, he is forward thinking... and he does want to take the business on...I think he quite enjoys the history bit but it doesn't hold him back in any way...it doesn't...I don't think the history stops him from making any decisions or stop changes the directions that he wants for the business...Which for me is good, I'm not part of the family, you know, to me this is a company I liked worked in but in the end of the day it's a job...to [the Managing Director] it's a family business so, you know, we've got different ways of approaching work i guess. EC: I think what you're telling me now it's quite important for you too because from what was evident during the conversation we had with [the Managing Director], you were highlighted as a key person to this business and I think this mindset and the visions you create for where you would like to take the company, it is very important and increases substantially your chances in succeeding. It would be a different case if you did not have this awareness and you did not act towards this change. I mean being proactive or starting to become more proactive as far as the future of the company is concerned...I think it is very valuable. MND: Yes...I think it is pretty exciting for me, you know, i enjoy coming at the work, I am one of this sort of sad people who enjoy coming to the work (laughs)... It's also good that you know i have a very good relationship with [the Managing Director] and his dad [Financial Director], we work well together as well so...we have a laugh. I've worked in a family business before where the family were ok but I didn't really feel part of the business...So I have sort experienced 2 extremes you know...I feel totally part of this business and the one I was before i was sort of looked at things from the outside...
7:08.7 - 20:55.1	Card mapping starts following the explanation of their usage. [MND: Question regarding the green cards: Are these things I am responsible for or things that I am directly involved in? So for instance, Manufacturing supervision - although I do have a supervisor...I'm still responsible for how the supervision happens... EC: Then you can choose this card also as an alternative activity (green card) with this particular definition.]

	Parallel Activities: MND: I've put Drawing Office there but that's because, you know one of the guys you will been seeing later is James and James is a Designer that we've got on a short contract at the minute, when he wasn't here I was the one who was producing the drawings... not that i really wanted that but there was really nobody else to do it. [Places drawing office and designer next to each other]: I wouldn't call myself a designer but if we have ever done anything new I would be involved in it, I might be doing the drawings there...help and discuss the ideas etc.. Shopfloor Manufacturing: I am involved there on a daily basis... Production Engineering: I define as the manufacturing processes for a particular job...Again, I get involved in that indirectly but probably less now than I was maybe 2-3 years ago. Procurement: The person who does the buying...she reports directly to me. But procurement and the sort of supply chain is something that we are trying to...we are trying to develop one...one of the things it's probably a weakness in the business that we're not very good at managing our supply chain, we've got historical suppliers, we've got good relationships because of the historical relationships but that's not necessarily a good way to manage the suppliers...so for instance I'm trying to find a new paint brush supplier in China, so we are trying to change the way that we do things. Planning: strategic planning...obviously as a Director I'm involved in there. EC: So, can you talk to me about your role there? MND: Well, I mean... [the Managing Director] has explained that we've been working on a new business plan, a new sort of 3 year business plan...we've been working on it about 9 months now, and it's been done as a team..and we've got to a point where we got the plan now and it's left the implementation of that plan...we obviously have the plan before the implementation so...we are working on that at the minute. Maintenance: I guess it's something that... we've got an engineer - but generally if there's anything series I am involved in there...if we need to spend a lot of money to fix the machine or something like that, [the Maintenance guy] will ask me ...if it is a minor stuff, it gets done. But some of the contractual things I am involved with. Tech: from a technical point of view, again, I've probably got quite a bit input on that, maybe through production engineering (he's not very sure

	though) Engineering: same. Design: Depending...have you know about the little [product] that we designed...well some of that was me and [the Managing Director] did that, we used a Design house up in [local college] they actually did this sort of design but we were involved in the brainstorming sessions and what have you...but one of the things that we realised is that...they come up with a good design eventually but it took too long. It's been 3 years and we still haven't really launch the thing now...we launched it and then we've had to go back at the design and redesign it a little bit, we are ready to launch it again now..that is one of the weaknesses we see in the company. It's a product development and design weakness. and that is why we as a business we said we need to be more innovative. To be more innovative you need a good product design process, we need to know what we are doing with design...I am not a designer, but I am heavily involved with the product development and design... Project management: When I was mentioning about a particular product that we designed and didn't implement very well...one of the things that we have identified is when we got new things happening we didn't design new things but we need to be better at managing the project...so we might come up with something that works but actually getting it to generate cash is the sort of the length of the project and what we need to do is develop a bit better project management...so generally if there's any project management to do, I'll do it, but only because we don't have anybody else to do it. EC: So, in terms of the activities that you are involved with just because there is no-one else to do, is this something that you enjoy doing or is it something that you'd prefer not to do? MND: I actually like doing it, but from what I realised as a director of the business and we made a commitment to grow the business...to grow the business and be a bit more strategic, we need to drop some of the things that we were doing before...we need to probably be less operational...and a bit more strategic...and some of these things are operational things...But one of the things i feel guilty about is that I quite enjoy doing these...getting into Solidworks and creating a few parts there..and sometimes it's quite easy to remain involved operationally because it's what you're good at, it's what you're used to, it's comfortable...so it has been quite a big change for me trying to change to be bit more strategic than operational...and the work we are doing with the business plan it sort of open your eyes that you need to be less operational and more strategic...I think I am getting to point now where I'm sort of devolving some of these things now...I think people are less relying on me for supervision now...in the past i would be the person who not there...the supervision wouldn't happen...I mean even now we've just unfortunately we have had to have a small redundancy a few

	weeks ago, we had to lose two people..well i did that, but really you could argue that this should happen at a level below me...there are still things that I am involved with and with that the reason I did that because it was so important that we got that right and I was a little bit unsure as to whether or not we had the right skills on the shopfloor...and that's the same for the most of these things, design and product development, are a good example of that. Management and Human Resources: I am also responsible for human resources as a director.
20:50.7 - 51:16.3	Interactive Functions & Frequencies. [MND: requested some further explanation about how to use the cards when individuals involved in more than one function, or functions who we belonged into one (e.g. Design & Product Development). EC: suggested that it is advisable to cluster the cards into groups for the functions that have the same actors.] [MND chooses first the cards before reflecting on them. Again, it was asked whether or not use a card that has already chosen in his alternative activities.] QA: it's a bit of a strange one, Quality Assurance, because we don't have anybody responsible for QA, but we have a Quality System, we tend to sort of manage the quality system, we've got a quality...um...we got a couple of quality auditors...I guess it's the same thing…isn't it? We've got 2 internal auditors, so every moth we''ll have a meeting about it... *[The selection of the functions has been completed and the participant is requested to place the color-cued arrows to indicate the frequencies.]* Shopfloor Manufacture: I'm obviously heavily involved in that... [Once MND completed with the selection of the arrows, EC asked from the participant to indicate the population in every function in the map] Sales: Been the Director of the business obviously I have a certain level of contact with Sales, [the Sales Manager] talks to me and I will talk to her, so we've got 5 people in the Sales department and I will have contact with them all, but there are different degrees. I have a bit more contact with [the Sales Manager] because she is Sales Manager, and a bit less contact with [external Sales agent] just because he's out on the road...and he is a salesman now, going to different customers, so I have less contact with him. EC: What about the rest 3? MND: Well yeah, I see [the Sales Manager] who is the manager, we've

	got the Sales Leader, who took [the Sales manager's] job when she was on a maternity leave...and there is the girl who you've met coming in today. She is the sort of telephone sales and customer service. [The external Sales agent[is outside probably twice a week, he is generally out with his car. And we've got the Accounts...I guess [the Accounts] would probably be Finance...So that's probably 4 in the Sales and probably 1 in the Finance [he had Finance card selected in the map as a different function] EC: During the mapping session with MD, it was indicated that Finance was taken care through his father. Why is it different? Do you see only [the Accounts] there or is it a different function? MND: Um...No...well, then it's not 1, it's 2 in the Finance. Basically, [the Accounts] is the person who deals with invoices and payments and stuff…MD's dad is obviously the Financial Director…so I was just dealing with [the Accounts] this morning about a payment I had to pay because normally MD's dad would pay, but when he's not there I'd take over the role. [Population continues] Estimator: [the Estimator] deals with all other enquiries, so if a customer says I want you to give us a price for the brush, [he] will actually come up with the basic design of the brush but also use a computer system to come up with the cost price of the brush...and [he] works for me. So he is directly responsible. EC: Great...now… although you talked to me a little about what is happening with some of the functions, I can see that you've indicated some differences in the frequency of interactions with your colleagues, could you please talk to me the reasons and how you go about, how things are more or less frequent and why? MND: Alright, I'll try give you an overview of how we communicate, I guess is what you are looking for... I'm communicating with [the Managing Director], we sit next to each other so quite often a lot of the communication that happens it will be conversations and we might discuss things while sitting at the desk...and quite often...there might be operational things, or maybe more strategic things...but we also got the more formal channels, so we got a board meeting every month, we have a management meeting every week, which the two of us are involved in and there's various other things like working on the business growth program, that's formal meeting in a year on the screen...so we'll have the formal meetings but we will also have the informal stuff…so generally that's how we get things done, how we make decisions. You know, we are a small company so quite often we can make a decision by having a 10 minute conversation sitting in our desks...that

	can happen very easily...we tend to be formal - when we have the sort of formal communications it's a way of maintaining it on a professional level…you know…we don't want everything to be informal... but if we need to make a decision quickly we can talk about and make decision and do it. We might kick some ideas informally, and then we might bring them to a formal board meeting or on a management meeting or we might say 'that's a good idea, let's get the team together' and you know let's talk about it... EC: What sort of things do you talk about in these meetings? MND: Well, pretty much everything...an example to that is the recent redundancy we've had...we sort of had it in our mind that we probably had too many people...but we actually made the decision to go ahead with the redundancy probably based on an informal conversation...and then we said 'yeah, we've probably got too many people'... EC: To me this sounds much about management, but not so much about manufacturing MND: Yes, this is more like an internal management...in terms of the manufacturing...um...Procurement...I mean I mentioned before about a project that I'm working mainly trying to identify a new supplier paint brusher...that sort of thing...again...dealing with the person in there tends to be very operational, it tends to be a bit more formal...we have informal conversations but it tends to be 'this what we need to do'...I'll be telling [the Procuring] what we need to do, she will tell me what she has done...it will pretty sort of, pretty formal communication... EC: Is this something that you'd like to have it differently? MND: I think we need to look at the whole Procurement function...I might speak to [her] informally if this is necessary, but I think the relationship is more of a working relationship rather than a personal relationship...that tends to be how I deal with Procurement communication wise... Shopfloor Manufacture: we got 12 people here and I do try to speak to everyone, everybody knows me, everybody knows that they can come and speak to us, I tend to be, you know..if anybody has got a problem then I'll tend to sort it... I'll hear about it...but the sort of main person hear is [the Manufacturing Supervisor]. She is the Supervisor and me and her have a lot of informal communication, so I keep an idea of what is going on at the shopfloor mainly via Donna. So, [the manufacturing Supervisor] will tell us if, say [the Estimator] have a problem, I'll probably hear about that problem first informally through her. EC: MS sounds like a broker, a link between you and the Shopfloor, is this right?

	MND: Yes, [the Manufacturing Supervisor] is a type of person who people will go to and sort of speak to probably intermediary, more intermediary than maybe they speak to me.. but she keeps it informal to what's happening...because as I have tried to move away from the Shopfloor is difficult to maintain a link and I sort of trying to maintain that link through keeping as sort of pretty close informal relationship with her. We still do the formal stuff, but it tends to mainly be done informally. EC: What about the Designer? MND: Um...Thats..that's..pheeeww...[the Designer] is a pretty sort of a formal guy...because of the way that we've done design, we had [the Designer] on a project, and when that was finished he's now on a internship, a 10 week internship project, so that had to be formal, to set up things had to be a formal process, and as [the Designer]..I mean [he] has been in the company for over a year now, um...he's very sort of...he's not very good at the sort of the informal stuff...but he's really good at organising things formally, coming up with reports, presenting his designs, he is very good at that sort of thing...so that communication has always been a bit...mainly been done on a formal basis...I tend to think we lose a little bit because of that... EC: What is it involved in your conversations? At what stage do you interact? MND: Initially with [the Designer] it was me giving [him] ideas as to what he could look for designing...so he's looked at a couple of products and they've really come from conversations with myself and other people... EC: Any other people...? MND: Um…maybe [the Estimator] who works next to him, he is this guy here (points at the Estimator card), [he has] got a lot of experience in the business... and the Engineer...so...I guess when [the Designer] first started he relied on me really for his ideas and the sort of direction...and I suppose since then I've sort of pointed [the Designer]in the direction and he's sort of got on with the design...and when he's pointed out with the direction then the communication me seeing him informally how he's getting on 'show us how you've been doing...', but when he's back to me he always comes to give a report, or to give a presentation...so that tends to be pretty formal. Sales: I have a direct responsibility with Sales, obviously as a Director of the Business, I am interested on how much we are selling every day, or what customer relationships are alike in the time - just like today, we were talking about a particular problem we had with a customer in the Midlands...and I was approached by Sales because I guess... EC: Was it a technical problem?

	MND: Yes, it was a technical problem, but even if it wasn't a technical problem, I'd probably hear about it because...well in some ways if it's not technical, it might be a procurement thing... or if it's not a procurement or technical it might be...I don't know…maybe a dispatch problem? EC: In this case, would you be taking a decision there yourself or taking with somebody else? MND: err...sometimes, yes...depends what it is...if it's something that we can...you know…if it's something like [the Sales] has a problem with a particular customer, might be complaining about something, if we can say 'right, send the customer a free of charge replacement', we can make that decision straight away. If it's something that is maybe a little bit more technical - I didn't realise that was a problem so we're going to have to do some more investigation on that... EC: Who would you consult at that moment…the Engineer? MND: yeah, I would take that problem and I might be going to speak to the Engineering or I might speak to [the manufacturing Supervisor], or I might speak to [someone else]...um...we do have a system…now if I was to do that I would actually by-pass the system we've got, so...we've a 'what's gone wrong' system...so anything that goes wrong within the business if it's a customer return or complain, it's just something that it shouldn't have happened , we tend to generate what's gone wrong form..and that would involve who it needs to involve...so if it's in-stores thing it would involve [Dispatch]... Estimator: on a daily basis, for instance today Eddie he's at a course, he's at a training course...[the Estimator] spoke to [the Engineer] to say 'can you cover if I get any enquiries in, can you cover?' [the Engineer] has just really started this job... EC: Seems to me strange an Estimator being replaced by an Engineer...? Why not a person from the Sales for example... MND: Because...if a customer phones up and says I want a brush to clean my plant pot, then [the Estimator] has the sort of knowledge - because he has worked in the business and he used to make brushes by hand..so Eddie will know how we are going to make that brush, he would know that it would need to be around bristles, he'll know how many tough to put into it, he'll know all it needs to be done on a particular machine... And because [the Engineer] is in charge of setting the machines that make the brushes, [he is] obviously able to do that, knows how brushes obviously are made and the best methods to make the brush so...it's actually a good point that you bring up because we have started talking about the fact that this job is probably now more Sales related than

	Production related...so we've started thinking about where that fits so maybe this job here is sort of sitting between Sales and Production...so that's something we have to... It would make sense if we had someone...I noticed one of the cards you have was a Technical Sales...and we've talked about it having a Technical Sales person...something that we look to identify... So, these are the guys I see on a daily basis... EC: One last question;, are these the people that you interact in your everyday routine changing frequency or changing at all according to different projects? MND: Um…Yeah…I'm trying to think of an example...at the minute we are doing a project where we are looking to reduce the technology to try to help logistics...I am sort of the main contact for that particular project...so that would involve me dealing directly with logistics within the business... EC: So that would not involve anyone else in the business, is that what you're suggesting? MND: Logistics in the business is the responsibility of [the Dispatch] at the stores, [the Manufacturing Supervisor] is in the Production and the Purchaser - so there are 3 people. ----- MND: We've just started thinking about having a design wall...an ideas wall...where people can put ideas...so me and [the Managing Director] have been speaking to two of the guys that are going to get involve in that [Designer and Estimator]...so there going to be 2 guys keeping an eye on that...So depending what it is, we might choose a particular person...if there is an initiative happening…you know…we want to improve something, we tend to just pick a person and work with that person. ---- MND: It's been interesting!

Appendix 14.
Sample of Pharma
Case Study Interview (1)

Name: CS4 Pharma-Design Manager

Timespan	Content
0:00.0 - 2:07.8	**First interview with Design Manager** (DM) DM: General Information about Pharma Well I have been with Pharma as now as sort of as an Industrial designer here...I was here 14 years ago. In terms of what we do, we are a manufacturing company for rigid plastic packaging...so with bend towards pharmaceutical/medical, we don't do any for food or chemicals...so essentially is about pharma and healthcare. And that's a conscious decision in terms of how we set up the business, in terms of our facilities, you know, we are cleaning room manufacturing facilities extremely clean as well...what the pharmaceutical industry would expect to see as well... we have long cycle audits every week really... We have 2 sites now, Pharma as it was started just outside London, came up to the North East probably 30 years ago, and it's been trading as Pharma...and 2 years ago we were taken over by [SE] and we are [SE] and Pharma now….[SE] used to be one of our competitors...and the time we didn't [do well financially], they took us over.
2:05.9 - 3:42.1	Since then it has been a very good fit because essentially we are making the same products as them so we have been able to streamline our production...we also in terms of costs the site which is best in SE which is best here, you know, after 2 years that is settled down now ...so, similar manufacturing sites, we are probably more on the pharma side, they are probably more on the health care side, we do a lot of work for pharma products with the clean rooms we have here and also the manufacturing techniques we've got injection moulding, we've got injection blow moulding, we've got injection stretch blow moulding, extrusion blow moulding, and injection moulding...right up from 60 tons to ...something... We also do printing here, we've got dry offset, screen printing, some other machines...labelling machines...essentially if it's packaging we are a one-stop-shop in terms of ...we have the design department , we are designing products and not only fitting the bill in terms of functionality and looks but also we design some that can't be made by ourselves…
3:42.0 - 4:31.7	We've got to have a good idea what the market expects in terms of price as well...so we are not designing an one off piece...in terms of the production here we probably make over a million pounds a day. EC: So, when you do the packaging how typically is that leaving the factory gate...I mean, so you've made the clean room environment closure, so you have a lid and a base and typically a closure over the top. DM: That's right...well there's going to be over a million parts a day... EC: So how do you pack those up?

	DM: Mostly, because they would go out to the fillers, because we don't fill here anything, we supply the components for the pack or the majority or one of them depending on what it is...but they normally go out tumbled packed or air packed. EC: Could you please tell me about the company size? DM: 250 employees in total, so that is split across the two sites similar...and it's probably 25-30 million pounds turnover... EC: Can you tell me a little bit more of the numbers between the two sites? DM: I think we've got 140 here... EC: How many of them are considered managers and how many [blue-collar] workers? DM: There are two in the design team, we've also got the Production engineers...in terms of design its only two...there's myself and there's a guy down to SE There are about 100 'workers' on the site here. We have a Sales team, some internal some external some on the road...HR...Maintenance... [EC explains again the purpose of the study and the importance of the size of the organisation and the people who are centrally involved in the development of products etc.] DM: In terms of how it changes slightly...we were quite a big design department here, we were four designers...when [SE] took us over, a couple actually left at the time and then I stayed up here and there was a guy just down in SE...So it has changed slightly in terms of ...we have sort in terms of how much workload...whereas we would never look at using outside help, you know, occasionally we have to now…but is very occasionally... EC: How much do you work with the other designer in SE? DM: What I do is, I do all the new design work up here...He's more, he's called designer but he's more of an Engineer...so in terms of any design work that needs to go to any changes to existing products to improve the functionality or tooling - he is involved with that...Any new business, new design work - that comes through me... And that goes sort of through, you know, the initial concepts might go around with the Sales quite a bit, in terms of meeting the clients, and actually finding out what they are after...instead of waiting for the Sales guys to interpret it...and then I'll take it through here with the Engineers

	here for the assembly, equipment...and then we have a Tooling Manager and a Technical Director who takes care of the tooling side of it...but I am involved right through the first production batch is being brought essentially…
9:46.3 - 13:59.5	EC: You were talking much about the Sales team...how much are they innovating in terms of the creative...if they are going to the customer are they looking to help them make the right decisions about how they deliver or dispense products? DM: Yeah, well, I worked with them quite closely in the past… because originally "*" knows of the design facilities, though it had to very clever sort of innovators who came over some packs that, they were sort of new, they all had patents done in 25 years of basically being written in bits of glass, specs you know, they wanted to go elsewhere and they couldn't... All of that changed 5-10 years ago when the patents came off and then everybody could have a go... and we could see that coming, that's why I was brought here originally, to bring some ideas, not wait for the customers to asks us for a product...we got a good knowledge of what they take from us, what their products are, and then just sort of taking a blue sky thinking in terms of taking some time thinking about this, you know, sit down and think a bit differently...I mean we had some great success in … it's one of the first jobs I did but at the time vitamin mineral supplements were all just round packs...the Sales highlighted that they were just round and that was their job, go out find the sort of somewhere we can get to, we are not particularly into it but it's similar...it's on the healthcare, blow moulding or injection blow moulding, etc...And they came back and said 'they all sort of looking round', they then would speak to the various supermarkets (seven seas, Tesco, all of that)... and I came up with some ideas, the brief that we were given was about an overall fitting pack, 3 sizes, cap, a good seal etc...And I came with this very simple pack and still selling them to the date and in various disguises as well and that was really just - we got Pro-/Engineer at the time, modelled it up 3D, had some SLAs made, painted up, then we went in to these targeted markets, specifically done with their logos on… The Sales team has changed over time since almost reintroducing it...but each project we do whether it is one-off on our back or ones that are we'd been asked to look at in terms of dispensers, you know a lot of that we can re-use for other products...'it might not be ideal for this customer but actually I know a customer to whom could be interesting'. And that we would then model it up, present it professionally, and then the Sales guys are going with that...and normally a that stage I would be with them as well, because they want to talk about the money side of it, any technical questions I can answer that ... it also comes across a little bit more professionally, at least demonstrate that you've given a little bit of thought and that goes really well...I'm not saying that every time they go 'Yeah, that's what we want, let's go for it", but one that gets us in the door to speak to…and normally it's 'that's not for us really', but I [may] know someone else that would be interested in that...

	EC: Within the segment pattern, does that give you the edge over other container manufacturers? DM: Yes, absolutely...
13:59.5 - 14:38.7	DM When we first got a good reputation we sort of going along, second our main competitor is now our owner...whereas we would be fighting for the same work, bring the price down, becoming one has allowed us to sort of level the price off...the design side which is, you know, the guys have the full sight of scene, you know, it's merit, particularly a year ago has put us on the top in terms of our segment...the pharmaceutical side...so, a lot of the time they would ring me directly, they wouldn't bother to go through the Sales team because they want to know quantities and prices...whereas they would speak to me in terms of, you know, 'is there a solution to this?' Because we are a manufacturing company, we took the decision that the design site was never changed...it's basically, what we wanted to do is to manufacture the product, whatever it takes, designing it, the right price, your filling lines, you know, we would take care of that... We have worked with design consultancies, we've worked on a number of projects, you know they've come up with some ideas but we've got a better knowledge how this can be made, quantity wise...that tells us what options you have on the manufacturing...soon, we've built a good reputation...and whereas beforehand there is a number of clients who would have spent quite a bit of money on the design consultancies, they would now talk straight to us to go through...nothing gets, you know, I've worked for a design consultancy for long enough but they are only going for the sort of information they are given and work with that, whist what we tend to do is, we're going audit their filling lines, so you know before we even start we've got an idea of what they can and can't do...and we sort of asking the questions, there's a lot of times that they don't want to reorganise their filling lines, they just want a new product, so we provide this, coming out with new ideas you know 'can't do that, can't do that'...we don't tend to make it too easy for them, you know, everything we present we try give them 2 or 3 ideas...the first one is you know 'here's what we think you want' > 'this is what I think you want' > 'and here's another one in case I got it totally wrong'...and normally what happens is you know 'I like that feature, quite I like the look of that, can we... [sort of combining features for the different ideas]...so we go with it...because of the Pro/Engineer, we've got rapid prototyping facilities in-house as well, so we're not spending huge amount of time on it...but it normally gets there pretty quickly. And on that stage, my job is getting all the information about the costing, how many [products] going into the box, how many pallets, what type of, does it need any secondary work, what materials etc...at the end of it they've got all this information, they can have the drawings if they want, they get the visuals, the models, the costing...it's a one stop shop so they don't have to have a go with a sort of consultancy who do the first bit and

	then they have to do it again etc. EC: How do you maintain design rights over the work, if you've authored it? DM: What we are trying to do is trying to get patents on…you know...if there's anything unique to the patents, we've done one recently and that's it's being great because in the end you don't sell plastic then…it's the IP. EC: So the company maintains that, if you've developed it even with a client you've maintained the design. DM: That's right...in some cases you know, at a stage the client might say 'we'd like to own the design rights', the lawyers would involve there...occasionally we do the sort of ...let that happen, you know... EC: The other thing is, do you sit on any of the standards bodies...is there anyone. DM: Not myself, in terms of QA we have a QA manager on site and he takes care of all the ISO standards, we do medical devices or medical...[measuring scoops]...he takes care all of the stuff needed in there, all he asks is all the information from me... EC: As a business have you thought about doing the fillers work or would that make you a pharmaceutical business? DM: I don't know that to be honest, we are quite happy doing the packs and stuff you know...we have in the recent past look at desiccant packs, filling closures with desiccant in them, you know, making some packs that you put the desiccant in after it's put into the closure...our competitors have gone one step further and started putting silicone gel in, but it's not really...I think that's why we have resisted in other projects that we've been asked to do, e.g. food packaging as I mentioned before [vitamin supplement]...if it's blow moulding we can do it, you know, we've got the facilities here...but I don't think we would have the credibility...there's one thing that Pharma has is the credibility, you know, because we've been running for long enough, our products have been written into specifications, so it's got a reputation for that...I think if you went into filling then you'd going on sort of diluting that, I think... EC: I suppose one other thing I was going to ask is, I presume on that basis the company would still be interested in products where perhaps it's containing 'sharps' such as syringes etc. DM: Yeah, we have looked at these needless injectors, we've done quite a few projects on that, in terms of, not the whole thing of it but parts of it, and we have one there being cost and coded as a separate cell, you know, it would be in a clean room, all on its own...it would be segregated from the rest of the shop-floor, and it would have a separate group of people

	essentially, there would be a team...because what we have there at the moment is that they are all trained to work on all the machines and the majority of it is not rocket science...but something as specific, we do have a vaporizer valve (and some other equipment) and that had a team all of its own, because we couldn't get one wrong...the assembly was testing everything, we got one bit together and then tested it, we got the next bit and tested again...[talks about some technical issues, the essence being the criticality and costs of getting everything right and avoiding errors.) So it's 'horses for courses'...I think on that one, the ones that have looked at, we have been successful in getting the whole lot of it, we have on bits and pieces – e.g. there was a twin shot valve that we looked at - but again our credibility is more on the sort of medical devices to up to sort of £10... I guess we do know where our niche is... Our clients are very risk averse...cause one thing that we haven't seen is any competition really from other than the far east...you know it will happen, we're not saying it won't happen, but are very reluctant to look at it... We do not have a huge amount of competitors specific to sort of pharma, all we see is not really in the pharma, they are in the vitamin mineral supplements, if anything that's what we do because in the health care projects they are not the best because they don't last very long and also become - you don't get long contracts, but the medical devices they get long time to get them into production but once you're in production you don't give them problems then you tend to have them for a long time...I've worked on projects here that have gone on/off for 5-10 years, going through the various regulation testing...but once you get it it's done… [depending on the projects they may have more or less time on the project]
26:06.1 - 33:16.9	EC: Things like usability and the whole idea of inclusive design, how much do you find that you can pitch to the client, using cap removal or I was thinking the sorts of products where maybe there are people with arthritic hands etc.? DM: Yeah, well, one thing we are known for is Child Resistant (CR) packs, and recently done one from ****, which I would have thought they'd want to do by themselves but they came to us just because of our experience with CR closures...we can show that we have developed numerous ones over the years...this particular one we got a patent out on it, it has gone to the American market...a lot of them are dictated by what goes in, you know, they are trying to reduce the pack size to absolutely minimum, this one is a spray, and for doing that the best child resistant cap is about that big, the kids can't put their hands around it...having an experience with it and having seen the tests with it it's kind of frightening for the designer because you think how am I going to get…you know…kids not going to get in there, but an adult at 70ties can...so through seeing that it would tailor the design, hopefully we are going through it this time, it has passed the US standards but because the kids can get in on their

	teeth, and we call them over them little gorillas because....we did a pilot test, sort of touch and go to see if it was going to pass, and the kids started getting to it, so they send us the samples back with the teeth marks - they were literally trying just to bite through the plastic. But on another side you give it to the adults and they trying to open it and can't do it and they just leave it and say 'I can't do it'...so we've got a bit of insight on that and normally the clients tend to run their own testing as well ... EC: How much are you really in competition with traditional glass packaging? DM: We've seen a lot, the problem with the glass is it can break so we're looking at other ...we've got a lot of enquiries for...the problem we have with the plastic is it can leak the oxygen and the vapour...we predominately use HD, a bit LD and PP as well, but it's not ideal, compared to glass is pretty bad...the PET we do, we've done some work PEN which was worth 14k a ton - PET is about 1k a ton... EC: How much of the plastic you are using is recycled/reused? DM: We are closed loop so depending on the product, depends how much percentage we can put back to it, if it doesn't go back in that product then it gets reground and used in a different product...the only waste that leaves this factory is some that's already ground.
33:16.9 - 42:25.6	EC: Is there a team that works on these stuff, trying to find better production methods etc.? DM: Yes, we have two change control agents at the moment, sponsored through the MASH incentive, they were here last week, that's one of their projects...we got a new General Manager since last year and that's what he's been tasked because in terms of when you look down on our costs that's where we can still see in terms of improving all closed loop...there's still an amount of money that go out of the door and a lot of it is just purged or contaminated so if we go from one colour to another we can't really use that … EC: How much does this affect your work as a designer? DM: Well, at the minute is about light-weighting in terms of reducing the actual weight of the product right from the start because we progress all of our toolings, we could do them in house or bring toolers in site but we tend to go wherever we think is the best tool makers...most of the original tools are still running...there's a maintenance program that does this.. [talking about an experience with tooling process and how it was a nightmare...MD noted that tools are playing a very important role in the practice of this manufacturing company...practitioners define the requirements of the tools, and tools then drive the capabilities of the company'...]

42:25.5 - 54:05.6	EC: Was there a particular reason for Pharma to move from London to the North East? DM: Yes, there was a grant for the land here...some history of UK here...etc. EC: In terms of [SE] and Pharma, have you been integrated into both sites or you remain in the two different ones? DM: Um...we have people from Pharma that have gone down to SE and working there now...but essentially is the same people in both sites, we have four factories, one we are about to move out ... EC: Is there a totally different team working down in SE? DM: Yeah, it is essentially a replica of this team. We share the Sales team... EC: Do you have the same production? DM: Yes, exactly the same, a lot of it comes from the fact that a lot of the packs we and [SE] were doing were the same, to the point that it made sense that were copied most of them, but the clients were asking you know we have this pack from Pharma, is not protected anyway, we want it cheaper so the [SE] would do that, and we were doing the same, we took a lot of work from them too...so in the end when we came together we said 'alright, who's got the best tools? We have the same products, which one has the best tools?' ...and some of our tools went down there for products they used to make on their tools, because our tools were better...

Timespan	Content
0:00.0 - 4:11.6	**Card mapping session starts:** **Parallel activities** Production Engineering: because I also design the drawings for assembly equipment, line setup in terms of machines, conveyors, I don't design conveyors but I would specify... Manufacturing supervision: that would be on the first production run, so making sure they know how they are assembled...so I would say 'initial manufacture'. Sales: I would say half of my time is probably shared with Sales…and with the development side. Marketing: in terms of that, we've done a brochure with all the products and all the information on the sizes…we've just done 3 different articles... EC: So would you get involved in if you are doing things like a

	tradeshow, designing and being involved with the stand layout? DM: Yes, we just did the pharma pack and we did all the sort of photographs on that, illustrator and photographs of the products we've done...I went down there as well just as the sort of the technical background to accompany the sales as well... Management: I'm probably part of the management but I do not manage anyone, I had 2 designers but not anymore...in theory you could say I'm managing the guidance, but he doesn't report back to me so... Procurement: that would be any equipment that we need to assemble, parts or tooling, I tend not...I'm involved with the production tooling but someone else orders that...it would be the pilot tools which I work with them... Drawing office : yes all the drawings go via me... IP: all the patents submissions as well. [*new card created for Costing]
6:05.6 - 13:26.2	**Interactivity** DM: what happens if some functions overlap? E.g. I see Drawing Office there but I am essentially the drawing office here... EC: Is there any other person in the function? DM: There is one in SE. EC: Then since you are interacting with him you should use it. Customer Services: logistics wise in terms of getting the project, the first production ready, dispatched - certainly talking to them...also getting trials done, I will liaise with these guys to get availability of machines. Planning: sort of links in with customer services, as we are coming at the start of manufacturing project, if one wants to know when his going to get product so liaising with planning to the machine availability, making sure we can get production out, dispatch. *[DM groups the two cards next to each other and EC asks whether they are the same person or not. DM responds that they are different people...same office though. EC then rearranges the cards by adding a short distance between them (instead of being clustered together).]* Procurement: to get the materials...the plastic, any additives, bags, boxes... Production Manager: he is part of the sort of the project team which I would be speaking to him really just linking him with Planning...making sure that he is happy in terms of when it comes in, he's got the bolts to man the machines, he's happy with what

	we're going to make, he's got enough information in terms of a new assembly, specifications for the packaging. [DM Faced with card Estimator: we don't have an estimator, that would be my job getting the costings...] Manufacturing Supervision: that would fall into the Production Manager's role Logistics is part of Customer Services. Product Development: Yeah, because we are working with a couple of design consultancies...working with them, um, occasionally working with the guys down in SE...or with techie teams of our clients. Shop-floor Manufacture: same with Manufacturing Supervision. Tech Sales: working with the Sales team in terms of offering the design functional and technical side of any inquiries. QA: after we write this, we help them write the specs, the DMS submissions, the packaging… you know the sort of regulations... Marketing: we don't have a marketing team really, this is our Sales team. Customer: definitely...I tend to speak to them directly, our Sales guys...as soon as a project we get their details and speak to them directly, I don't like going through the Sales guys each time...and I don't think the clients do [either]. Tech & Design grouped with PD. DM: It's predominantly Sales and the technical side really, the production tooling, technical director, the specs...doing any advertising...working with the client...I think this is probably it.
13:27.6 - 23:20.0	**Frequency** I put the same on these two as it only happens at a certain point, essentially the same point of the project...it's basically when we have developed a product, we've cost it and the clients accepted it, and we've gone to the production tooling…so at that stage we know that e.g. in 16 weeks' time we will have a tool on site, we'll trial it and if it's good and we are happy with it, then we will put into production...a month after that, in terms of the project plan, we need Planning [one of the two above] to make sure there's enough material, there's enough additives, the right people on board…Procurement [the second], obviously getting the materials on site for that because what we do is we got a very small warehouse, but we can't buy a month in advance, we basically do it just in time, the day before... Product Development: I will be in charge of the project...not

	necessarily on doing all the parts of it but in terms of managing it...my projects I am project manager. DM: The number [in the PD card] there is 6, there's some internal people there, there's probably 3 or 4 I work with, in terms of project team...and then also some external agents as well - I mentioned some design consultancies. EC: Do the external agents involve only on specific projects? DM: Yeah…normally it's their project, they would come to us to go to the next stage in terms of production line . The design development there it's certainly the majority of my time...certainly the next thing would be Sales involvement...I spent a lot of time on the phone with them...either humbling about [reflecting, discussing] or going to see clients with them or...they are coming in with the enquiries and then comes directly to myself...and then we decide jointly whether it's worth progressing. The Technical Sales Director is involved in that as well, you know, if it right for this plant, or the plant in SE, is it right for the business, you know, and how much time is it going to take. Stepping back from that, the QA side, long period now we have a process integration engineer who does all the measurements, CMM measurements, puts together the specifications, the sort regulations as well. Customer: that normally revolves with the Sales...normally I speak to them [Sales], I need to speak to these [customers] to get further indication to what they are after, if I have more questions on the information that the Sales guys had at the time etc. These ones just occasionally, already mentioned Procurement and Planning...really that only happens once projects are live, you know, we've ordered the tools, it's coming in, 16 weeks' time, in 20 weeks' time I'll make sure there's material on site and machinery, people...and he [MS] will be involved at the time but then it moves to that stage as well. Customer Services as well, let the customer know, making sure that these 2 work together (Production Operation-Procurement-Planning] ...He can only plan it only when he knows what else is on...so that machine might be in use for somebody else...
25:22.2 - 25:24.5	**Links with SE (**after asked by EC) DM: My boss is down there...I work for the technical director who is one of the 5 main directors owning the company...We meet up once a month...which is normally , we've a management meeting once a month and a Sales meeting and I'm part of the sales meeting. So I report on the projects that are in development. We share the same Sales team [with SE] and I report on our development for both sites.

	EC: So would you get involved in a product development that might end up being manufactured in [SE]? DM: Yes, absolutely...we just had one this week. EC: So in that case would that be a different person to disguise? Would you have another Productions Operations guy or this would...how do you liaise with that person? DM: Um…on that particular project I would hand over...err...you see it just happened last week, we designed something that was going to be made here but instead it is going to be made down to [SE]… It would be more the Technical Director who would be going through down there... Even if they put the technical there i would be...cause you would then be taking...I would still get the parts and progressing with the client...but once the first productions are out of the way then we'd be down to [SE]... so yeah we've got the same [person, pointing at Production card]. EC: Is that the same person? DM: The technical would be different... EC: So you'd need a different card there... [EC reflection: The Technical Director was already placed in the group with product development were DM indicated 6 members in total.DM suggested to put 7 instead of 6, yet EC felt that the circumstances are different and thus would be more appropriate to add a new card. That is, on a different project where manufacturing is taking place down to [SE] there are different people involved.] [EC rearranged the cards at the uper right corner where the cards 'Product Development' and 'Tech' were...DM then suggested that perhaps best way to describe this is that there is a Technical team to both sites.] DM: There is a technical team in this company on the Product Development and then you can call a technical team down to SE, which is the Technical Director, the guy on the CAD as well, so there are 2 in total. Internally we got Design Engineer, Technical Manager, and the process integration Engineer... **Interactions done.**
29:46.8 - 41:04.0	EC: So, nowadays when you're actually looking at a new product development, are you consciously looking for IP protection? You see that as a value?

	DM: Yeah...absolutely...I've mentioned that before...we give the client some brand protection...this particular one is for a new [child resistant pack] ...it comes out later this year...they're going to be the first in the market with it... it's a good project in terms of...it didn't take huge amounts of development but it has been quite tricky to get one and get it through the child test. **Quality of communication** DM: It's a tricky thing really because we are such a small company and you know most of it is on site, most of it within that room or at the end of the corridor...I have been here for so long...we don't really have any problems with anyone...um... Customer: that's probably the most difficult one...one because you are not on site with them...everyone else is on site... EC: What about the sales team, do you have regular meeting points every month? DM: No, it's basically all the time...it's normally always on the phone or emails... In terms of quality of communication you could say it's not as good, but in terms of amount of communication you can say is more...it depends on what we are trying to do,...is this quantity or quality? EC: It is quality we are looking at now. DM: I will start with the best ones first... [placing arrows on the map first-inaudibly] Do I have to use the yellow one [weakest]? Because I'd think that yellow means bad communication and I don't think I have bad communication. EC: You could see it as the least of the three. DM: Yeah... he can be a pain [pointing at Production card, bottom left corner grouped cards] EC: Can you tell me about it... DM: The production manager really on both sites all they want to do is ...they get as their names suggest, it's Production, and that's how they are monitored...and new product development gets in the way of production because basically developing on site there going to be trials, people are going to be trained, so you know..the hardest bit is getting him involved early on with the ...he's invited to all the meetings, whether he comes in all...he does his bit to be fair but relying on him then sort of he is in the project in the guys in the shopfloor...he is the 'mouthpiece' really from the development side to the shopfloor...

	EC: Is he managing the 100 people in the factory? DM: Well...he is the factory manager or production manager, and then we have a number of team leaders...and then the team leaders are in the charge in the sort of... EC: Are they divided to particular functions [expertise/specialties]? DM: Yeah...um...it's more functions, it's blow moulding or injection moulding or assembly... and that's really...I wouldn't say the communication's bad, but if it could be improved you know once it gets to the shopfloor everyone's on board...but I say the only thing he want to do is like 'fff, the machine is still..', you know, …'it's out of production to do a trial…', you know, '…I'm going to be marked down for that.' ...in terms of development to anything we can do offsite is better but you know, we haven't got infinite amount of money so some things have to come in here...I'm a great believer of the right machine...you know the machine is going to run production - that's a really important part...We do use toolmakers that have their own moulding machine to trial, but in terms of the final adjustment of the tooling I always like ti in here... Planning & Procurement: Good communications with the girls that are in there...whatever I ask they are absolutely very accommodating...it's just that I don't ask them that often...we haven't got that many projects on so it's not ....it's once a week... EC: But when it happens it's good? DM: Yes it is EC: Then why not use the red arrow? DM: Um...[bit confusion with the arrows' colour indication again - DM notes that the colours for him indicate that on a scale of 1 to 10, the lighter yellow is a 7, and the rest onwards 8-9-10] DM: That's what I was trying to get at the start...I don't have a bad relationship with anyone…If I did I would do something about it...I'm a great believer in a happy team, and involving everyone, you know, and over the years it has developed very well...it hasn't been in the past, you know, there used to be 2 separate functions development and production, and never would come in contact...but the problem with that is that you land on their doorstep and they are already negative…"it's not going to run nah, nah..." Product Development: We are sitting in the same office, whatever project comes up, you know, we're not a massive team now, so what we tend to do is just have the design discussion we sit down, brainstorm a few ideas, go away, come back, and that's when it's needed, there's no particular, you know, we don't see in Monday morning, we're going to sit down and go through it …that's just as it went... EC: Do you ever encourage people like your Operations

	Production Manager to get involved in any of that? DM: Yeah we do, as soon as...what we tend not to involve them in the sort of particularly, the design stage, if it's something that is totally new to us we would sort of get them involved, at a stage where we think alright this is going to happen... it might not be signed off yet but, you know, now is the time to show it if you have a real problem with them...and normally by that stage, we've designed it, it's not certain tons but you know, we've designed a valve, a tooling or certain rapid prototypes have been made, the clients indicated that they'd want to go ahead with it, you know, but what we haven't done is, we haven't ordered the tooling, and at that stage if needs be, not that I remember ever happening, but we would just...if they said 'I'm not happy with this', we'd just stop all tooling…and go back, you know, it'd be a bit embarrassing going back to the client at that stage but there's always an option there... Once we have the signed drawings, we then take it into the SLP we have that any changes have to go through a special change control, but we don't do that before this first, signed off the drawings by the customer to go to tooling, because it changes every day and there's no way I can put it just ...so it's only once we get the signed drawings which we order the tooling on, any changes on split lines or kind of a radius here etc., all of that… We've got a fair idea of what we can get away with but if it changes then we got to get the client [to confirm], we've got to change it...but at that stage again we're back to the question...that's when we've got a project meeting with everyone involved, so we have *Production Manager, *if it's IBM we have the chief IBM technician, * we have QA in, *we have Sales in, *Procurement, *and Customer Services...and basically that's normally a PowerPoint stating; this is a project, we've won it, we're going to need a tool, planning when the tool is going to be finished here, here's the project plan, I need you to order the materials so it comes in...we had a massive warehouse in the past, but we haven't now, we've got a very small and everything is delivered just in time -I think material we have to get, we got silos, but if it's master batch it comes on the day before we use it. We don't make any stock...well, saying that, there were a couple of projects where the clients insisted on safety stock, but apart from that we don't run on any product - even our standard range that we get pretty sure that it will sell, we just make it to order. That means a lot of tool changes, but we're looking on that... EC: How do you record, store and disseminate project knowledge? DM: All the projects, in terms of our projects, we give it a number when it comes in, and all the supporting data is in the project file...so, you know, in theory if you wanted to repeat that project we've got the file and everything would be in it. EC: In practice? DM:...um...to be honest most of it is on emails...we used to print off

	everything...now, I think if you wanted to do it, one you'd have to go through my email and probably the links to that is the Technical Director, we would have his emails in terms of the production tooling, the QA I would have all the emails, the materials, the specs, the sheets... EC: I guess what I wonder is how does a novice integrates within current practice, how does the learning occur? DM: I knew you'd ask this, I saw it in one of your emails...that's a tricky one, really, and I would...we rely on having somebody...saying, at the minute, without me you would be on your own...If I was run over by a bus it would be quite tricky for somebody to come and take over...we've always had two at least designers, in addition to me...and we are talking about getting another one now, just really to almost…I'm not sure enough but to get an idea of the system, the way we do things, where to look...it's a lobby here! you know, our clients expected...you know...we have to have our project file, we have to be ready for them to see 'get that signed drawing out from two years ago...' but somebody who comes in tomorrow and nowhere to look, he would have a real difficulty. In the design site, none of this would really come out...it would be...again because it is so small you can model your way through it...cause I had to...no one showed me how to do it but I spend a lot of time here...but you could make it a lot easier. EC: Do you do things at the end of the project, you know, you're saying you're taking something from the first production batch or the pre-production batch, once you've validated it...do you do any sort of meeting of the team and sort of use that to disseminate, you know, perhaps talking to shop-floor or the production manager? DM: Yes, we have done it...as a matter of course we don't but when we are deciding on what projects to keep, there is a big session finding what products we had, what tooling we need to update because certainly towards the end of 4 years ago we'd just run it, cover it up here, cover it up there, 'just keep it going wherever just don't spent any money on it...we haven't got any money, you know, the money is going to that factory over there'. But the new guys said 'right' we call it the hit-list, which is basically what tools need to be replaced or fixed, they said 'nothing, no tool is running down' we either fix it or replace it. And that went through all the projects in terms of tooling...in terms of new projects, to be fair we don't have like a debrief...we used to do FEA sort of techniques, it wasn't a full one...as like a formal thing...but it would go over on stuff that you know…a lot of the stuff we do is variation of a theme we have already done. It may well be, thinking about that, because what we have got used to is the same team...I've worked with these guys for years, it hasn't changed since [SE] took over, and we know how each other

	[works] and even though we are not doing it formally we're doing it anyway…as you mentioned, if someone new came in and I have mentioned the guys here..is that, we are vulnerable in terms of, you know, if I get another job or got knocked over, there's not somebody that would sort of just step in... EC: It sounds as this is something that concerns you...how do you deal with it? DM: Yes, it's been mentioned...I've certainly mentioned it numerous times. EC: What are the difficulties you encounter for finding a solution to this? DM: Well, at the minute the costs are well held...it's quite hard to justify it because 1) it's safeguarding something that might not happen, so it's a risk and probably a risk that we will take...probably it's very hard to justify an extra person in terms of work, at the minute...but the way we spend a lot of money on the sort of advertising, you know, like we're on different search sites now, we've done all these articles, we have a new - what used to be the factory manager here, the CEO for this site, he's taking over the Sales directors job and he is really enthusiastic and the signs are pretty good...because it's very easy for me to just have too much work...a couple of projects and the day to day stuff and all the drawings have to go through me, any changes to existing products on the shop-floor have to go through me, the Sales meetings, the Management things...I'd love to be designing all day but I would think it is probably 30% of my day maybe. There's 3 or 4 of us that know the system [meaning NPD process] of developing products...they wouldn't been doing the design side, if I wasn't here...but they would be working with the design consultancies...certainly, there's no illusion that if I left the place would not come into a grounding halt...they would find a way through, but the worrying bit wouldn't be new projects...it would be projects that are ongoing [consistency]. I've worked with a lot of clients through years and it would be hard also to keep them on board as well…Company wise it would probably be better to have someone who has a list of people, has a face and a name. About using Pro/Engineering: We looked at changing it quite a few times but we've got so much legacy there...and everyone's pretty well trained up on that. Relationships with [SE]: It is really that idea, you know, getting out there, developing products, as I mentioned this morning, forget about waiting for us to be asked...I would have a list of things I need developing which the Sales team or Director they've heard a whisper that there's a product out there that needs this type of dispenser or...and before, hopefully before we are asked we'd have it already designed...and again a lot of that we've designed for other people and brainstorming sessions hasn't been ideal but...you know…because I've been here a long enough I'm going 'Ah, I remember that, I'll fine tune it and change the volume of that and that would do for these guys...'

Appendix 15.
Sample of Pharma
Case Study Interview (2)

Name: CS4 Pharma - General (Site) Manager

Timespan	Content
0:00.0 - 10:00.5	Position: Site Manager Working 10 months in the company SM background: Technical...started as an apprentice tool maker a [company1], during the apprenticeship I continued further education at the college of art & Technology, did ordinary and higher certificate in Engineering, decided that my career laid outside the tool room, and enrolled to an honors degree in Mechanical Engineering at [*] university, moved into the Manufacturing and Engineering department at [company1] because of the new skills, I worked there for 11 years and then I was made aware of a local opportunity called [company2]which works in a completely different engineering sector,[company1] is a very heavy engineering -turbine generators, [company2] at the time worked in the automotive industry and they wanted to start a new division in the north of England to make [parts for] motor vehicles... I went there as a **Technical Manager** to write specifications for all the machinery etc. and then eventually run all the technical functions on the site and all the engineering functions, product function etc. Then became the MD of the company. [EC's notes: After a long time spend abroad with his family, returned to the UK and looked for something local with the experience of 11yrs in heavy engineering and 14 in the automotive industry]. SM about his current job role: The product is a learning curve, manufacturing is not a learning curve, I've been working in manufacturing for the past 25 years and the problems are the same wherever you go, that's the reality...the difference in this business is that I am in effectively a satellite site…I am the General Manager [in this site] and [this site] does not have all the services[here]...for instance Sales and Marketing are centralised out to[SE]...Product Design, although [DM] is here, he is officially centralised down to [SE], he just happens to be located in an office at [Pharma]…so, Product Design is centralised, Purchasing is centralised, although we have a person on site who does expenditures - not really contract negotiation but expenditure ... Sales and Marketing are centralised...and the Board of Management, the 5 owners of the company, are also based at [SE]. So, [SE] has central administration and then there are two manufacturing facilities, each with very similar capabilities, each with a very similar customer portfolio and each with a remarkably turn over…each plant has 12m turn over, each plant has about 130-140 workers on the site, and each plant has very similar technologies...they complement each other very well. It's not very surprising, this company was in administration back in January 2008 running financial difficulties...[SE] and [Pharma]who were 2 separated companies at the time were very big UK

	competitors and it was only a matter of time before one of them go 'bump' ...[Pharma] was the first to go bump and [SE]bought them...effectively you have the 2 biggest UK competitors merged into one...but they are remarkably similar in many ways. [SM comments on the cards and parallel activities: some of these things have got similar things written on...this card has Administration and this has Administration Supervision...now everybody does some level of Administration...it's up to you, I do both...It's the same with Procurement, I don't buy anything but I do procurement supervision...I don't know if you have one but we will see as we go through.] Production Planning: yes, I am responsible for the Production, the planner reports directly to me... Manufacturing Supervision: also… Shop-floor Manufacture:...er...you have similar things here...it's a question of where to draw the line... EC: Shop-floor refers to the workers in the factory whilst the Supervisor to the person who supervises them... SM: that's what I am saying, the Supervisor of the factory reports to me, the people report the Supervisor...that's what I was trying to... [Realised that he was talking about people that he interacts with and not his own multitasking roles]
0:00.0 - 20:21.9	Parallel Activities HR: I write some of the policies...not all of the policies, I validate all of the policies but I only write some of them...things like corporate social responsibility, ethics, things like that, higher level policies, not the ground needs policies but the higher level ones there, I am actually writing these myself. EC: How do these policies disseminated to the company? SM: Policies that go to the HR policy manual are then cascaded down to a handbook which goes to all staff, it's revised every year...if you get to the business as a new employee you get an induction plan which has the main policies included in the induction handbook. Finance: I'm heavily involved in personal union in the operative planning, the yearly operative planning for the next financial years...during the months of September, October and November, I will work directly with the Financial controller of the site to prepare the business plan for the next year.

	QA support: Similar to the HR, I write some of the policies...It's not always the case of the QA team to write up all the policies...everyone on this site has the right to write a policy...you might find it unusual for the General Manager to write some but I do...if there's a particular issue which I want accelerated I would write the policy myself. CEO: Absolutely right, I am effectively the CEO of this business [meaning Pharma's site] Costings and built materials: I don't get involved unless there is a change of materials which then has to be authorised by me. I only get involved with Costings if the costing generates a situation that could be marginal in terms of return...so...let's say that for certain products we have certain guidelines in terms of the gross profit that we would like to achieve from our part...if you fall outside from those guidelines it then falls at the hands of the General Manager of the production site to decide whether he can recover to a good situation over time with a set of actions or he has the right to say 'no, we're not going to offer that product because that would put us in a bad position'. EC Is this with regards to technical capabilities? SM:Yes, but also our commercial vulnerability...it is actually at site level...the sales department who are centralised will get the enquiry and they will crunch the product costing with the Technical team in the first round...but to actually decide to move forward and offer it to the customer becomes the responsibility of the General Manager of the site...the General Manager decides whether the contribution is significant enough to warrant placing the offer...if it's not he has two choices: a) 'no, I'm not happy that you offer that' or b) alternatively, 'I am happy that you offer it but these are the things which are going to have to be done before it comes into production in order to bring us back to a good cost base'. Manufacturing Supervision: it's straight forward of course, I am...we have a fairly flat structure in this business, every manager of the business reports to me…it's very simple...so, yes MS, yes Administrative Supervision...I try not to get involved in their daily business, although only to stir and guide a little bit...that doesn't mean I don't do some things in personal union...especially if there's continuous improvement activities going on the site...I'm a quite active player, I like to be on the teams...but that again it's just to make sure that the teams stir the direction that I would want them to be. Design Project management: Anyone in the whole organisation can be nominated as a Project Manager...anyone. When we win a new project, our system is, one of the first things we do is we nominate a Project Manager for that project. EC: How is this happening?

	SM: It depends on the type of the project and the skills that people have got in the organisation but as you could imagine...you might think it's straight forward, let's say we win a new project...logical thing would be to make a project manager probably the Technical guy, or the Quality guy...you know what I mean...someone who's handling most aspects of the project. But if we are running 20 projects at the same time you cannot get 20 projects to one person...so we have on our project management sheet the ability to nominate a Project Manager who 9 times out of 10 is the Technical Manager [refers to DM] of the company...but not always...and also on capital projects it's specific, which are not linked to new projects, we have the same system...you know in capital project it's quite often the person that initiates the idea so If I say, you know, I've got 3 silos of material outside, the silo delivers the material to the machines, and we've got another 70% of our business which we deliver from our batch stock which is heavy label intensive...if I say tomorrow 'I don't like this logistic situation, I want to put another 10 silos, we're going to need 10 people, we're going to do this and that...'. If I bring that idea to the table you could be sure I would be nominated as the Project Manager to realise this ...you are the person who brought the idea, the person who crunched the numbers, who said 'if I can do it I can save 4 people, I can do whatever', so you put your name behind it and you've got to manage that capital project from that point forward...of course you can use people who delegate certain activity, but you retain the control. EC Who takes the decision for the person, is it a collective decision or...? SM: If the General Manager of the company doesn't make it, it's made by the Board of Management...there are 7 people on the Board of Management, 5 co-owners and the 2 General Managers of each site which sit together once monthly. Quite often on those meetings we will talk about large capital investments that are coming through and the question that will be asked is 'who's going to be the nominated Project Manager of that'. Sometimes it is not necessary because the General Manager at the time of posing that application has already proposed somebody...but if nobody has been nominated on the sheet the question will be asked on that forum. Contracts team: I am directly responsible for setting all contracts…and whether they are for third parties, whether they are for employment contracts, whether they are lawful obligations, it's not done by the Board of Directors, it's done by the local General Manager... EC Do you also deal with IP issues? SM No, not IP...IP is centralised because Product development is centralised.
20:21.9 - 20:26.2	*InteractionSM

	Site Manager [that is me] Designer/PD/DO Planning QA [Customer: SM comments on the card; the customer wasn't in the green pack [multitasking roles] by the way...' EC: It normally refers to the external customer...are you a customer? SM: Yes...I am the end customer sometimes because we sell into company...so I can be the customer to our [SE]facility. EC: That's great information, it's now recorded and noted down, thanks.] Marketing: I don't think we have this here...it's a funny thing but we don't have product marketing here...we have a website, it is all I would say...we have people that work as business development managers but I don't know how that would be market...so I would say no to this card...In my opinion! [Issue with the card Systems supplier - SM: hmmm, no, not really, systems supplier - if you had Suppliers which I didn't see already the answer would be yes but this is System Suppliers... EC: You could use this card as Suppliers instead, that's not a problem.] SM: There is one noticeable missing...External Auditors [EC creates new card]. [After SM's selection of different functions EC asked whether each card represented a different person and suggested that in the case where a person had multiple roles then the cards should be clustered in a group. This led to regrouping and rearranging the cards] SM: There is one missing... IT. EC created new card]. SM: Another one missing is HSE - Health, Safety and Environmental - it's a separate part of our organisation... Also, another one missing is CI - Continuous Improvement, which is another separate part of our business…runs completely independent, to all other functions...because it runs as an independent it's directly reporting to me and this is very very important because very often they hit roadblocks… [both cards were created]

24:54.0 - 29:54.8	*Population* Sales: I see 3 different Sales people, and a Technical Sales - one more... and I actually see a Commercial person, is a slightly different version.. EC: What does he do? SM: He does product costings, customer contracts... EC: Like an Estimator...? SM: Yeah, like that. [an Estimator card is added to the map… 2 people there.] Management: I am going to exclude the management of this site...I take only the central Management... over and above the CEO there is 5 more which I interact with...on a regular basis, in [SE]. QA: regularly 3 Manufacturing: 1... the way this organisation works... EC What about the Shop-floor card? SM Well, I have an Operations Manager on this site so...you know, strictly speaking I do what I shouldn't, I should go through him all the time...I don't, but I should. Finance: directly 2... one here, one in [SE] Suppliers: various…more than 12. SM: Let's do it how it should work...and how it does work (he attempts to change the population on certain functions] EC: I'd like you to keep it to how it actually works instead of how it should...it is more realistic and this is what I am interested to know about. SM: Okay, that's fine, I wasn't sure if you wanted to know how the structure is meant to work or how it's working in practice...then if we are going to admit it truly representative we need to put 2 in there [Engineering - it was 1 before] because I talk quite often directly to the Maintenance Manager ... and in here needs to be not 1 but 5 because there's 4 shifts Managers who, whoever is on shift I talk to.
34:03.3 - 51:03.2	***Frequency*** [SM places the arrows first.] SM There's probably 3 reasons (why the frequencies are like that)...one is that we are going through a big Change Management program, so we've embarked on a Change Program with the Manufacturing Advisory Service (MAS), we have 2 people in the workplace being trained up as permanent Change Agents, who were on a yearlong Masters class to learn Lean Manufacturing techniques and as a result of that, during the year which started April 1st this year and will finish March 31st next year, we have a

	series of workshops going on in the business so... Manufacturing, Engineering, Quality, CI...it's a very intensive year for them and I'm the leader of that, I'm the guy who initiated the programs and deeply involved with those guys... The second reason is that we are a business of growth, we are expanding quite significantly, so we have high project activity...and again you have the same groups of individuals who are driving those projects, Quality, Manufacturing, Engineering. EC: How do these new projects initiate? SM: The strategy for...the markets which we operate in and the sales we try to attract are driven centrally. The only thing which we do on a regular basis is to advice the Sales team where we have excess capacity which has not failed...and also the limits that we would go to attract that business...so, I said we have fixed and firm guidelines as to what margins we would accept on products…that depends whether we've got available capacity or not...clearly if we have some areas of the business, some technologies where we have available capacities, we might relax our guidelines...and that judgment is made by the Site Management teams...so I would regularly, at the Board of Management meetings say 'okay guys, on extrusion blow molding I've got one and a half million pounds worth of sales capacity...or so many thousands of hours...on that particular business I know that I normally insist on a contribution factor of X, but on this case if you can fill that capacity I would accept Y...it is a largely driven, the strategy is largely driven from the Sales department themselves, but there is some guidance from the business to where excess capacity might become available because projects have died or customers have left the business, can happen also... The other area which is strong and you can see from the red arrow is Finance...it's not an exaggeration to say that I spend a proportion of everyday with my Financial Controller on this site because I keep, I like to believe I keep quite tight control of what's going on the business. EC: There is no team in that function? SM: No, on this site there is only one. EC: Is he a Financial Director? SM: No, his role is predominantly profit reporting...Down on the [SE] site there is a Financial Director and there is also a Credit Control there in site, we don't have a Credit Control here, we don't deal with invoices...no book keeping, what we have is true financial control, someone who does profit reporting...we have a Management Accountant, a qualified one, he's not a book keeper, we don't have any book keepers on this site, these are central activities. Obviously there are some intense parts of the year, we are in the middle of the Planning for the next year at the moment so, you

	know, we spend a good proportion of everyday for the best part of the month where we work on the financial planning...at the start of each year we have financial auditors in, doing external audits on the company, again we are spending large proportions of our time together...outside of that is just managing the business on a daily basis. That's why the red arrows are red arrows... The next level down which is down from red...you'll see HSE, Customer Services, IT on this site, HR, Logistics, all are key processes on this site that I interact with on a regular basis...but not as regular as the other ones [red]...there might not be everyday ...if I put a red arrow on, I'm interacting every day...if I've put a just less than red arrow I'm interacting more than once a week with those. EC: What about IT? What's happening there? SM: The IT is largely Systems Development and because we are going through a big Change Management program which is about a lot of the systems...so IT might be something that one day is this color today, red, and yellow any year's time...it's current state…but I agree, it's not normal to have that level of activity with IT, it's very current. EC: Could you please tell me about the system's changes you are working on? SM: Ah, yes, we are trying to implement in Manufacturing Techniques on the shop, eliminate all wastes, reduce all non-value added activities, change the balance of non-value adding activities to value adding-activities...it's a cultural change for the business... EC: Where these techniques are coming from? SM: Lean Manufacturing techniques are something that my former company was very well developed on...we were a world market leader in the automotive industry which is a very demanding industry…and you can only become a world market leader if your Continuous Improvement programs are very active. So, yes, it is something that I am very familiar with, when I came in this business I was a little bit surprised honestly speaking, that we are operating a fairly heavily regulated industry because we are working with prescribed drugs and the systems and procedures were not what I would consider to be efficient and being robust. So this is something I'm seeking to change and change very very quickly...and a lot of people in the business are struggling to keep up with that pace of change...and that's why I had to take somebody out of the business and then enroll them in a CI position permanently in order that there is someone that is driving the change in the business...and someone who can make objective decision, who is not influenced (points to all the functions of the map). He [CI] is a change agent...because he reports

	directly to me, any obstructions [points again at the functions] that he may had driving the change in the business of course can be knocked out. EC: Is he a part-time employee? SM: No, he is a full-time…he is an ex-Shift Manager from this business...I've taken him from his position for one year, I've actually taken two out of their jobs, I took one of these guys [Quality] and one of the Shift Managers...but it's a little bit complicated...I have one which is really dedicated as a CI guy and another guy who let's say getting the training but he is not tagged on that role. EC: In terms of the systems that you are trying to implement, are you concerned at all about the fact that these derive from larger organisations? SM: I don't think that the size matters, I think it's a mandate; I'm not talking about buying expensive systems. EC: Much is being said about small businesses and their competitive advantage being characteristic of their informal structure. SM: I don't think so, I think the way of this company is inefficient...it wasn't quick at all, that's part of the problem...it's very paper driven, it's very labor intensive business, it has no systems or very limited systems, it's control of data and therefore its analysis of data distribution is slow, it's inefficient...and that's what we are trying to change...and many of those systems you don't see it here, I write them myself! Because that's what I do with my spare time...I write Systems. So the reason I'm working with these guys is because I'm actually writing these systems. The Quality Management system that is being run in the business was also written by me...and I'm not talking about procedures, I'm talking about physical hard systems so... that's the reason for the second color down. SM: If I talk about the oranges [arrow color], I would be talking about people that I wouldn't necessarily interact with every week. EC: I see that on PD and Sales [cards] SM: Yes, these are central functions...all along the top ([refers to cards' map] are central functions...cause we said before this is not the management of this site (pointing the Management card), so these are central and because they are central there is no guarantee that I will interact with them every week...same with the Customer [card]. EC: When do you have to interact with Sales and PD? SM: PD on a new product development, quite frankly, if there is a new product into the business we will have Project Management, we liaise quite closely...also input into conceptual designs, advice

	on what's cost effective to manufacture, what's not cost effective. Sales: minimum once a month where we are given feedback on how the sales are going in the business, whether they are going slow, who's up, who's down, where we see particular risks that they may not see...they might be thinking about developing the business but they are not looking at what is happening at the existing business. Tech sales: it's the same but more on a Project management capacity. Estimating: every new enquiry that is coming in is fed through this site for some level of comment or analysis...especially if the cost looks marginal. Management: meeting with them once a month, the CEO (card) and another 5 member of the board. EC: Anyone else that joins these meetings? SM: No, only the general managers... Planning: you may ask why this is not one of the core processes but the truth is that it is causing very few problems so that is why, the person there is very efficient, i have very few reasons to talk to. Customers: only when there is a customer visit or in the event of major quality consent, when they escalate it through our organization, they come directly to me. SM: The yellows clearly are less frequent... EC: What about the external auditors? SM: Well, there are several external auditors, the main one is the Financial audit, they will come in for two-three weeks a year, they will go through our Management accounts...part of that process is to interview the Site Manager and talk about all the corporate compliant type issues, whether there are aware of fraudulent activities in the company etc...We have to go through this every year. We also typically have Audits from our Insurance brokers, you know, who go through what's been happening in the business the last 12 months, where the risks are... Suppliers: only when there is a significant claim and our normally Purchasing or Technical guys are having difficulty convincing the supplier to 'cough up'. CEO: clearly I have more interaction with the Board of Management than I do with the CEO...I will only see him at the board of Management.
51:03.2 - 1:02:04.4	***Quality*** SM: The communication at the board level is very good to be honest...the board meeting that we have every month is very well structured and I would say that it's efficiently long in terms of

	period time to cover up; we have a full day long meeting, 8 to 10hours, we cover most aspects of the business. Where I would say the business as a whole has a communication problem is between these functions [pointing at the top of the map] EC: Could you show to me through the arrows? Again, the red refers to most effective and yellow to least. SM: You are talking about effective communication of me or across the business? Because there is a difference, I am communicating quite well communicating. EC: Exactly, what I'm interested to know is how you are experiencing the communication amongst the different functions and whether you find things working well or not. [SM places the arrows at the opposite direction facing him] EC: is this about communication towards you? SM: It's about communication from them to other areas of the business...I'll tell which ones are not as strong...I'll stick at the yellows for the moment. Suppliers: Our interaction with suppliers is terrible...speaking honestly we have no relationship with our suppliers, it's a big problem of the business, big big problem. Suppliers in this industry are too strong and we are too small, so there is no relationship building between supplier and customer, very very difficult. Customer: Information coming from them is not always accurate...it can be often quite misleading because they don't want to tell us everything that's going on. Sales & Estimator: Information coming from our Commercial Department is also...I would call it 'not real time'...they may well have a very good impression of how the market developing but they can't tell you what's going to happen in the next three months. So, that in itself is, I don't know if it is poor communication or they just don't have the information in hand. EC: How does this affect the business? SM: Um...Planning...it is very very difficult in the short term. EC: Do you have an example of an affected project? SM: Yes, we have plenty good examples; we won a project for a company which is based in Ireland, it's an American company, should have started manufacture 2 years ago...bought new machinery specifically for that project, the project is still not in production yet, it is still in discussion. You'd have to ask this group of individuals to tell you 'Why?' They don't share information readily....um...difficult customer, difficult approval procedure, but at the end of the day all projects related, time delays are due to not understanding the customer's needs...and they then communicate

	that wrong impression to people who use that to make judgments on how to prepare the business for that new project . EC: Where does this information hit first? SM: It can go anywhere, really...but generally it should, I emphasize 'should' be going, because I am here only short time so I can tell you where it should be going - and that is through this guy [pointing his own role] into these people [Engineering] and to these people [Board of Management]. Nut in reality in former times that didn't happen. Because in this site until I come, August this year, there was a Technical Manager...what happened was is that it didn't actually go to the General Manager, it went to the Technical Manager...the General Manager in former times wasn't involved with all the functions as I am now…so, I'd like to believe it will get better in the future because before there was no central point of contact [pointing own card], what they did was they went to several different people on what they thought was a common level but it wasn't a common level, so... the information is inaccurate coming from these functions. To be honest, without putting reds to the rest, I am quite happy with the rest. They are not the ones which I would consider to be in some way weak... EC: A last question; What do you consider, while being in this company the last 10 months, to be the competitive advantage of Pharma that drives innovation? SM: We have a very very strong technical competence in the company, not only in PD, [both DM at Pharma and [SE's Technical Manager] have now many years of experience of rigid plastic packaging development and have been very innovative, I'm sure [DM] showed you a work that we've done very recently...but we have a very very strong technical support on processing - that support is coming into the company from other much much larger organisations. EC: You receive [outsource] it you mean? SM: No, we have it, we own it...but it came out from much bigger organisations, very very well-schooled people, so we have a Technical director in [SE] with vast amount of years of experience...we had a Technical director in [Pharma] who is now working on a central level in Technical sales who is a similar level…and we have Engineering support on both sites again ... I think most of the technical staff in the business are 15 years or more of experience in this industry. EC: So it's a knowledge asset... SM: Yes, absolutely, it is a knowledge asset...but also this company has a lot of IP, a huge percentage of its annual sales is its own products. A much higher percentage in that that'd be sell with other people's IP, we do have some projects where

	customers own the IP themselves because they own the tooling, they own the design rights, but a big percentage of our products, 60% or more are our own standard products so we have a huge range of weapons in our armory that we can launch in the market place that other people are unable to offer. So it's holding that balance with the IP, because this is an industry that is fairly easy to copy. So what I think what this company, specifically [Pharma]particular over the last years, has [is that it] really tried to focus on the safety aspects of the plastic packaging - we have a huge range of child resistant closures. A lot of the industry went for the cheap plastics, speaking honestly, but this company went into a completely different direction and said 'okay, even if it's not legislations today, then in 20 years' time everything will have to be child resistant, so why don't we make all our range standard child resistant or at least give the option'. So we have one container but a choice of two caps...a non-child resistant and a child resistant fitted on the same bottle...and that's something that [DM] was heavily involved in, in that whole development of child resistant containers and for all of those we own the IP. So we have a huge knowledge base of technical engineering but we also are a company who has a high percentage of its products where [Pharma] owns the IP. EC: Things that make you vulnerable? SM: Price management. EC: Anything from the external environment? SM: Yes...suppliers...we have no relationship with them and we are very very vulnerable...I think this year we had 8 suppliers who have come forward with false measure notices which basically means they've stopped production of our own materials with immediate effect...that happened I think 8 times this year. And in our case, if it is a pharmaceutical application it can take up to 2 years to re-register our product...so if the supplier comes and say 'I'm not giving you any material next week.

Appendix 16.
Sample of BoPro
Case Study Interview (1)

Name: cs5 BoPro : Owner/Design Manager

Timespan	Content
0:00.0 - 7:43.5	***Highlights of BroPro's general information from the meeting with Owner/Managing Director, led by EC and two University colleagues** DMD: so the Rugby was a diversification and it taught me a very valuable lesson why diversification should be approachable thoroughly at the outset... EC: So, is it because of the sort of price-based competition in that market or is it something... DMD: It is to the Marketing Promotional site... EC: The site or the effort of the other companies...? DMD: Yes, they are presenting complete ranges of products, not specialist and niche ranges so...going in to a retailer, first question was 'why should I buy from you? I've got an excellent product...why should I buy from you... why should I open another supplier account for a niche product when I can get to [other companies] and I can get a good range and I can buy everything together...'. And you know I can give him a lot of unique selling points but not sufficiently dynamically different to persuade enough, in enough volume, to follow everywhere...and it's also very very much brand-driven... [DMD talks about sponsorship of a local rugby sports team] … so you know I had J.N. from the [rugby team] and others from the team wearing them - we couldn't sell them in the shop because [the rugby team] couldn't afford to lose their kit sponsorship by [another competitor brand]...so, it was...I was too small to play, I was being eaten, I was a little ... I had the product right but I simply happened...looked into the marketing and sales structure of the sports trade enough...I think you could do a better business study around that...as to why. So, now I have fewer diversification because there are hundreds of products that I could go, there's hundreds of sports, I've no problem designing products but I won't do it under my name unless I've got the marketing and distribution absolutely [in place]. EC: Given that experience, how do you look now at BoPro and where BoPro sits as a brand amongst its competitors? DMD: BoPro is still brand leader in the pedestrian body protectors, certainly for innovation and certainly for style and fit...and weather we are on value, I doubt it...because we are not on the value cheap end, I would guess that one of the Chinese or the Indian manufacturers probably getting the lead in sheer volume...but as far as design fit, brand, we are up there...in the countries for selling well into...there are some I've never cracked e.g. America. EC: Where do you see growth markets these days? Is there anywhere that you are targeting more?

	DMD: Yes, um...I mean we have very little sales in Denmark, so we need to talk to Denmark which is a specific country...there's all the Russian and Baltic states and China as a mainland...we see a lot of expansion in the BoPro brand, in parts of Europe we only selling unlabelled, we are now selling through a sales agent, and we found that our pricing structure from our top product is better sold through an agent because it gives a better margin...so there's whole piles of expansion just even within the market we are in.. Germany has become our second biggest market now and that's because we've employed world sales agents and sold directly to the shops so there is no reason you can't do this in France, you can't do this in Spain or Italy. EC: Does the Sales agent act like a wholesale or they just get a commission? DMD They get a commission...whereas the distributors have to put much bigger margins, they are expecting big margins so you...you'll have to knock back your price so far to remain competitive to get your sales. EC: May I ask what is the size of the company? DMD: We are about just over 2m turnover. EC: and in terms of staff employed? DMD: 22-23 employees. EC: Does this number include also the people working in the factory...? You do have a factory right? DMD: We do the final assembly here, it is on site here...everything we do, we make, we have a lot of products come in partialLy made or fully made. EC: So you outsource the raw materials? DMD: The foam is outsourced and the cover is made by a designer outsourced and the final assembly of the two takes place here. So, not fully factored and that's been a good move and we are not planning on changing that. EC: They are still considered a UK product because of the...? DMD: The changes in nature...neither part can be sold on their own...so it changes its nature from a cover and a foam panel into equestrian body protector, designated as made in the UK. It's also an IP protection, it means nobody has everything. EC: So the expertise BoPro offers is this assembly of the various parts into a useful product? DMD: Everything is down to us, every part we bring in is designed by us...actually...um...they've put in a technological slot at the moment of which I quite like [she means as a company description]. EC: Who did this?

	DMD: We think it originated from Manufacturing Advisory Service. EC: Right, and is this a slot that you would be more comfortable with? DMD: No, I'm quite happy...because somebody looked on my website and saw Ultra-flex technology and from then we said we work technologically advanced products...(laugh) it is brilliant, I'm very happy really. It certainly is by accident and certainly opens doors at the moment.
11:00.5 - 12:14.4	DMD: Once our expertise [was about] passing safety standards...I think I've probably underestimated my knowledge in that area now...um...and we are pretty expert about and in working with foam, cutting shapes that fit – it is easy to meet safety standards but it is difficult to produce something that also fits. EC: Yeah, I think there's a lot of other things in terms of understanding the material...because it's not just about cutting foam, it's understanding, you know, there's so many in depth research about how the materials behave...that's where we did work with [...] DMD: Yes, and it's probably not realising what you know actually...I don't think that I totally understand what my strength is. EC: Coming back to what you said about not knowing your strengths, I was wondering about the staff that you are employing, how do you choose the right people that eventually may add more value to your existing expertise and competiveness? DMD: I think employment is one of the biggest challenges for small businesses because inevitably if you bring somebody in with calibre, they will inevitably use you as a stepping stone to move on. And so retention in a very small business of high calibre personnel is a great problem, because they have nowhere to go... e.g. you are bringing a Purchasing Manager - he has no promotional prospects. He's fine where he is, he's coming in as that and so he either is going to move on to a bigger company where he can make an impact or he is going to stay. And if he's staying, he's staying because he doesn't have the calibre. So, employment as a whole for a small company is a big challenge...I have a mix of people here, the front of this [member name] who is with me for 20 years, she knows my company inside out and she does her job extremely well...and I think she'd be terrified in moving now because she'd have to learn and I don't think she is in her comfort zone. I've got [another member] who she's been with me as outworker sewing when I did the gift work (previously the company made gifts, it follows later) […] and I've got [another member]who lives locally, absolutely happy in customer care, she has flexibility, she is happy with her job. Front office, Administrator who I see personally… in the back I've got [another member] who came in 5 years ago, he was Purchasing Manager... and to be honest with you, I could do with probably more expertise in this area...but...otherwise he is my Senior Manager, he's been here 5 years, and he's doing the job...then I've got my Marketing team, they tend to change often because they are younger people who are bringing new dynamic

	ideas and they tend to use you as a stepping stone…so Marketing side I tend to look at more temporary people who are here less than long term...Designer I think is much the same, design tends to be a rotating personnel, [previous designer] did 4 years and I think that was exceptional... […] the last graduate stayed 1 year and I did not get any return as far as I am concerned and I'm still angry with her...that's bad return on investment for me, waste of time. So I've got to make sure, I think 1 year restraining, one year is return on investment and thereafter. So I still cannot forgive [previous designer], just because I've done the training, she only got just at the point where she was useful and she's gone. In the Assembly site is also self-trained, we bring people and train them, it's fairly unskilled in what they are doing... EC: Who is the trainer? DMD: Depends what they are doing...Design - I train, Production - I've got 2 good Supervisors and they will pair somebody with the appropriate people. Certain skills you get someone with certain ability and you train them within your particular products...the pack and dispatch, the final assembly you get people with no skills and is fairly basic. Assembly work we train in house…cutting, we train them...people usually within the Pack and dispatch move up out into more skilled...they move into either to selling or quality, or into cutting...most of the other coming from a basic level. EC: And those people are more stable, aren't they? DMD: Um...yes...I don't think people approach working quite the same way they used to...particularly if you are rurally located, somebody would come to you and might stay their entire career with one person. But I think the mentality now is people simply don't expect to stay on one job for any length of time...so I don't expect to retain my staff necessarily for any length of time. EC: Is the business seasonal according to specific events etc.? DMD: We are trying to make it as unseasonable as possible, the mix of customers helps. We have export customers based in ...you know that diary (points on the wall were a monthly calendar is) shows the export orders...err...April was quite acquired and May […] But yes it is slightly seasonal, this season, the back end, back 6 months are the busier than the front 6 months. EC: Where do you think there are opportunities still that you haven't investigated...have you got any field like that at the moment? DMD: Longer term, definitely, I mean, diversification has got stayed within the sales/marketing sector...Technology is starting to emerge and I certainly want to rule it in or out...that would be collaborating with somebody who is already in the dynamic market...I mean the dynamic expansion as opposed to slow and permanent, quick inflation, quick deflation...I don't know how it's called. EC: The airbag... DMD: Yes, it's the airbag, exactly…there's one guy that creating the

	market and he is doing a very good job at that...I'm sitting on the safety standards committee that is looking right at the standards...so I'm missing lot of knowledge. I'm about to contemplate starting the research to see if I can find someone to pair with, someone to collaborate with, who is perhaps in the motorcycle market, or the automotive market... EC: How would the partnership work then? DMD :They would have the air technology...I'm looking for the air technology.
29:19.4 - 51:54.1	EC: So the range, you talked about Rugby being difficult because you hadn't got what the retailers would considering complete right? DMD um, yeah, and I just haven't got the money, I don't have the finance to really pursue the marketing to expand. EC: My feeling is that there is always a way of creating innovation...I think one of the biggest pluses for BoPro is the whole idea of contour and fit which a lot of the other products seem to lack. DMD: Yes, exactly...it would definitely have to fall more into that and fall into that market. EC: If you are in a retailer with two other body protector manufacturers, what's the thing that you want the retailer to tell they going to educate the customer about your company as opposed to, you know, the way it does this here and there on the product base. DMD: It's all fit...my theory is that a saddler by BoPro is a range that can fit 100% of people who walk through that door and want a body protector. And we've got a wide range of stock sizes and we are good at making garments that fit people, and then on top of that at the marketing end we offer a bespoke fit if somebody falls absolutely outsized. So, by stocking BoPro we want our garment to be the one that they pick up first. So, if they are selling to a customer they will pick us first because they know they can get a fit, they know they can get a sale. There will always be cheaper ones, I'm not trying to enter the market at the cheap end, because the very cheap end, their fit is 8 sizes that fits 100% of the population from small child to big adult, and it doesn't. EC: Is that stuff written into your marketing communication? The fact that 100% of the people will fit into our products. DMD: Yes, we certainly put that, I don't know if we quite put that out but we certainly made all to fit on everything we do, yeah...I'll give you some marketing material. DMD: One of our current project which we are now at the very beginning is to collaborate with another Chinese and Israel company with a Chinese factory or an Indian Manufacturer, I've got the choice of 3 to produce multi-panel garments which is the other technology which we don't currently use. The reason we don't is poor related cost. There are 2 main methods of making; one is single panel and the other multi-panel.

	EC: So, multipanel is separate pieces in pockets? DMD: Yes, and we started with that and then we moved to the single panel, and there is still the option, I've got 3 manufacturers, now, what I would be doing is, and the reason I haven't progressed is that I'm just teetering on the edge because I need to sort out confidentiality, I need to visit them first to then realise what 's going on because all I've been doing is providing them with my shape to put the multi-panel in, not their shape...and some of their shapes are very very unflattering, but it's the actual capability of sewing the pockets that they've got and I can't do. So, it's just this teetering on the edge, I've just got to be brave and go forwards. EC: So the way that you're buying the current range, how long established are your sort of supply chain relationships there? DMD: They are all well established. EC: And do you have a sort of, do you have the buying power to restrict to what they do for the people or not? DMD Um…I would say no because the supply chain I have in the 'impact absorbing material', in both cases the converter has sourced the new material for the market...so I don't necessarily have a restriction on where and who they convert for, but I've got a long term relationship with them so I know I am negotiating at extremely good prices, I know that one of the converters only works for me now and isn't interested in going somewhere else. Whereas the other one actually wants the whole UK market, is never going to sell to me exclusively and I can't even find out where their foam comes from because they've absolutely got it tied up. They have their supplier in China, nobody else has found them…could be anywhere, Vietnam, I don't know where their factory is. It's all absolutely down to them I haven't got a clue. And they've done all their testing under their name...I don't want it, I'm very happy that they've found it, that they've tested it, I'm happy they've kept it for themselves, whereas for everybody else I know where they've got it from. [Transcript Video 5]: "you don't want to just draw pretty pictures on cad, you actually want to do the fashion, the fabric, the pattern, you know…you end up with the specs and how it's made, you don't want to be handing these to somebody else. You got to understand the product, the body, how do you measure the internal parameter, how you work out how the market goes, so you can have your adjustment. EC: I think it is a combination of product design and fashion DMD: you are right, it is product design with an interest in fashion.

Name: DMD Mapping exercise

Timespan	Content
0:00.0 - 5:46.4	***Parallel Activities*** Background: Design DMD: Product Testing - Design Project manager - PD - Designer - Tech - That is all the same area that is my strength...which is all [about] product.

	Then I have role with key Customers. So, you've got the Design section (a group of cards) that leads to Manufacturing...I get involved in all of that...and that's my specialisation. And then I get involved in Management which then leads to Sales...and as any CEO I have to get involved in Finance. Management group of cards: Sales, HR, Marketing, Customer Services, IP, Finance, Planning. Design Group of cards: Design, Tech, PD, Design Project manager, QA Support - Tech production Specs, Engineering, Manufacturing
5:46.4 - 8:18.5	***Interactions*** [Cards first selected and then asked for the population.] ***Population*** Management: I've got 2 managers...the Equestrian Product Manager and my Operations Manager...and my Operations Manager is in charge of Production Manager and Procurement. Marketing sales, customer and external agents is the Equestrian Brand Manager. EC: So how many people in total within the management team? DMD: If I have a Management meeting I will have 3 people apart from myself... Procurement is the one from the Management. Operations Production Manager is the same person...so he is doing 2 jobs. Marketing again 1 from the Management. Sales - There's 6, there are external Sales agents but they are not employees...so it depends. External Agents (IP and Auditors): There are various companies. Finance: 2 - I have 1 Accounts Manager and 1 external accountant manager. HR: I have office with 1 person there and I have 3 people in the office so you could have 2 and 1... so it's Admin 2 and HR 1. PD: 2 Sample Machinists and 1 Designer [DMD] Manufacturing: 2 supervisors, one in the Warehouse - one in the manufacturing

	Shop-floor: about 12.
14:42.1 - 20:26.5	***Frequency*** PD & Design: This is my background, that's my strength, my knowledge base, it may become less frequent if I had a mature established department, but I don't so… And all the time, because I work in the same office (Sales, marketing) and the same with the Procurement and Production Manager - it's daily because it's part of the Planning, part of what we do. Slightly less on the finance side. [EC comment/reflection: The mapping exercise is not working well due to tight time constraints put by DMD as well as the many distractions that occur during the interview - people coming in, talking to the participant, etc.) PD: It's feedback from Marketing and Sales and customers that leads you to design and development... Management and manufacturing come into play in the design development...Manufacturing they come into it when the product is ready to be put in production...they come after the design development, they have a late input, but they will see it at a quite early stage because the 2 supervisors come into the weekly product meeting...it involves an overview of the designs that are up and coming, so that they are well aware of designs and the progress before they come into production. DMD: points at a chart on the wall; Current design review - that's where we are up to with new products that may be coming on, Design faults & changes - that's anything that has come to ** on current products that's causing a problem that we might be dealing with and they can draw it to our attention, they can say something is taking much longer to make, it's causing grief, it's not easy. And then it's what we are doing actively to prevent something from reoccurring or some return becoming a problem. Production meetings happen once a week and management meeting once a month.

Appendix 17.
Sample of BoPro
Case Study Interview (2)

Name: CS5 BoPro – Marketing

Timespan	Content
0:00.0 - 3:44.0	**Interview with Marketing** Years in company: 4 and a bit. M's background: Worked at a catering company which were the distributors of tableware, safe jackets and things like that...I had a Marketing assistant role... EC: What made you come to this company? M: It was a step up in my career, getting a bit more responsibility, it also at the time I was interested in horse-riding so I had a big interest in the area too. It would expose me to more areas of marketing such as working with distributors and label and retailers.
3:44.0 - 7:03.9	*Parallel Activities* Marketing and Sales are very linked, regards four agents in the UK who sort of managing that because they all independent Sales agents and I am the first call between the agent and BoPro, so…with the agents we run the ports to find out how they've been in to see a customer, what the feedback is from the customer, how often the customer ordered, what products they take and what other opportunities there are...and looking at where Sales are growing or declining, we would look at the budgets and see what to do with the product, and then how to market it. Management : part of the management team. Planning: this time of the year we plan the budget for the year ahead and that's about how to achieve a percentage of growth in each product area and how my Marketing is going to contribute to that quote...so I've got to plan exactly what I am doing every single month and then see if I can get some help, that doesn't voice well (laughs), help coming from the front office...we have what we call here the front office and the back office. This is like the first point we call Sales, orders and Admin - and anything that requires a next step is sort of in the back where [senior managers] and I are. IP: I got involved in that couple of years ago about, you know, um, registering our name with a solicitor and it's pretty much [another member] who deals with IP, but I have been involved in that.
8:59.9 - 21:34.4	*Interactions* EC: [after completion of card selection] Is there something missing from the map? M: That would be the Marketing, taking the product to market in a product launch and the feedback...but internally, there would be... Planning & Management: that's what we are going to do, when, how, that kind of thing...and then that kind of interlinks in a way with...

	Sales & Customer: we are trying to get feedback from the agents as to whether we are doing the right thing, whether there is demand... and then you might end up speaking to the customers directly. For instance we know there is demand for a new type of product and we're using feedback from Sales and our customers to build in to the Planning (above). EC: Where does the demand come from usually? M: It would be the customer, at the moment it is. But sometimes it might be a need that we recognise or it might be a way for us beating the competition...but the projects coming to my mind are definitely customer-driven. EC: Why do you think, from your own point of view, the 'creating something that you recognise' is not happening as often? M: Um…well the company is quite small, the resources are quite limited so we find we can work well on a project at a time...and the lead time for working a project can sometimes take about a year. So, everyone is concentrating on that project and there's not enough people to be looking at doing a different project. EC: How do you approach the customer? M: Because the equestrian market is so small, the most people know about BoPro anyway, and it's quite a big brand for body protectors and our agents they are commissioned to do that job...but when we get to trade-fairs, there people come to us but we don't actually go out knocking doors. * **population*** SM-MS-manufacture: there are 3 people there but sometimes it is a little bit unclear as to who go to...so, sometimes I go to just one and I should have gone the other one. Planning & Man: That is really [DMD] and the rest of the team kind of, it's just happens...so it's not that we have a huge planning meeting where we are saying this is what we are going to do. We should do but sometimes peoples' role into projects and projects and sometimes there is no really Planning or Management...but when there is, like we've got a project at the moment that is a little bit planning and management, someone has to own it. EC:Who is involved at the current project? M:[senior managers] Admin: it's the admin that is associated with running the project, for instance, with [a new project] you would have technical files, everything has to be made to safety standards, so you have to do the admin things. It used to be my activity but [DMD] has moved it to someone else...it's someone who is not in the front office but neither a manager, she is in-between. PD: One main person...and the CEO [DMD]…it is difficult at the moment because we don't have a designer...so if we did have a

	designer it would the designer and [DMD] that would work together...so at the moment we only have one person and that is [DMD]. [DMD] recognises that there is a need to have two people there but she likes to take her time when recruiting so she knows who this person is. Sales: 5 external.
21:34.6 - 29:47.4	***Frequency*** CEO: all the time, she wants to know exactly what is going on, all the time...and wants to know where we are at, what is happening, what is preventing the project from [progressing]. It's when the agents come back to us telling us that the sales have gone down with a particular product and you start looking and asking questions 'why?' ...so we need to find out why...the size might not be right, or whatever. EC: If it was a case of not fitting well how would you get this information? Is it coming from the customer? M: Um…yeah, they are quite forthcoming with their feedback. It would be a mixture of; sometimes I go out to do trainings to retailers to see...and every now and then I go visit our key retailers and then it's when you're having conversations with them now and then and you see the fitting and you say 'what do you think?' and...when for instance, last year I went down to [a retailer] for feedback and the body chest we'd upgraded, it took us a year and a half upgrading, didn't fit anybody. And customers would then come back and say 'I'm not ordering anymore from you' and it's that sort of comments...and I would then feedback this information to [DMD] and to the designer when there is one...the designer would either try to redesign it or argue about it, whilst [DMD] always see things from the company point of you. [DMD] would then drive forward a new design, would probably want to improve that garment but the feedback from the agents and the general feedback from the Management team is…I'm looking at Sales and what does or doesn't sell, would then persuade [DMD] not to revamp that product again, don't waste any more time on it, bring a new one out, it's better. EC: So, it is between the conversations you have with [DND] and the agents who take decisions on what to do with a product? M: Yeah. EC: Manufacturing? S* No but... And then we've got the system that says things are selling or not. We have a range of high-visibility vests that for years and years and years the agents have been telling us that they just don't sell it, the commission isn't big enough, the products are low value and they don't earn enough to want to spend their time to sell it. But the Manufacturing, we don't order enough quantities to bring the price down, so there's a decision; we decided that we are going to stop doing the high-visibility vests but we don't tell the agents that yet. But

	the Manufacturing is involved because he then has to work out the quantities he used to make in order to fill in the size gaps in order to sell the rest of the range...so there's two kind of areas: there's where you've been innovative and then where you're being reactive? I suppose...
29:47.4 - 35:15.3	***Quality*** M: I find this area [Manufacture] the hardest to communicate with. Because I would want something, say for instance we are sponsoring a team and we are preparing samples for photography and we didn't get the sizes until the very last minute - very often Marketing is full of last minute, and we say 'I need this and this'. Whilst the Manufacturing always trying to plan...so it's like 'you can't have it - why can't you plan more?' and this is the biggest problem because it's about flexibility, it's about me trying to plan and to get them more involved. EC: How do you resolve this? M: It's always get done...sometimes [DMD] comes in and says 'this takes priority'. I would just say that they are not very flexible, from my point of view, but their point of view they might think that I'm completely nuisance, probably [due to] a lack of understanding from my part of the whole process and how long things take. Because when you are living in a world where you order something and expected delivered the next day, I can't comprehend and I can't tell a customer that new orders are going to be in 3 weeks, it just doesn't make sense. I can understand it when it is made in the Far East and come in huge quantities, but when it looks as a normal product and there's a long leave time, because you run out of something or there is not enough staff, then I just can't understand how...I just think it could be more modern and quicker? EC: Are you taking part in any of the production meetings? M: Sometimes, and when I do I find it much more useful, it does make a big difference when I do come in. And I should be doing it more, the communication is possibly orange when I go there, then I understand their point of view and they understand mine too. And I can also know then if something will take 3 weeks instead of being told 3 weeks later and then talking to the customer saying 'sorry...' The next worst I'd say is with the front office (Admin) because I am not very good at delegating so that's why I find it many times quicker to do it myself. EC: Do you think this is more for personal reasons? M: Yeah, probably...but then I've never been given anybody to delegate too and then they also started understanding that I'm not their boss and they're not mine... We started having sales meetings to kind of make it easier to let the Sales team to know what is going on in the marketing and for the

	Sales to tell us if there's any negative feedback, which comes back to Product development. But it was always kind of one way; it's like, it was starting as marketing telling Sales what's going on, or Admin what's going on, and then Admin saying 'alright, you can go now...' , and then you say 'do you have any feedback, or any customer complaints?' and the response was 'oh, no, everything's fine...' But it's that awkward silence where you think 'right, okay...' EC: When you refer to Sales though you don't refer to the external agents but to Admin right? M: Yes. External agents: they are all self-employed and working for BoPro for about 20 years...they are very loyal and they all have their own ways for selling. They don't feed back as much but you would then notice that their sales have picked up so they find their way through. Communication is mainly via telephone, the reports come by email and then we discuss these over the phone...there is one who is coming in all the tradeshows etc. and he is the most active of all.

Appendix 18.
Using Pytheas to Collect Data from Cases

Appendix 19.
New Pytheas Cards Derived from Case Study Research

Engineering	Product Development	Management	CEO	Tech
Human Resources	Planning	Manufacturing Supervision	Procurement	Finance
Sales	Manufacture	Administration Supervision	Personal assistant	Designer
Shopfloor Manufacture	Dispatch & Logistics	Marketing	Progress chaser	Maintenance
Admin	QA*	Contracts team*	System Supplier*	IT*
Site Installation*	Tech Sales*	Site Manager*	Drawing Office*	Estimator*
HSE (Health and Safety Executive)*	Customer*	Customer Services*	Technical Production*	Operations Production Manager*
IP (Intellectual Property)*	External Auditors*	Costing*	Product Testing*	Production Engineering*
Design Project Manager*	Authors “Content” *			

Newly derived positions highlighted with *

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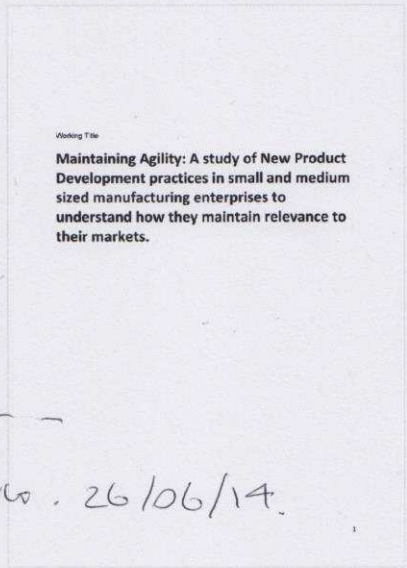

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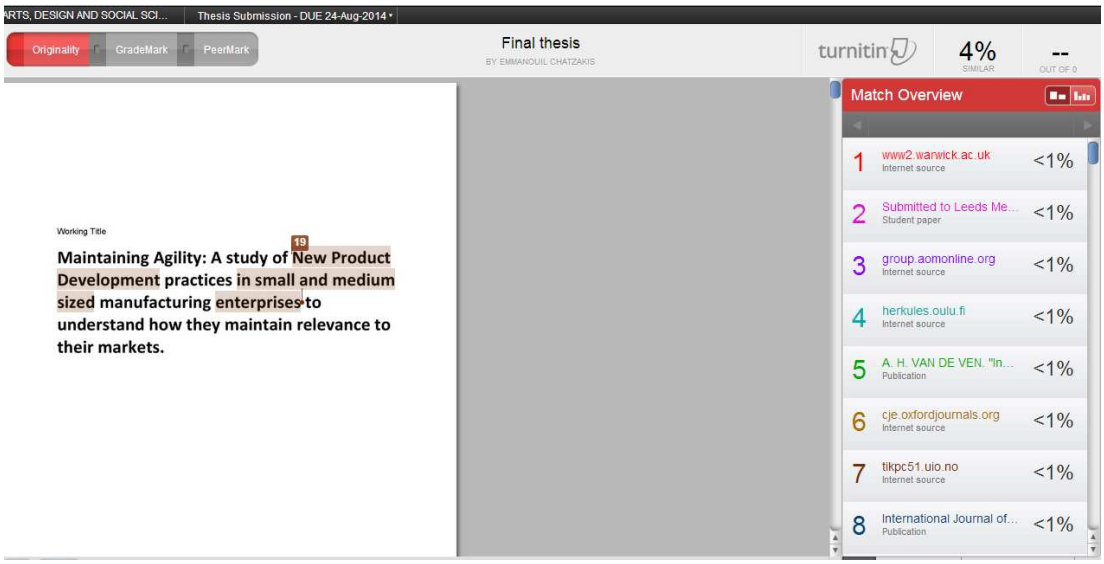
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