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**ENTREPRENEURIAL NETWORKING, TRUST PROCESS AND
VIRTUAL INTERACTIONS**

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**A thesis submitted in partial fulfilment of the
requirement of
the Robert Gordon University
for the Degree of Doctor of Philosophy**

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Abstract

The aim of this research was to understand the entrepreneurial networking process and the role played by virtual interactions. In particular, the objective was to establish how, and if, virtual interactions enhanced collaborative incremental product innovation in supplier-customer networks within biotechnology SMEs (Small and Medium Sized Enterprises). Employing a phenomenological approach, two data collection techniques were used; participant observation within a small biotechnology firm provided a preliminary study and was followed by 16 in-depth interviews with bioscience entrepreneurs in SMEs in Scotland.

The results indicated that entrepreneurial networking was important for the generation of collaborative incremental innovation; innovation opportunities were embedded in entrepreneurial networking process. In addition, the study found that the networking process was complex and dynamic but was punctuated by several relationship stages, whereby each stage constituted a relationship state. Each state could be characterized as dynamic and complex but an evolving relationship stage. The progress of collaboration was thus dependent on the evolution of the relationship. Moreover, the research identified trust to be the key determinant of the relationship process; the nature of trust invoked was found to be dynamic, progressive and multi-dimensional.

The study explored and classified how the entrepreneurs used three "ideal types" of networking strategies to engage in the trust formation process. These were, namely, Technical, Combined and Social Approach, utilised in different relationship situations. Furthermore, the study showed how factors, such as inter-personal characteristics for bonding social capital, the use of virtual interaction, trust process, the level of knowledge tacitness and relationship processes, all impacted on the collaboration for incremental innovation. Importantly, the study indicated that an understanding of virtual interaction needed to be contextualised in the circumstances and conditions of the entrepreneurial networking process.

Consequently this study contributes to knowledge in the areas of entrepreneurial networking process, virtual interaction, supplier-customer relationships, trust and product innovation generation.

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Chapter One

Introduction

1.1 Introduction

This is a study to explore the entrepreneurial networking process and its impact and within this the impact of virtual interactions on the generation of collaborative incremental innovation. The aim is to understand the entrepreneurial networking process and within this the role of virtual interactions. The focus of the study is in the field of networking of entrepreneurs. It is concerned with the main theoretical and practical perspectives of entrepreneurial networking¹. The generation of incremental product innovation in the SMEs² (Small-and-Medium Sized Enterprises) in the biotechnology industry³ is set as the context of the research. More specifically the study concentrates on the networking between bioscience entrepreneurs and customer networks that have led to successful collaboration in entrepreneurs' innovation practices.

Innovation is defined as "a process of discovering something new from an idea and developing it into a saleable product/or service" (Attridge, 2007, p.222).

¹ Entrepreneurial networking refers to networking/or network interactions of entrepreneurs in their pursuits of innovation and entrepreneurship.

² SMEs (Small and Medium-sized Enterprises) are defined in various ways. This study uses the criteria of BIS, the Department of Business Innovation & Skills, UK which defines a SME as: small enterprise as one with employment less than 50, and a medium enterprise as one with employment of at least 50 but less than 250 (BIS, 2009, p.4). Also see (Curran and Blackburn, 2001, p.8-21).

³ The UK is the home for biotechnology. Since the discoveries of molecular and genetic biology in scientific research at the University of Cambridge, UK in the 1970s, the increasing knowledge and recognition of biotechnological applications have led to the emergence and development of the biotechnology industry and various connected industrial sectors. Biotechnology is one of the most research- and knowledge-intensive industries in the world. The industry has made significant advances in our understanding of the way in which plants, animals and humans work, with direct benefits in many areas (Rosiello and Orsenigo, 2008).

"Innovation" and "entrepreneurship" have become common words that often appear in business books or journals over the last two decades. The meaning of "entrepreneurship" is closely related to the concept of "entrepreneur". Entrepreneurship is a behaviour, a distinct behaviour of an entrepreneur (Drucker, 2007). Entrepreneurial innovation relates to that of an entrepreneur who always searches for change, responds to it and exploits it as an opportunity (*ibid.* p.25).

Entrepreneurship constitutes a powerful source of economic development (North and Smallbone, 2000; Schumpeter, 1934). The emphasis is relevant to the decisions that we have to confront, that is, making changes and creating value in order to survive on an ongoing basis, particularly in today's environment which has been increasingly volatile. In the revised edition of *Innovation and Entrepreneurship* (Drucker, 2007), Christopher Bones pointed out that there were four major changes around us in the last two decades, including globalization, stakeholders' demands, the digital economy and networked organizations. These changes have created great challenges to entrepreneurs, especially those of SMEs that may lack resources. Innovation provides potential sources for entrepreneurship not only to achieve changes but also to help entrepreneurs find the right processes and outcomes (Yue et al., 2004).

Generating innovation is a characteristic of biotechnology firms; biotechnology firms in the UK are mostly comprised of SMEs and are entrepreneurial, they have played an important role in creating wealth and jobs (Hine and Kapeleris, 2006). Referring to product innovation, this has been widely studied from various perspectives including psychology, economics, organizational management, sociology and marketing, yet much of the research has focused on radical innovation although a majority of product innovation is incremental.

Incremental innovation generally produces outcomes of something with minor improvement. The process of generating innovation involves a lot of effort and hard work such as searching for new ideas, carrying out evaluations and the exchanges of information and knowledge. This could be derived from knowledge gained from a conversation with various sources of people, including those both external and internal to a firm. One of the sources could be a business customer.

Two firms may have a series of interactions and form business collaboration in order to pursue the generation of incremental innovation through joint effort. With the emergence and prevalent use of modern electronic technology, entrepreneurs of two firms may become physically "invisible", in other words "virtual" to some extent during their interactions with each other.

It is recognized that customers form the most important group of external stakeholders contributing to the generation of incremental innovation, and therefore, supplier-customer network interactions attract the research interest. This thesis will investigate the impact of supplier-customer virtual network interactions on entrepreneurial networking in the collaboration for generating incremental innovation in high-tech SMEs in the biotechnology industry and aims to understand the role of virtual network interactions in the process of collaborative incremental innovation. Initially, this research will explore the nature of the process by adopting a phenomenological approach to interpretative study, similar to that utilized by Hellstorm (2004) in elaborating the concept of innovation. The understanding gained via this exercise will be used to clarify a further and deep exploration of incremental innovation in context, with particular attention to the relationship between an entrepreneur's virtual network interactions and the perceived networking process. More specifically, the nature of the process of collaborative relationship in entrepreneurial SMEs will be examined, and this is related to trust building and development. This further exploration will lead to an investigation of the relationship between virtual network interactions and trust which is shown as a multi-dimensional concept.

This chapter outlines the study area of this research. It will illustrate the need to understand a field that requires in-depth research and which consists of apparently directly related, however substantially complex and intertwined conceptual areas within incremental innovation collaboration, therefore presenting the justification for the research. The last section of this chapter will provide an outline of the chapters of the thesis, as a guide to bring the reader into the context of this study.

1.2 Justification for the Research

As highlighted above, entrepreneurial innovation is a main source of stimulating economic development (Anderson et al., 2007; Drucker, 2007; North and Smallbone, 2000; North and Syrett, 2008; Schumpeter, 1934). The topic of innovation has raised scholars' attention from multiple disciplines. Above all, product innovation is a vital part of many industries (Danneels, 2000), particularly in high-tech industries like biotechnology (Ahn and Meeks, 2008). Given the acknowledgement of the complexity of product innovation, Roy et al. (2004) pointed out that radical and incremental innovations are two types of product innovation that distinguish the degree and impact of the changes to an organization and the markets. Since incremental innovation is associated with lower risks and less capital input, it is not surprising that firms are far more capable of producing incremental innovation (Rothwell and Gardiner, 1988; Von Hippel et al., 1999). Yet, little research has been carried out on incremental innovation (Cooper, 1994; Olsen, 2006). This is reflected in the biotechnology sector (Casper and Whitley, 2004).

SMEs in high-tech sectors like biotechnology are perceived as an important source of product innovation (Anderson et al., 2007; Berry and Taggart, 1998; Cooke, 2002; Utterback and Suárez, 1993). In particular biotechnology in the UK has maintained the leading position in European countries throughout 1980s and 1990s (BIS, 2008) and it remains as the second in the world next to the USA at present in terms of its productivity (BEER, 2005; Smith and Bagchi-Sen, 2006). In 2003, the sector consisting of 466 firms employed 22,400 people and these firms generated £3.6 billion revenue. In 2005, the medical biotechnology sector alone generated £2.63 billion revenue. In 2006, the UK firms accounted for 40 percent of the total biotechnology products in the pipeline in Europe⁴. Most of these firms are SMEs (Pitt et al., 2006). The products of biotechnology SMEs provide new technological solutions for the industries such as pharmaceutical, public and animal health, energy, agriculture, environmental protection, chemical, food, nutrition, manufacturing and other industrial sectors (BIS, 2008). Any

⁴ UK Trade and Investment (2008). UK Biotechnology and pharmaceutical opportunities [Online]. Available from <http://www.ukinvest.gov.uk/Biotech-&-Pharma/en-GB-list.html?page=3>. Accessed 29th September, 2008.

changes in the production of new products affect various sectors directly or indirectly. Therefore, SMEs in the biotechnology sector are crucial source of innovation contributing to the success of the overall UK economy.

Biotechnology SMEs feature biotech-based entrepreneurship (Ahn and Meeks, 2008). This is not only manifested by the birth of new business start-ups, but also the pursuit of innovation by established firms throughout their life time (Cooke, 2006). In recent years, along with the increasing emergence of biotechnology SMEs which is in the context of increasing global competition, the UK government has paid much attention to improving the diverse skills of science entrepreneurs⁵. However, it has been recognized that science entrepreneurs in the biotechnology industry globally are in the position of needing appropriate entrepreneurial and management skills (Hine and Kapeleris, 2006, p.1). A survey by the Scottish Executive conducted in 2006 shows that the SMEs are still in the position of needing more support in the training for management skills, including networking skills⁶. Scholars (e.g. Berry and Taggart, 1998) also emphasized, as small high-tech business continues to grow into established business, high-tech SMEs have a strategic weakness in confronting the competition even though there are sources of opportunities. Therefore there is a growing need to strengthen management (including networking) knowledge and the skills of innovation which can be integrated into their overall business strategies. The concept of incremental innovation in entrepreneurial SMEs and in biotechnology will be explored in more detail in Chapter Two. Drucker (2007) pointed out the importance of science entrepreneurs' understanding of innovation and the diverse range of knowledge, capabilities and skills needed in order that they are able to seize the opportunities and lead their SMEs to pursue successful entrepreneurship through the processes of innovation. The generation of incremental innovation is a complex phenomenon; it includes cognitive and affective aspects (Corti and Lo Storto, 1997, 2000; Madhavan and Grover, 1998; Polanyi, 1967) and is affected by individual characteristics (Albrecht and Ropp, 1984; Knight, 1967) and organizational attributes (Roy et al., 2004). In

^{5, 6} Department for Business Innovation and Skills (2008). Medical Biotechnology sector [Online]. Available from <http://www.berr.gov.uk/whatwedo/sectors/Biotech/Biotechmedic/page10217.html>. Accessed 6th October, 2008

particular incremental innovation is influenced by the dyadic interactions of a SME and its network partner.

The incremental innovation of entrepreneurial SMEs is perceived as a social-economic process (Anderson et al., 2007; Granovetter, 1985). SMEs do not operate in a vacuum, but rather in a complex and dynamic environment with various external stakeholders such as customers, suppliers, trade associations (Pittaway et al., 2004) that affect the economic outcomes of the business. In addition, bioscience entrepreneurs themselves are by-products of their social environment (Anderson and Miller, 2003). Very few biotech firms can survive without strengthening their relationships with various stakeholders, particularly those external ones who may be potential network partners (Bagchi-Sen, 2007, p.753).

The theories are echoed by the reality. Since 1980s an emerging and growing trend is that firms including both large firms and SMEs are increasingly dependent on external collaboration for new idea development and R&D activities (Cravens and Piercy, 1994; Hagedoorn and Schakenraad, 1992). The average portion of innovation originating from external sources was estimated to be about 45% (Linder et al., 2003; Prugl and Schreier, 2006). At the moment, to large firms innovation is understood as more and more risky whereas it occurs more often in the supply chain networks of SMEs (Fountain, 1997). The networking approach to product innovation generation is particularly important to SMEs, as it helps them to overcome the weakness of lack of resources due to their size and resource constraints (Croom and Watt, 2000; Liming and Aram, 1995). However, most existing literature has examined "what" contributes to innovation generation by collaboration (Von Hippel, 1978). There is little research examining the process of dyadic interactions, particularly between SMEs and their most important external network – the customer network (Roy et al., 2004).

An exploration of the literature of the processes of dyadic network interactions in supplier-customer network shows that they are not only related to the network connections of an entrepreneur, but also to the collaborative relationships and the modes of interaction used. It appears that the relationship is the main entity

of the interaction process (Albrecht and Ropp, 1984); a further exploration suggests that the building and development of trust is viewed as the key determinant that leads to a successful collaborative relationship. The process of trust, as a multi-dimensional concept is affected by the modes of interaction. However, a majority of empirical studies of supplier-customer relationship processes is concerned with marketing perspective; very little if any research has examined the processes systematically in the context of incremental innovation, especially with a focus on the inter-play of social capital, virtual interactions in the trust process and how the manifestation of these elements and factors impact on incremental innovation processes. Furthermore, not one of the relevant studies has been in the biotechnology sector.

Referring to the modes of interaction, entrepreneurs use various interaction modes to interact with each other. This may include traditional ones such as brochures, scientific publications, and meetings in conferences. As technologies continue to advance new modes have emerged in addition to the traditional ones. A trend towards using new electronic modes has been found in entrepreneurs' network interactions in the biotechnology firms in their collaboration for product innovation (Fontes, 2005). Whilst virtual interactions allow for advantages such as linking people globally and speedy responses which are not achievable by traditional modes, they make the physical presence become less visible, in other words, the individuals are virtual to each other. There is a lack of research related to the impact of virtual interactions on the process of incremental innovation in supplier-customer networks of SMEs in the biotechnology sector.

The suggestions highlighted above indicate that the use of a particular virtual mode by an entrepreneur in the process of collaborative incremental innovation should be viewed as a holistic and collective experience, a meaning making process. One way of understanding the impact of the interactions is to listen to people's narratives of their life experience (Larson, 1992; Patton, 2002). People share their experiences which echo behaviour and attitude through daily conversation with others. It appears to be appropriate that a researcher collects the knowledge for the research through getting close to entrepreneurs, and listening to their life stories about the use of virtual modes in the processes of

collaborative incremental innovation. The narratives reflect the reality of entrepreneur's experience in dyadic interactions from the supplier's perspective, enabling the researcher access to the reality of how collaboration in incremental innovation is influenced by network interactions. Such narratives will also disclose the way in which entrepreneurs make sense of virtual interactions in innovation experiences. As such the descriptions will serve as a basis for seeking patterns and trends in the meaning making process and the conceptualization of the role of virtual interactions in the process.

Each entrepreneur's experience of virtual interactions is different from one another's in terms of establishing network relationships, virtual modes used, individual characteristics such as personal competence and capability, and respective organizational factors. More specifically, the process of building and developing network relationships involves emotion and feelings in the interactions. Accordingly, scholars have called for and encouraged more attempts at using interpretative approaches in entrepreneurship research (Cope, 2005; Johannisson, 1995; Larson, 1992). Phenomenology is an interpretative study approach using lived experience (Moustakas, 1994). It enables a researcher to reach a deep understanding of a phenomenon from the descriptions and explanations of those people who have the lived experiences and to make sense of those experiences. The undertaking of a phenomenology approach to entrepreneurs' experience of collaborative incremental innovation in supplier-customer networks and especially the impact of virtual interactions on the experience shall provide insights into how entrepreneurs make sense of such collaborative experience. It is found that the use of the phenomenological approach to the inquiry in entrepreneurship research has been barely explored, and none in incremental innovation.

Thus, this study adopts a phenomenological approach to obtain a deep understanding of entrepreneurs' experience of collaborative innovation, revealing the impact of virtual interactions on the collaboration and therefore product innovation. This study not only provides the descriptions of entrepreneurs' experiences as such, but also explores the nature of the lived experiences and the way in which virtual interactions are related. The data will be used to develop

a theoretical model through an inductive analysis in the context of collaborative incremental innovation.

This study can be useful not only to science entrepreneurs in the biotechnology sector but also to other high-tech sectors in similar situations. It provides deep insights into the phenomenon of collaborative innovation by entrepreneurial SMEs and such insights cannot be reached by quantitative research (Anderson et al., 2007; Anderson and Jack, 2002; Schumpeter, 1947). In addition, to some extent it can also be useful for SMEs in the management of network relationship with other external stakeholders, for example suppliers, and other aspects relating to entrepreneurship, for example market expansion. For government and other supporting bodies, it provides insights into entrepreneurs' virtual interaction patterns, their behaviour and attitudes in pursuit of entrepreneurship and thus relevant support and policies may be formed or revised.

1.3 Research Objectives

The general themes of this study are related to entrepreneurs' experience of networking process with customers in the context of collaborative incremental innovation, and the ways in which virtual interactions are conducted and therefore shape the networking processes. It also examines how the collaboration operates, and how this may determine the outcome of those interactions, that is, the generation of incremental innovation. This is closely linked to network relationships, in fact, the trust building and development process in the collaboration. The ways an entrepreneur uses virtual modes influence how trust is built and developed in the networking process. The overall aim of the study is to investigate and gain understanding of entrepreneurial networking process, the impact of the process on the generation of collaborative incremental innovation and within this the impact of virtual interactions. To achieve the aim, the research objectives are summarized as below:

- ❖ To explore entrepreneurial networking processes between biotechnology

SMEs and customer-networks and the impact of these processes by interviewing entrepreneurs to uncover the processes of collaboration in generating incremental innovation, and the ways in which virtual interactions affect the network relationships and therefore incremental innovation generation.

- ❖ To develop a theoretical model of entrepreneurial networking process and its impact, and the ways in which virtual interactions impact on the network relationships and incremental innovation generation.

The detailed research questions to be explored in order to fulfil the objectives are:

- What are the key components of the networking process in the collaboration for generating incremental innovation in supplier-customer networks?
- How do they relate to network relationships and virtual interactions?
- How are virtual network interactions and network relationships related, and how is this manifested through entrepreneurs' narratives of their experience in the collaboration for incremental innovation generation?
- How can we understand and what can we learn from the entrepreneurs' narratives?

1.4 Summary and Outline of the Research

This research is original in that it will investigate the entrepreneurial networking process and its impact, and the ways in which virtual interactions are conducted and impact on entrepreneurial SMEs' collaborative incremental innovation by employing a phenomenological approach to interpretative research.

Chapter Two, Chapter Three and Four are set out as a review of the literature. Chapter Two examines the nature of incremental innovation generation as a preface and context to suggest that firstly, there are several factors identified as influencing incremental innovation and they are inter-related. Secondly, incremental innovation generation by collaboration in supplier-customer networks is viewed as a socio-economic outcome of network interactions. The processes of network interactions and collaborative relationships shape the process of incremental innovation generation. The network relationship is identified as a major component of the networking process. The use of virtual modes is identified as a factor (or/to play a role) in the networking processes, influencing incremental innovation.

Chapter Three examines more closely the supplier-customer network relationship processes. It explores the theories of supplier-customer network relationships, suggesting that although various models emerged in explaining network relationship processes, nevertheless trust emerges as the key theme of the processes. It suggests that trust possesses multi-dimensional facets, manifested as different types of trust and in operation either separately or together affect network relationships and incremental innovation.

Having discussed in the previous chapters that virtual interactions can be a part of networking conducted by entrepreneurs in the process of collaborative incremental innovation, Chapter Four then discusses the connection between the use of virtual interactions and the trust building process. It examines the impact of entrepreneurs' virtual interactions on the trust process in incremental innovation, which may be seen as a sense making process. It goes on to suggest

that it does not matter whether the entrepreneurs' virtual interactions are transactional, communication or networking, the experience of networking behaviour should be viewed as a whole in incremental innovation generation. In addition, it points out that there is less understanding of the impact of virtual interactions on multi-dimensional trust building and development in the process. The suggested conclusion is that there may be a general model which can be identified which shows entrepreneurial networking process including virtual interactions experienced by entrepreneur. Such a model may be unique for each entrepreneur in his/her network relationship processes.

Chapter Five describes and explains the research methodology and design, illustrating how a phenomenological approach to interpretative research will be employed. This chapter explains the research design and techniques for data collection and analysis. It justifies the research methods and techniques of the phenomenological approach, and highlights an emerging trend in the use of computer assisted qualitative data analysis (CAQDA) in conducting qualitative research. The advantages and disadvantages of using computer programs are discussed. This chapter ends with a critical review of the methodological approach taken and the research design, and recalls and reflects on the PhD process, likening it to an adventurous journey with mountains to climb along the way.

Chapter Six reports and analyzes the research findings. It shows the classification of the components in the networking process in incremental innovation collaboration which emerged from the data, and then it explores the connections between those classifications to profile three ideal networking approaches: Technical, Combined and Social Approaches. The characteristics of networking behaviour undertaken using different approaches are demonstrated. This is conducted based on the categorization of the networking processes. The processes of entrepreneurs' network interactions using different approaches appear to show a gradual process, of entrepreneurs and customers getting close to each other and resulting in the network interactions. The components of the networking process are identified, as they emerge from the relationship processes experienced by entrepreneurs using different networking approaches.

The components consist of four stages: Antecedents, Linking, Development and Maintaining the Contacts. The connections between the entrepreneurs' networking approach and the stages are addressed, and the nature of the relationships assigned to each approach with customer networks is revealed. The use of virtual interactions is shown as a factor in the networking processes.

In addition, Chapter Six highlights the importance of trust building, development and maintenance, emerging from the data. Trust per se is shown as a developmental process. The dynamic and complex process is discussed in the context of incremental innovation in supplier-customer networks. The last section of this chapter indicates different factors affecting trust process; inter-personal trust is identified as the most influential factor. It seems that the entrepreneurs' different networking approaches initiate inter-personal trust in different ways.

Furthermore, the significance of bonding social capital in the trust process is uncovered; entrepreneurs' different networking approaches to building trust are likely to be associated with the presence of different types of bonding social capital. These reflect the dynamic of several groups of influential factors within the networking process, in that the impact of virtual interactions in terms of using email is dependent on the interplay of several factors, namely the bonding social capital, the trust process, the stage of the network relationship process and the level of knowledge tacitness. The chapter concludes with a model demonstrating how Antecedents, Linking, Development and Maintaining the Contacts are comprised of a dynamic and circular process of entrepreneurial innovation practices.

Chapter Seven focuses on the discussion of the research findings, locating them in a broader context of existing product innovation, supplier-customer network relationship and virtual interaction literature. It goes back to discuss the networking process of incremental innovation collaboration model, which demonstrates the insights into a progressive process. The discussion uncovers the complexities and dynamics between the components. This is carried out by linking a set of topics, networking process, trust process and virtual interactions through the phenomenological approach and referring them to the cognitive,

affective and conative components of product innovation generation examined in the literature review. This chapter highlights the usefulness of obtaining entrepreneurs' experience through their narratives, and the usefulness of phenomenological approach in gaining insights from the narratives.

Chapter Eight outlines the key research findings and brings about the conclusions and the theoretical and practical implications of this study. It also draws out future research recommendations.

Chapter Two

Biotechnology Product Innovation

2.1 Introduction

Innovation is defined as the implementation of a new or significantly improved product (goods or service) or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations (OECD, 2005). Product innovation is lifeblood of many industries, in particular high technology industries such as the biotechnology sector. Product innovation is recognized as an important source for organizations as well as industry growth (Ahn and Meeks, 2008; Danneels, 2000), it is also a strategic instrument for firm competitiveness and survival (Bhaskaran, 2006; Damanpour and Evan, 1984; Kristensson et al., 2004; Roy et al., 2004; Van der Panne et al., 2003). New medical products derived from biotechnology and which have been in the market between 1980 and 2000 contributed considerably to the increase of patients' lifetime and reduction of costly hospital stays (Attridge, 2007). New biotechnological products also contribute to ways of treating contaminated land or solving other environmental problems (Ahn and Meeks, 2008; BIO-WISE, 2003).

In today's complex business environment, managing to survive is the first consideration of companies (Porter, 1990). Product innovation is therefore an organizational business focus and strategy used by many biotechnology firms to cope with the complexity of and changes in the environment (Calabrese et al., 2005). Product innovation is also a complex process commencing from the awareness of problem/needs, consisting of various events, activities and decisions to reach the outcomes of something new that is useable (Damanpour, 1991; Knight, 1967; Rogers, 2003). For a firm, product innovation generation includes all activities relating to problem perception, information collection, attitude formation and decision to adopt innovative ideas as a solution to the

problems or needs (Damanpour, 1991; Knight, 1967; Rogers, 2003). The process is critical to move an innovation forward, since once a decision of adopting an innovative idea is made, the later stage of production, manufacturing, marketing and distribution, can be carried on (Rogers, 2003). Differing from the bureaucratic structure of big organizations, entrepreneurial biotechnology SMEs possess organizational flexibility which enables them to adapt to the changes in the environment and to grow through innovation generation (Danneels, 2000; Parker, 2002). The traditional way of approaching to new product innovation by relying on firms' in-house capabilities is no longer appropriate. Instead, networking has been used as an approach for collaboration in order to generate product innovation by the biotechnology SMEs. The inter-organizational collaboration is formed to obtain organizational flexibility, necessary knowledge and skills, other resources and operational efficiencies (Cooper and Edgett, 2008; Cravens and Piercy, 1994; Ledwith and Coughlan, 2005).

Various types of innovation can be complex and difficult for entrepreneurs to understand and manage, thus efforts made towards innovation generation may not fit their firms. Hence it is crucial that entrepreneurs understand the product innovation and the effect of networking in the process (Roy et al., 2004), and those factors in the innovation process so as to achieve the success. Although the importance of product innovation is recognized and numerous studies have been made into different aspects, there is no a universal theory for biotechnology product innovation (Attridge, 2007). An understanding gained indicates that it is not applicable to use a one-fits-all model in all innovations (Dewar and Dutton, 1986).

It is argued that product innovation can be viewed as a source for entrepreneurship, an approach firms take to cope with the complexity and changes in the environment (Danneels, 2000; Drucker, 2007). Product innovation may not be the only reason for a firm to form an inter-organizational network. Firms can be attracted by the potential benefit associated with a collaboration (Cooper and Edgett, 2008; Howells et al., 2003). Product innovation and the ways in which network interaction is conducted may constitute an entrepreneur's consideration in selecting network actors.

However, product innovation is mostly perceived as a complex concept. It tends to be affected by individual characteristics as well as the environment in which an individual is embedded. An entrepreneur's way of connecting to a wider economic community is an important influential factor. Moreover, the networking process also determines the generation of biotechnology innovation and it provides more opportunities for enhanced innovation performance (Rothwell, 1991).

In fact, networking itself is a process by which innovation can be materialized (Anderson et al., 2007). Generating product innovation through collaboration is substantially a process of network interactions between two firms. A collaboration formed allows them to take joint actions for developing new products. This chapter will thus begin with a review of existing literature on biotechnology product innovation. It will go through the nature of innovation, processes and types of innovation and product innovation generation. Following the context set for this study, this chapter will review the phenomenon of biotechnology SMEs collaboration for product innovation and identify the gaps in the literature. Very little if any existing research seems to have examined the generation of biotechnology collaborative product innovation in supplier-customer networks from the firm's perspective. None of the studies have investigated how the entrepreneurial networking process is operated, its impact and within this the impact of virtual interactions on the process and the generation of biotechnology product innovation. It will be elaborated later that this study will review and develop a pre-understanding of the concepts. The pre-understanding will be used to explore and to understand the networking process which emerged from the entrepreneurs' narratives. However, to start with, the nature of biotechnology product innovation and the elements of innovation concept will be considered.

2.2 Biotechnology Product Innovation: Nature and Generation

Innovation⁷ is a very complex and broad concept. Its effect on firms has raised scholars' attention from multiple disciplines, indicated by Garcia and Calantone (2002, p.110) in their review of innovation. Studies contributing to the field have been from various perspectives, such as psychology, economy, organizational management, sociology and marketing. Psychologists focus on creativity, individual behaviour, beliefs and changes, e.g. one of the study areas is related with the aspects of innovativeness, determinants and measurement, in that psychologist Marcati et al. (2008) examined entrepreneurs' innovativeness and personality in the adoption of innovation. They studied the measurement of general and specific innovativeness of the entrepreneurs and how the innovativeness relates to entrepreneurs' personalities. Economists generally focus on the implications of innovation rather than the process of introducing something new, e.g. Song and Thieme (2009) investigated the impact of supplier involvement on the pre-design and commercialization of innovation, and the impact of the involvement on radical and incremental innovation. Organizational strategists are concerned with the maintenance and improvement of an organization's performance influenced by the changes made on products, structures and processes, e.g. Damanpour and Evan (1984) studied the rate of innovative idea adoption and its impact on organizational performance. Sociologists emphasized the processes of and changes in the firms, and people involved in the innovation, e.g. Larson (1991) examined social control between partners in entrepreneurship and innovation. Through the marketing approach, scholars generally considered the diffusion of innovation, e.g. Hassan (2008) studied the promotion of innovation, customers' acceptance of new products and procedures. They emphasized the importance of marketing research to the identification of customers' acceptance of new products.

⁷According to Knight (1967), innovation has positive and negative impact on an organization, unless it is specified, innovation in this study represents those that have positive impact on organizations.

2.2.1 Nature of Biotechnology Product Innovation

In the early nineteenth century, Schumpeter developed a well defined innovation definition from an economic perspective in his book *Theory of Economic Development*:

- (1) The introduction of new goods – new to the market or new quality of goods
- (2) The introduction of a new method of production or new way of handling a commodity commercially
- (3) The opening of a new market
- (4) The new source of supply of raw material
- (5) The new organization of any industry (Schumpeter, 1934, p.66).

He distinguished innovation and invention. The invention is outside the economic domain, it does not become innovation until it is produced and used. However, Solo (1951) and Goswami and Mathew (2005) claimed that focusing on novelty and newness, Schumpeter's definition fails to account for the source of innovation. Schumpeter (1934) addressed that innovation is possible without anything that is identified as invention. He offered various descriptions relating to the types of changes in innovation, but none of them covered its source. The only indication of the source is from an entrepreneur's mental activities, creating something new from the mind. Although Schumpeter's definition is broad in an economic sense, Solo (1951) argued that innovation is defined in various circumstances and disciplines. Therefore, it has various meanings accordingly, ranging from tangible products and ways an organization are organized to a comprehensive interpretation, which include intangible products such as knowledge and technologies. In their review of innovation, Garcia and Calantone (2002) noted that although there are many definitions, a new innovation smells just as sweet if it is labelled by any other names. Scholars (Damanpour, 1991; Goswami and Mathew, 2005) agreed with Damanpour and Evan's (1984) view, in that "innovation is a widely used concept and the term is variously defined to reflect particular requirements and characteristics of a specific study" (*ibid.* p.392). This shows that the understanding of the innovation concept has been

developed as being comprehensive. The definitions reflecting the accumulated knowledge of innovation are summarized in Table 2.1.

Table 2.1 Definition of Biotechnology Innovation

(Knight, 1967, p.478)	An innovation is the adoption of a change which is new to an organization and to the relevant environment.
Mohr (1969)	Innovation is the degree to which changes are intentionally implemented that is new to the organization.
Zaltman et al. (1973)	Any idea, practice, or material artefact perceived to be new by the relevant unit of adoption.
Damanpour (1991, p.556)	The generation, development, and adaptation of novel ideas on the part of an organization.
Rogers (1995)	An idea, practice or object that is perceived as new by an organization.
Garcia and Calantone (2002, p.112)	Innovation is an iterative process initiated by the perception of a new market and/or new service opportunity for a technology-based invention which leads to development, production, and marketing tasks striving for the commercial success of the invention.
(OECD, 2005)	Innovation is the implementation of a new or significantly improved product (goods or service) or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations.

Acknowledging the difference between invention and innovation, Goswami and Mathew (2005) hold that a common ground reached by all of these definitions is related to the "idea/practice/object", "new" and "process". Each researcher may also emphasize their particular interests in and focus of the studies through those definitions. Basically, an innovation is something new. It is derived from an idea/practice/object. Such an idea enters into a process of diffusion and becomes something new which is then commercialized by the unit of adoption. Innovation discussed by this study means something new to an organization.

Innovation is a process, associated with uncertainties and difficulties, as shows in Table 2.1. The recent definition, of Garcia and Calantone's (2002), has further developed Schumpeter's view by emphasizing one of the analytical dimensions of innovation – process. In this sense, innovation is viewed as a process with hard work, repeat procedures, difficulties, trials and uncertainties. It involves a series

of actions, commencing with an understanding of a new opportunity, production, market and utilization. Accordingly, Attridge (2007) suggests that innovation is defined as a process of discovering something new, from an idea into a saleable product/service. This definition is useful in biotechnology, and it pertains to product innovation which will be discussed further in the following sections.

2.2.1.1 Type of Product Innovation

Studies have used various terms to describe different innovations. Past research shows that the classification of different analytical dimensions is important for understanding a firm's behaviour and how innovation is generated (Downs Jr and Mohr, 1976; Frederickson et al., 1974; Knight, 1967). A review of the classification shows, in general, innovation can be categorized as: product vs. process (Karlsson and Olsson, 1998; Utterback and Abernathy, 1975), technical vs. administrative (Damanpour, 1991; Knight, 1967) and radical vs. incremental innovation (Damanpour, 1991; Roy et al., 2004). These categories are not exclusive of each other. The changes in one category are likely to generate those in the other categories.

Firms distinguish their focus between product or process innovations because of different core competences generated (Knight, 1967). Product innovations are new products or services introduced to meet an external user or market's need, whereas process innovations are new elements introduced into an organization's production or service operation, such as methods of handling materials, task procedures and the means of information flow (Damanpour, 1991; Utterback and Abernathy, 1975). Product innovation is the lifeblood of many firms and industries, in particular knowledge intensive industries such as biotechnology. New product development represents the growth of firms as well as the industry (Ahn and Meeks, 2008; Danneels, 2000; Hine and Kapeleris, 2006; Keeble, 1997; Rogers, 1995). In this sense, this study will focus on product innovation.

Evan (1966) pointed out that a difference between technical and administrative innovation reflects a general distinction of changes between social structure and

technology. The decision making processes between these two types of innovation are different (Daft, 1978). Technical innovation refers to the changes in products, services and production processes of technologies. It is subject to the work issues, which can be related to either product or process innovation (Damanpour, 1991; Damanpour and Evan, 1984; Knight, 1967). Most product innovations involve technological innovations (Rogers, 2003). Administrative innovation includes the changes in organizational structures and administrative processes. It is indirectly related to the work issues, and it links to the management of a firm (Damanpour and Evan, 1984; Knight, 1967). In the biotechnology industry where products involve high technologies, product innovations produce technological changes. They can be new or improved ways of testing, diagnosis, treatment and action of using biotechnology for interfacing diseases processes⁸.

Product innovation includes two types – radical vs. incremental innovation (Damanpour, 1991; Knight, 1967; Roy et al., 2004). The difference between radical and incremental innovation concerns the degree of changes that is as a result of innovation. Firms may expect to adopt internally and allocate relevant resources to make relevant changes. Hence entrepreneurs need to understand these two types of innovation. Damanpour (1991) noted that the importance of distinguishing the difference between radical and incremental innovation lies in the differences of the influential factors and contribution made by these two types of innovation. Scholars defined various types of innovation on this aspect, attempting to explain the degree of change that an innovation brings into an adopting organization. Yet, Roy et al. (2004) argued that the classification of radical vs. incremental innovation has long been accepted in the innovation literature. Referring to the focus of this study, a radical innovation produces fundamental changes in the configuration of an existing product. Such innovation is radical to the supply chain members (Roy et al., 2004, p.62). In contrast, if an innovation has less radical changes, which include modification or adding new

⁸ Syntaxin (2009). Product Pipeline Overview [Online]. Available from <http://www.syntaxin.com/biopharmaceutical-product-pipeline.php>. Accessed 6th January 2009. Also see (Attridge, 2007) Communicating about Innovation in Networks of Three U.S. Organizations. *The Journal of Communication*, 34, p.78-91.

features to the existing products that provide additional benefits or redesigned products in order for reducing costs and repositioning, then such product innovation is defined as incremental innovation. For example, a reduction on material thickness (Damanpour, 1991; Roy et al., 2004) or alternative molecules developed with different attributes that have value in treating certain disease variants (Attridge, 2007). Incremental innovations offer improved products that better satisfy the current and potential customers' needs (Varadarajan, 2009).

Apart from the new product generation perspective, scholars also describe the impact created by the level of product change on an organization and its market. Cooper (1988) suggested that various levels of product change can be defined according to the degree of newness brought to the company and to the market. According to these two dimensions, Booz et al. (1982) identified six types of new products, including: (1) new-to-the-world (products are new to both of the organization and the market); (2) new product lines (new to the organization, but not to the market); (3) extensions to existing product lines (new to the organization, but not new to the market); (4) improvement/modifications to existing products (with enhanced performance or better perceived value to customers); (5) repositioning (existing products that have new applications or new markets) or (6) cost reduction (products that have similar performance as the existing ones but at lower costs). Generally firms pursuing product innovation have a mix of these sorts of product innovation, including those in the biotechnology industry (Couchman et al., 1999).

Whether radical or incremental, developing a new product is a risky job (Garcia et al., 2008). The literature has discussed the level of product change, in that an innovator would go through a process in innovation generation, and this brings about a concept of risk. Radical innovation is normally associated with a high degree of risk and uncertainty, since this type of innovation is disruptive or discontinuous (Damanpour, 1991; Garcia and Calantone, 2002). In some cases, a radical innovation can create a new industry such as laser and e-commerce (Walsh and Linton, 2000). It means that the more radical an innovation is, indicated by the amount of knowledge and new knowledge needed from a firm, the more risks, difficulties and uncertainties it creates for a later stage of

implementation (Rogers, 2003). Empirical studies suggested that most firms are far more able to make incremental improvement to existing products, roughly 90% of all product innovations are incremental innovations (Rothwell and Gardiner, 1988; Von Hippel et al., 1999). Incremental innovation involves a lower risk and less uncertainty, and need less technical expertise for the implementation. Hence, firms generally develop more incremental innovations where setup problems and capital input are less (Olsen, 2006). Radical innovations and incremental innovations are not exclusive of each other. Radical innovation can be initiated by many small incremental step changes (Olsen, 2006; Sheridan, 2007).

So far, scholars described the type of product innovation from different dimensions, namely new product generation per se, the impact to the organization and market, and the innovator. On the one hand, these dimensions show the complex and multifaceted nature of product innovation and that a multi-disciplinary approach needs to be adopted in the process in order for successful innovation generation. On the other hand, entrepreneurs need to think about product innovation with a systematic view and to ensure that relevant resources are available for pursuing business objectives. Apart from “types” that have been used by scholars as a way to understand the concept of product innovation, “stage” is also employed as a way to demonstrate the innovation.

2.2.1.2 Stage of Product Innovation

Capturing its dynamic nature, the literature also shows that product innovation is a process which includes two stages, initiation and implementation. The innovation initiation stage consists of the idea generation and persuasion which is a launch phase. It includes all of the activities relating to problem perception, information collection, attitude formation and evaluation and the decision to adopt an innovative idea as a solution to the problem/or need (Madhavan and Grover, 1998; Rogers, 1995). Implementation stage consists of all of the events, activities and decisions in putting an innovation into use (Damanpour, 1991; Knight, 1967; Madhavan and Grover, 1998; Rogers, 2003). The decision to adopt an innovative idea serves as a boundary of separating two stages (Rogers, 2003,

p.421). In this sense, the generation of product innovation in this study involves both the initiation and implementation of a new product.

New product development is a complex phenomenon that such a classification of radical or incremental innovation, which distinguishes the changes generated by an innovation, may not suit all product innovations. A critical view points to innovation research relating to the perception of whether a one-fits-all theory can be produced and applied to all types of innovation across industries (Dewar and Dutton, 1986). Given that the occurrence of incremental innovation is far more frequent than radical innovation, many existing studies have focused on radical product innovation, including those in biotechnology (Casper and Whitley, 2004). Little research has been carried out on incremental product innovation (Cooper, 1994; Olsen, 2006), thus incremental product innovation in biotechnology SMEs constitutes the interest of this thesis.

Studies showed that the degree of product innovation, whether radical or incremental, is closely linked to the type of network partner of a firm's networks (Pittaway et al., 2004). In addition, different types of networks may contribute more or less at different stages of innovation generation (Biemans, 1991; Bruce and Rodgus, 1991). The types of network partner and product innovation generation are highlighted in sections 2.2.2.2 and 2.2.2.3 of this chapter.

So far, this section attempts to understand biotechnology product innovation by beginning with the concept of innovation. It has revealed that innovation is, indeed, a complex construct. Our knowledge of what is innovation tends to be more comprehensive as our understanding enhances. For example, a progressive understanding of innovation is represented by the quantity and diversity of its typology, and the recognition of the elements in the processes, the characteristics of risk and uncertainty (Rogers, 2003). Scholars have attempted to perceive its nature from different aspects. Attridge (2007) argued that there is yet no universal conceptual framework on biotechnology product innovation. Damanpour and Evan (1984) suggested that innovation is a broadly used concept and that specific theoretical attention on the concept should be dependent on the needs and nature of a particular study. Among various types of

innovation, product innovation is crucial and is lifeblood for the survival of an organization. Incremental product innovation has become the focus of this study. The rest of this chapter will continue to seek to understand product innovation generation and the relevance of the biotechnology industry.

2.2.2 Generation of Biotechnology Product Innovation

The definition of innovation has been examined from different perspectives, similarly the process of product innovation generation has been studied from diverse disciplines, including anthropology (Arnould, 1989), economics (Dosi, 1988), psychology (Breckler and Wiggins, 1992; Petty and Cacioppo, 1986), sociology (Albrecht and Ropp, 1984; Knight, 1967), social psychology (Drazin and Schoonhoven, 1996) and marketing (Hakansson, 1987). Existing studies have identified certain variables influencing product innovation generation from different angles, attempting to improve our understanding of a firm's behaviour in innovation practice, and therefore to enhance innovation performance. The definitions indicate that a product innovation is rooted in and generated from human nature, ambition and potential to improve life and the way of living.

A review of literature shows there seems to be different views on what should be included in the generation of product innovation. However, in spite of the differences scholars appear to show consensus on several aspects of product innovation generation. Firstly, the process of product innovation is a process of people interactions (Hellstrom, 2004; Madhavan and Grover, 1998). The individuals involved in the innovation do not live in a vacuum; rather they interact with each other during the innovation processes. Secondly, in general there are two basic aspects involved in the product innovation generation process, namely cognitive and affective perspectives. Thirdly, individual characteristics and organizational attributes affect the processes. These aspects are not separated, rather inter-related with each other. The remainder of this section will go through these issues.

2.2.2.1 People Interactions

Referring to the first argument, it is recognized that a product innovation commences with the recognition of a problem or need, which “stimulates research and development activities designed to create an innovation to solve the problem or need” (Rogers, 2003, p.137). As indicated in the foregoing, product innovation generation involves all activities related to problem perception, information collection, persuasion towards attitude formation and the decision to adopt innovative ideas as the solutions. Albrecht and Ropp (1984) viewed that product innovation generation is a process of diffusing the innovative ideas, while Rogers (2003) noted that innovation generation involves a series of choices, actions and decisions over time through which an organization evaluates a new idea and decides whether to carry on the innovation practice. Referring to the focus of this study, Dosi (1988) argued that technological innovation is a process of searching for solutions and dealing with the uncertainty in order to solve the problems/or needs. In biotechnology, a problem/need can be, for example, the use of traditional chemical products/methods in treating contaminated land. Such traditional methods, however, have side-effects of polluting the environment. An innovative idea/solution to the problem can be the utilization of biotechnological products/methods as a replacement to the traditional technologies so that the side-effects can be avoided⁹. Nevertheless, Hellstrom (2004) held that those activities, events and actions of a product innovation are seen as a process which cannot be separated from people interactions, and they are social actions. Hellstrom highlighted that humans are the main entity that carry out these activities and events. This concept of people interactions is related to two aspects, one is dyadic interactions with the people involved and another is related to a broader sense of network connection.

2.2.2.1.1 Dyadic Interactions

Referring to the first aspect, scholars agree that as a process of people interactions product innovation in established firms includes both cognitive and

⁹ Contaminated Land, <http://www.abricon.com/contaminated-land-problems.asp?gclid=CMfsw67VjpkCFQIF3godTTV9Zg>, last accessed 2nd February 2009

affective aspects (Corti and Lo Storto, 1997, 2000; Madhavan and Grover, 1998; Nonaka, 1990; Polanyi, 1967).

2.2.2.1.1.1 Cognitive Aspect

Cognitive perspective of knowledge creation refers to skills, knowledge, and strategies that each team member brings about, and this is influenced by the situation (Madhavan and Grover, 1998). In examining team members' engagement in a product innovation, Madhavan and Grover (1998) argued that the creation of knowledge is the central theme of the product innovation process. They highlighted that the innovation process is a process of new knowledge creation; a new product is an outcome of knowledge creation. The cognitive aspect of a new product relates to the role of explicit and tacit knowledge in the new knowledge creation. Explicit knowledge resides in formulae, textbooks, documents, tools or Internet (Uzzi and Dunlap, 2005) that are comparatively easy to articulate and communicate (Madhavan and Grover, 1998; Polanyi, 1967). Corti and Lo Storto (2000) pointed out that explicit knowledge can be produced and stored by employees in terms of reports, white papers, plans, technical documents, spreadsheets, designs, blueprints, formulas, memos and symbols, etc. Thus, firms do not have great difficulty in accessing explicit knowledge. Tacit knowledge, however, refers to the type of knowledge that is informal and disorganized, with a high degree of unawareness and cannot be explained completely even by an expert and cannot be easily transferred from one individual to another; and it is only obtained through a long process of apprenticeship (Madhavan and Grover, 1998; Polanyi, 1967). Corti and Lo Storto (2000) defined tacit knowledge as consisting of "ideas, opinions, judgments, assumptions, meanings, questions, decisions, guesswork and stories that cannot be stored in some physical support" (*ibid.* p.248). Hine and Kapeleris (2006) held that tacit knowledge is skills and experience. According to Polanyi's (1967) "iceberg" metaphor, tacit knowledge constitutes of roughly 95 percent of a pool of an individual's knowledge, the rest is explicit knowledge. This means that new knowledge creation is mainly subject to tacit knowledge creation. It implies further that product innovation relies on tacit knowledge exchanges and creation; and much of such knowledge has not yet been in the public domain or it is

difficult to codify (Anderson et al., 2007; Howells et al., 2003). Scholars (Anderson et al., 2007; Nonaka, 1994) claimed that the exchanges of tacit knowledge are also difficult to articulate and transfer unless those who possess it are able to or willing to illustrate it to others. Hence the exchanges are deeply embedded in the human interaction processes and relationships.

It appears that the notion of distinguishing explicit and tacit knowledge has been accepted by many scholars, those that hold similar views include, for example, Kogut and Zander's (1992) who differentiate knowledge and know-how; Uzzi and Dunlap (2005) who separated public and private information; and Dosi (1988) who distinguished information and knowledge. Although various terms are used, the differences are rather terminological than substantial.

Whilst indicating the importance of tacit knowledge exchanges, scholars (Albrecht and Ropp, 1984; Dosi, 1988, 1993; Knight, 1967) pointed out that information flow is one of the important elements in tacit knowledge integration that creates new knowledge, since information flow is critical in product innovation process whereby an innovator searches for solutions to the problems. The information can be, for example, the limited effects and the side-effects of, and a range of diseases treated by a particular medicine. Dosi (1988) demonstrated that such information that is constructed by specific technologies is scientific inputs of new product development.

Understanding the key elements of new knowledge creation in product innovation generation helps the entrepreneurs be aware of the determinants of the process, and therefore effectively manage the process. Given the importance of tacit knowledge exchange and information flow in the creation of new knowledge, Corti and Lo Storto (2000) found, based on an empirical study, that grasping tacit knowledge is nearly impossible if one is not familiar with the original organizational processes/or routines. Grasping tacit knowledge is a result of the accumulation of know-how of an organization. It is not achievable even if one observes and talks with the experts of the firm. In a similar vein, Dosi (1988) noted that familiarity and "grasp" of tacit knowledge comes from heuristic of know-how, e.g. "how problems happened" and "how to improve them", which are

as a result of practices, repetitions and more or less gradual improvements so that the individuals are able to explore the opportunities in new product development. Hence, tacit knowledge cannot be acquired easily, since it is invisible, transitory and ephemeral (Corti and Lo Storto, 1997). Referring to the flow of information, Albrecht and Ropp (1984) and Knight (1967) emphasized the critical role of "fast feedback" in ensuring information flow between the individuals, and this relates to the modes of interaction used. As technology advances, electronic interaction modes (e.g. email) may have a certain impact on yielding "fast feedback". In addition, Dosi (1988) pointed out that for a firm which is innovating, the access to a broad source of information may provide individuals the opportunities of gaining initial scientific inputs which lead to product innovation. The notion, "a broad source of information", is related to network connection. Again, electronic media such as websites and emails may assist individuals to access a broad source of information by enabling the network connection.

To explore the ways in which tacit knowledge and information flow affect the generation of product innovation, Corti and Lo Storto (2000) investigated technical product innovation from a cognitive perspective. They suggested that as a result of problem solving, new knowledge creation is affected by two cognitive factors, ambiguity and uncertainty. These two key cognitive elements are related to knowledge tacitness and information flow respectively in new knowledge creation. Ambiguity refers to the state of a system when there could be a few different possible interpretations, often contrasting, of a situation (Corti and Lo Storto, 2000, p.249). Ambiguity emerges when knowledge is tacit. Ambiguity increases when knowledge tacitness becomes greater and which stimulates new knowledge creation. Hence the exchanges of tacit knowledge require rich personal face-to-face interactions (Madhavan and Grover, 1998; Nonaka, 1994; Nonaka and Takeuchi, 1996; Polanyi, 1967) to reduce message ambiguity in new knowledge creation. Uncertainty is conceptualized as a state in which "a system falls as a consequence of the lack of information" (Corti and Lo Storto, 2000, p.249). Uncertainty hinders the process of new knowledge creation by affecting information flow between the individuals (Corti and Lo Storto, 2000; Johnson, 1990; Le Flanchec, 2004; Nonaka, 1991). To reduce perceived uncertainty, entrepreneurs are recommended to enable information flow between

the individuals in dyadic interactions. These cognitive factors influence the ways in which an individual perceives the complexity of problems/or needs in product innovation processes.

It appears that people interactions are crucial in facilitating tacit knowledge exchanges and information flow, the two cognitive aspects of product innovation generation. Primarily the potential new knowledge is embedded in the individuals (Madhavan and Grover, 1998). Scholars (Corti and Lo Storto, 1997, 2000; Nonaka, 1994; Nonaka and Takeuchi, 1996) argued that tacit knowledge cannot be easily extracted because people interactions are embedded in complex social relationships. In addition, the flow of information is closely related to interpersonal social relationships (Athaide et al., 1996; Huang and Chang, 2008; Kanter, 1982; Roy et al., 2004). The individual social relationship is classified as the affective aspect of product innovation generation.

2.2.2.1.1.2 Affective Aspect

Another imperative perspective in the generation of product innovation is affective aspect. The affective aspect relates to the relationships that affect the coordination of discrete individuals who bring competences and skills into a new knowledge creation process (Corti and Lo Storto, 1997, 2000; Madhavan and Grover, 1998; Polanyi, 1967). Albrecht and Ropp (1984) were the earliest scholars who identified the variables of interactions from communication perspective of innovation generation. They investigated how innovative ideas are discussed in individual's interactions in intra-organizational innovation, and emphasized the importance of information flow and relationship development between individuals. Albrecht and Ropp (1984) revealed that innovation is a product of complex inter-personal interactions between individuals. During the interactions information and knowledge held by different individuals are exchanged, which allows for new knowledge creation. They found that information flow and new ideas emerge when social/personal matters are exchanged in the interactions. The conversation only on innovation topics is very rare. This shows that innovation generation is a dynamic process of information

and knowledge exchanges, and learning through people interactions (Rogers, 2003). The process is constructed by an individual's social/ or personal perspective of the interaction. Without social exchanges, the exchanges of a problem/need that lead to an innovative idea are hard to exist.

Following the notion that tacit knowledge transfer and new knowledge creation are embedded in social relationships, Albrecht and Ropp (1984) shows that the interactions of new ideas are embedded in strong, developed and stable interpersonal relationships between two individuals. They found that close and strong interpersonal relationships foster the emergence of new ideas. According to Madhavan and Grover (1998), the flow of information involves the exchange of tacit knowledge. A close and stable social relationship between the individuals is an antecedent for fluent tacit knowledge transfer. The relationships between the individuals in a network will be discussed in more detail in later sections of this chapter.

2.2.2.1.1.3 Individual Characteristics and Organizational Attributes

Dosi (1988) highlighted that an innovator's capabilities in terms of specific and un-codified abilities are an important factor in new knowledge creation, since they determine the knowledge base for new product development. Focusing on intra-organizational interactions, Baldrige and Burnham (1975) found that individual characteristics such as sex, age and personal attitudes do not appear to be important factors, rather administrative positions and roles are shown to have an impact on the individual involvement in the innovation process. Concerning individual characteristics and how they relate to people interactions within the organizations, Knight (1967) pointed out that an individual's attributes such as belief, self-image, knowledge, life experience and social status are the factors that have an impact on innovation generation, since innovation generation is a dynamic process which consists of persuading, forming attitudes and making decisions on adopting innovative ideas as solutions to the problems/needs. Those individual attributes determine an individual's behaviour and the formation of attitudes.

In addition, the impact of individual characteristics on the generation of product innovation is not only examined in its own right, but also in the context of people interactions in relation to product innovation generation. Albrecht and Ropp (1984) found that innovation generally occurs between two individuals who are of the same status. The finding is supported by Lincoln and Miller (1979), in that the perceived individual similarities play a role in the formation of organizational relationships. Dosi (1988) proposed that to some extent tacit knowledge can be shared by collaborators/or colleagues who have common experience. This seems to show that although difficult, there are conditions in which tacit knowledge can be transferred in the interactions.

Furthermore, the impact of an individual's characteristics on product innovation is considered by linking to his/her environment. An individual's network connectivity affects dyadic interactions in new product development (Anderson and Jack, 2002; Granovetter, 1985; Lorentzen, 2008; Roy et al., 2004; Tinsley and Lynch, 2007); more detail will be discussed in the next section 2.2.2.2 of external networking. Scholars also pointed out that not only should individual characteristics but also organizational attributes be considered to affect the success of product innovation, such as knowledge and technologies, networks, markets and organizational structure, which are the resources of an organization (Goswami and Mathew, 2005; Kumar, 2004; Ledwith and Coughlan, 2005).

Given the relevance of the key elements and factors in generating product innovation, this study has shown that product innovation generation is comprised of cognitive and affective aspects; these two basic aspects cannot be separated from people interactions. The recognition of the importance of dyadic people interactions allows for the identification of the relevant elements, namely network relationships, interaction mode, individual characteristics and organizational attributes involved in the process of people interactions in new knowledge creation. However, it appears that most of the studies have focused on investigating the role of these elements in the context of intra-organization product innovation generation (Albrecht and Ropp, 1984; Dosi, 1988, 1993; Hippel, 1988; Knight, 1967; Madhavan and Grover, 1998; Nonaka, 1990; Polanyi,

1967; Rogers, 2003). A recent trend in product innovation has shown that firms, particularly SMEs, have paid great attention to external collaboration as a way to develop new products.

2.2.2.2 Biotechnology Product Innovation through External Network Collaboration¹⁰

The networking approach to product innovation generation is particularly important for SMEs, as it helps them to overcome the weakness of a lack of resources because of size and resource constraints (Croom and Watt, 2000; Liming and Aram, 1995). This is demonstrated by the fact that the demand for reducing innovation cycles and fast moving biotechnology industry calls for effective innovation activities from the SMEs. In addition, increasing R&D costs have pushed the SMEs to explore innovation capabilities from the external environment through collaboration (Gassmann et al., 2006).

The most common benefits of the collaboration include risk sharing, cost reduction, information acquisition, collective learning, access to complementary knowledge and skills and new markets (Eisenhardt and Schoonhoven, 1996; Hagedoorn, 1993; Kleinknecht and Reijnen, 1992; Kogut, 1989; Powell et al., 1996) and extended networks which bring more opportunities, encourage collective learning, and therefore, improved organizational innovative capabilities. The interactions also lead to improved trust and bond between parties which facilitate problem-solving, joint actions and innovation generation (Huang and Chang, 2008; Tracey and Clark, 2003). Furthermore, Roy et al. (2004) noted that incremental innovation, characterized by minor changes and gradual improvement made to the existing products is likely to be generated by novel interactions in supplier-customer relationships.

¹⁰ In this study, collaboration refers to a way of a SME working together with other organizations in the external environment by arrangements; such arrangements can take several forms such as joint ventures, trade associations, licensing agreements, management contracts, R&D collaboration, social norms (Pfeffer and Salancik, 1978; Soh, 2003).

Beesley and Rothwell (1987) conducted an investigation of 100 innovative SMEs in the UK and indicated that 89 percent of these SMEs have at least one important external network. In addition, based on an intensive study of 12 technological SMEs, Dodgson and Rothwell (1989) confirmed that successful SMEs are actively engaged in seeking and creating external networks and set such networking approach to innovation as a crucial organizational strategy. External collaboration for product innovation generation is a useful strategic tool in achieving SMEs' growth and competitiveness (Cooke and Wills, 1999; Danneels, 2000; Freel, 2000). The form of collaboration can be various, ranging from joint activities in R&D, equity joint ventures to collaborative manufacturing (Powell et al., 1996).

Given that external networking has become increasingly recognized as being critical to product innovation generation, this does not mean that internal network interaction within an organization is less important. Danneels (2000) noted that technological competence enables a firm to have the ability to produce new products with certain features. Competence refers to "an ability to accomplish something by using a set of material, e.g. materials, equipment" (*ibid.* p.2). As highlighted in the last section, people interactions within organizations affect cognitive and affective aspects of product innovation. Undoubtedly an entrepreneur's ability to manage both internal and external interactions effectively is needed (Ledwith and Coughlan, 2005). However, for a SME, developing product innovation can be a very risky job. It requires a large part of financial funds to go into a project, and this is associated with opportunity costs of committing scarce skills, knowledge and time to one project instead of another (Beesley and Rothwell, 1987). Thus, anything that can be arranged to reduce the risk by obtaining the resources from external environment is considerably useful to any sized firm, particularly SMEs (Birley, 1985; Ostgaard and Birley, 1996; Szarka, 1990). Engaging in external network activities may have effects on reducing risk and cost, and can enhance the market and technical knowledge of a SME which constitute an important part of innovation generation (Beesley and Rothwell, 1987). Therefore, it is the interest of this study to focus on the external network interactions of biotechnology SMEs for generating incremental innovation.

Roy et al. (2004) highlighted that the network connectivity of a firm is an important factor external to the dyadic interactions. This may involve direct links with vertical networks such as supplier, customer, distributor and competitor. The particular benefits arising from vertical network involvement include the exchanges of information, innovation improvement, access to markets or channels, cost reduction, quality, word-of-mouth and reputation effects, extended credit terms and firm growth (Lipparini and Sobrero, 1994; Pittaway et al., 2004; Wilson and Appiah-Kubi, 2002). The firm may also interact directly with horizontal networks of university, science partner, industrial community, government agency and trade association (Hadjikhani and Thilenius, 2005; Wilson and Appiah-Kubi, 2002). In a systematic review of innovation and networking, Pittaway et al. (2004) noted that the type of networks with which a firm is engaged in the collaboration for product innovation tends to be related to the type of innovation generated. This view is supported by empirical studies in that incremental innovation more often comes from network interactions with customers (Biemans, 1991; Von Hippel et al., 1999). The collaboration with suppliers is likely to generate a production innovation which is new to a market (Baiman and Rajan, 2002; Ragatz et al., 1997; Song and Thieme, 2009). Joint effort with universities generally develops more radical innovations (Häusler et al., 1994; Liyanage, 1995). Any network link is established as a result of dyadic interactions (Anderson et al., 1994). Accordingly this study will, from a firm's perspective, focus on SMEs' dyadic interactions in the external networking process in product innovation.

Apart from direct links, the biotechnology SMEs have indirect relationships with others because of network partners' relationships. A firm in a network thus has a number of exchange relationships with other firms (Low, 1997, p.90). Regional studies (Ahn and Meeks, 2008; Audretsch, 1998; Cooke, 2002; Jack et al., 2004; Porter et al., 2005; Porter, 1990) have shown that collaboration actually involves networks of networks which offer great advantages to an individual firm for innovation and productivity. The two aspects are important for knowledge based industry that does not rely on natural resources. They are also important for the long-term prosperity of any nation (Leonard, 1995; Porter, 1990). Managing

inter-organizational relationships in diverse networks can be challenging to the entrepreneurs in SMEs in biotechnology, particularly because many of them are scientists (Ahn and Meeks, 2008). Knowledge and skills are needed in managing such processes in order to improve innovation performance and to achieve overall business objectives. Network linkages in the collaboration are built upon people interactions to form a network for product innovation generation (Beije and Groenewegen, 1992; Hakansson, 1987).

The notion of network connectivity, proposed by Roy et al. (2004) is relevant to Dosi (1988)'s theory of the elements of new knowledge creation, in that network connectivity provides the source of information, and of problems/or needs, highlighted by Dosi (1988). To an organization, information containing problems/needs that is as a result of network connections is viewed as a potential opportunity for new product development. Moreover, network connection enables tacit knowledge exchanges between internal and external of a firm (Ernst and Kim, 2002), facilitates the sharing and the integration of tacit knowledge, and therefore, new knowledge creation which lead to innovation generation (Anderson et al., 2007; Macpherson et al., 2005; Rosiello and Orsenigo, 2008; Roy et al., 2004).

Recent studies have indicated that SMEs' network interactions extend from a local/or regional to a global scope (Fontes, 2007; Gertler and Levitte, 2005; Gittelman, 2007; Hendry and Brown, 2006; Lorentzen, 2008; Moodysson and Jonsson, 2007; Rasmussen et al., 2001; Rialp et al., 2005). A mix of local/or regional and global networks have emerged in SMEs in biotechnology for pursuing product innovation. Fontes (2007) claimed that biotechnology scientific production is increasingly recognized as an international phenomenon. Gittelman (2007) indicated that through the mass media of scientific or joint scientific publications, scientists in the biotechnology firms were able to access global networks and build up knowledge-based communities. This is how product innovations are initialized through the formation of collaborative networks. Mass media includes, for example, brochures, posters and publications and corporate websites. From a firm's perspective, a network partner may get to know firms through mass media by means of brochures, corporate website visits, or existing

social/personal network ties with the previous working colleagues or friends or the extended networks of these existing relationships. Rogers (2003) found that mass media are more effective in creating knowledge of innovation ideas, however, they are not the most important communication modes in persuading networked firms to form a favourable attitude towards the new idea.

As addressed in the earlier section of this chapter, Albrecht and Ropp (1984) and Knight (1967) found that information flow and fast feedback are important in interpersonal interactions in product innovation generation. However, Albrecht and Ropp and Knight have focused on intra-organizational rather than inter-organizational networking within which product innovation takes place. In refining Albrecht and Ropp's (1984) and Knight's (1967) view, Roy et al. (2004) suggested that modes of interaction, including a range of different means from face-to-face meetings, letters, faxes, emails, electronic data interchanges to web-enabled business-to-business operating systems are an element in the inter-organizational network interactions in innovation generation in supplier-customer networks. Roy et al. (2004) also proposed other two elements, namely quantity and scope of interactions which are useful in understanding the interactions, and these will be discussed in the next section 2.2.2.2.3.

In fact, Albrecht and Ropp (1984) and Knight's (1967) view concerning the speed of feedback is actually related to the interaction modes (Roy et al., 2004), time and geographic location between the individuals. The complexity of a mix of network interactions at local/regional as well as global level in product innovation generation brings a great challenge to entrepreneurs in the biotechnology SMEs. As will be discussed in Chapter Three, with the biotechnology SMEs networks expanded from local/regional to global and the emergence of various modes of networking supported by the new technologies, networking may be managed effectively and efficiently by using virtual modes, e.g. email may have an effect on knowledge transfer and information flow across time and geographical distance.

A review of the existing literature shows that there are various elements in the network interactions in product innovation generation, e.g. tacit knowledge

exchanges, information flow, network relationships, individual characteristics, organizational attributes and mode of interaction and these elements can be viewed as part of a holistic behavioural process in a network formation in collaborative product innovation. These elements are used for analytical purposes, however, in the real world they are integrated into a holistic system of an entrepreneur's networking behaviour (Beije and Groenewegen, 1992). For example, in an informal cafeteria coffee meeting with a collaborating firm, the entrepreneur of an established biotechnology SME represents himself as an individual; in the meantime he also has business interests and objectives in his mind representing his enterprise. In the interactions, all of these elements are integrated into his behaviour and take place simultaneously in one meeting.

The discussion of sections 2.2.1 and 2.2.2 has also shown that the generation of biotechnological product innovation is understood as a complex and dynamic phenomenon, because the elements involved are diverse. The complexity of biotechnology product innovation has been discussed in the proceeding section 2.2.1. It is shown that product innovation has been defined in various ways and from different perspectives. It consists of a variety of elements, which are perceived to participate and interact in the process in various ways. The dynamic nature of biotechnology product innovation is indicated by the effect of network relationships and modes of interaction (related to time and distance). An innovation is affected by the time involved in the generation process. Entrepreneurs of biotechnology firms spend a lot of time obtaining information (Soh, 2003), e.g. various information about the product innovation is dispersed in the firms and in the market, the efforts can be time consuming and costly. Thus, the speed of information acquisition and feedback affects the time spent on the process. Distance refers to geographical location between a biotechnology SME and its network partner. The further the distance the more likely the firms are in need of virtual interactions in the process, because the possibility of managing face-to-face meetings is understood to be less (Fontes, 2005; Powell et al., 1996).

Product innovation generation is understood based upon complex elements and is affected by various factors and the factors of factors. It is embedded in people

interactions. Network relationship in collaborative innovation is changeable and progressive, and influenced by an individual entrepreneur's behaviour as well as the resources of an enterprise (Albrecht and Ropp, 1984; Knight, 1967).

Figure 2.1 Generation of Collaborative Biotechnology Product Innovation (GCBPI)

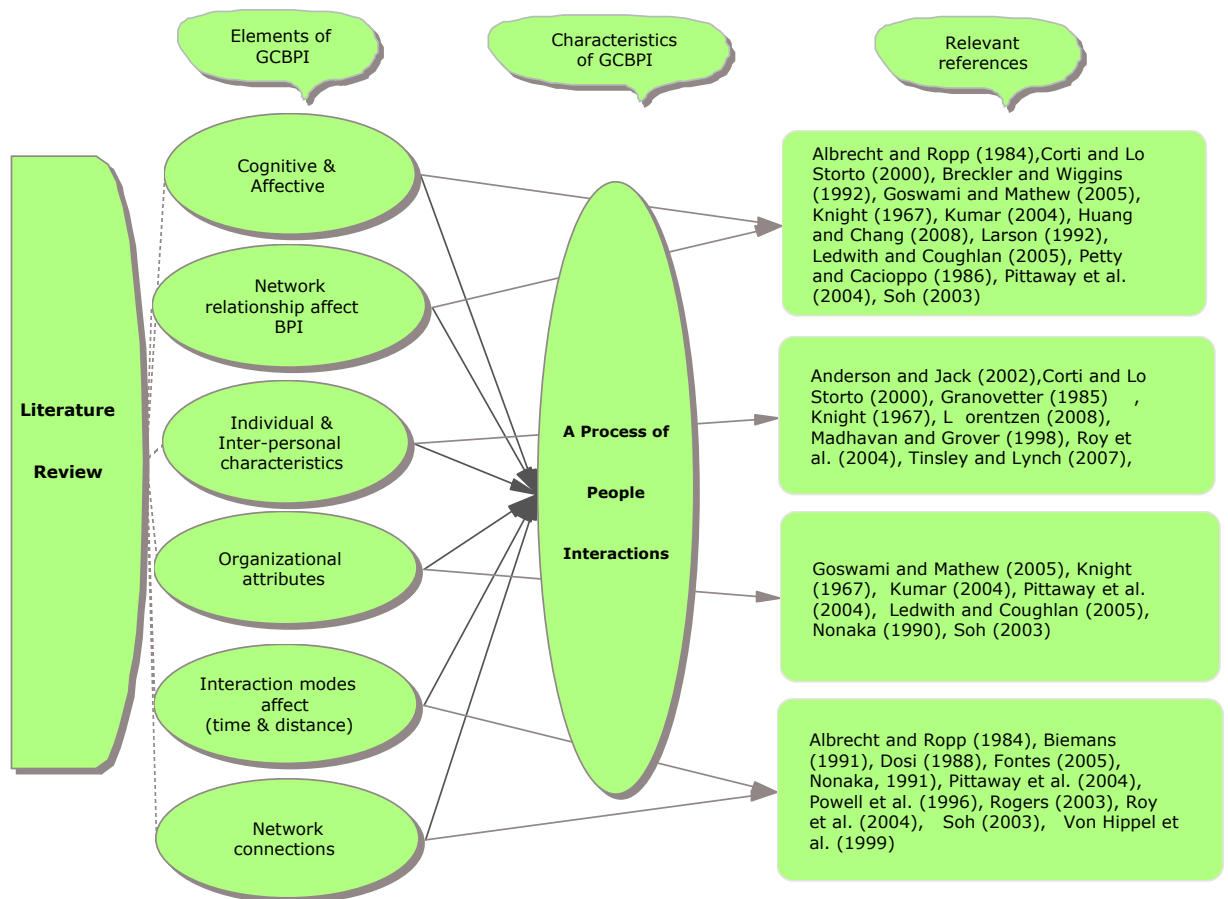


Figure 2.1 summarizes the literature review of the generation of collaborative biotechnology product innovation. The main characteristic, highlighted as A Process of People Interactions is located in the middle of the framework. The elements discussed in the foregoing are on the left, the sources are provided on the right side of the framework. Whilst the framework may be useful to entrepreneurs in biotechnology SMEs in understanding the concept of product innovation via collaboration, it may also be useful to scholars of product innovation in studying the phenomenon from an analytical perspective. Nevertheless, it essentially shows a picture, setting a context in which

biotechnology SMEs' external networking takes place in pursuing product innovation.

As discussed in this section 2.2.2, the recent emerging networking approach for product innovation generation used by SMEs in the biotechnology has indicated that external networking is an effective way in responding to, and of interacting with, a SME's external environment. Given that the interest of this study lies in the external network interactions in biotechnology product innovation generation, Pittaway et al. (2004) argued in their systematic review of innovation generation and networking, that customers are the most valued network partners when firms confront innovation generation. This view has been supported by empirical studies, which demonstrate that the most important collaborators of product innovation are, firstly, customers, and secondly, suppliers (Kaufmann and Todtling, 2000, 2001; Prugl and Schreier, 2006). The following section attempts to gain an understanding of firm-customer network interactions in product innovation from the existing literature.

2.2.2.3 Biotechnology Product Innovation through Networking with Customers

"I don't want to invent anything that nobody will buy."

Thomas Aha Edison, *Source Hauser et al. (2006, p.688)*

In new product development, firms have realized that fulfilling customer needs is a difficult, time-consuming and challenging event (Kristensson et al., 2004). This explains why scholars have paid much attention to the customers' contribution to the generation of industrial product innovation and suggested that involving customers in new product development process is important for successful product innovation (Jack et al., 2004; Pittaway et al., 2004; Von Hippel, 2001; Von Hippel et al., 1999). Bruce and Rodgus (1991) investigated open conversations between customers and firms, they found that the dialogues enable firms to know the existing as well as emerging needs of the customers,

and such needs are ahead of the competition. The creative ideas generated from customers' problems/needs set a good start for innovation, they are crucial to the success of the innovation process; since studies show that many innovations do not fail at the later stage but in the beginning of new product development (Khurana and Rosenthal, 1998; Kristensson et al., 2004). In this sense, firms can obtain information, innovative ideas and advice through customer-networks for product innovation (Birley and Cromie, 1988; Ostgaard and Birley, 1994, 1996; Soh, 2003).

The involvement in customer-network relationships reduces the risk of innovation and enables owner-managers to target the resource input more precisely, since the knowledge of customers' problems or needs reduces the uncertainties and risk of failure for firms that are innovating; this is achieved by ensuring the potential products meet the customers' needs (Athaide et al., 1996; Gassmann et al., 2006; Gemunden et al., 1992; Pittaway et al., 2004; Ragatz et al., 1997). Firms must incorporate their key new product development activities with the existing and potential customers (Biemans, 1991; Gassmann et al., 2006). Danneels (2000) argued that a firm's competence to link customer-networks affects its competence to generate product innovation. This competence refers to a firm's ability to accomplish something by using a set of non-material resources, e.g. understanding of customer problem/needs, and such competence has an impact on the firm's long-term innovation performance (Gemunden et al., 1992).

Empirical studies have indicated that collaboration with customers generally generates incremental innovation, whereas collaboration with suppliers is likely to create products new to the market (Baiman and Rajan, 2002; Ragatz et al., 1997). As highlighted in the early section of this chapter, incremental innovation is more common in organizations. Therefore, this study will focus on firm-customer network interactions in the process of incremental product innovation generation.

Despite the fact that customers problems/needs are important to innovation generation (Hauser et al., 2006; Iwamura and Jog, 1991; Rothwell and Gardiner, 1988), however, many firms have not brought customers into their new product

innovation processes effectively (Alam, 2002; Kristensson et al., 2004; Martin and Horne, 1995). In addition, although there has been research in relation to customer-network and product innovation, yet a majority of them focused on the links between the strategies of firm-customer network and the impact of technical development of the firm (Awazu et al., 2009; Bruce and Rodgus, 1991; Cooper and Edgett, 2008; Danneels, 2000; Gassmann et al., 2006; Michael and Robert, 2008). For example, Awazu (2009) examined the role of ICT in managing customer records and the new ideas of innovation, and its management impact on the firms. More research that provides insights into dyadic interactions is needed in order that effective management of customer-network interactions can be achieved in the process of product innovation (Roy et al., 2004).

To address the importance of networking in product innovation in supplier-customer network, Roy et al. (2004) proposed that the generation of incremental innovation most likely is associated with those supplier-customer relationships within which network interactions are high. They employed network embeddedness theory and structural theory to explain the impact of interactions on innovation. On the one hand, networking between suppliers and customers builds ties which yield strong relational embeddedness¹¹ (Granovetter, 1973, 1985; Gulati, 1995; Uzzi, 1997, 1999), such relational embeddedness relates to the formation of norms and "sense" between individuals in the collaboration (Dwyer et al., 1987). Roy et al. used an example to explain relational embeddedness that as the familiarity increases between network partners, a brief email message or phone call may be adequate to communicate the latest issues related to an innovation. This example appears to involve two aspects of the interactions. The first concerns the network relationships and product innovation generation, in that empathy, embeddedness and familiarity derived from the interactions facilitate the cognitive aspect of product innovation. The second aspect is related to the interaction mode and the network partners'

¹¹ Relational embeddedness refers to "the degree to which commercial transaction take place through social relations and networks of relations that use exchange protocols associated with social, non-commercial attachments to govern business dealings" (Uzzi, 1999, p.482). The concept in business relationships was initially raised by Granovetter (1973, 1985) from sociological perspective which highlights that market exchanges occur in the context of social relationships and these relationships regulate the flow of goods and services. Such a view of social embeddedness provides an understanding of organizations' economic activities (Frankel et al., 1996; Granovetter, 1973a, 1985). Scholars have applied the theme in various business contexts involving relationships, such as marketing, innovation and entrepreneurship.

understanding of the cognitive aspect of product innovation. The later issue will be discussed in Chapter Four. On the other hand, based on Burt's (1987, 1992) cohesion and structural theory Roy et al. (2004) argued that the interaction process and embeddedness generate a bridge over the knowledge gap between network partners who possess high specific knowledge. They held that more efficient interactions, knowledge overlap and efforts from both network partners are highly valuable in progressing incremental innovation, since network partners are bound together to exploit success through the network. Accordingly Roy et al.'s (2004) emphasis on the network relationships appears to show that affective components, resulted from human interactions are the determinant for creating new knowledge and thus product innovation, since they form both emotional and cognitive elements.

Furthering the issue of mode of interaction, one of the elements of network interaction which is highlighted in section 2.2.2.1.1 Roy et al. (2004) noted that quantity and scope are also the key elements of dyadic interactions in the supplier-customer networks in product innovation generation. Yet, according to Roy et al. (2004) the quantity of interaction has been well investigated through a broad range of topics from a firm's perspective, such as duration and times of visit, sales force management and the reporting system (Dwyer et al., 1987; Ford, 1980; Hakansson, 1987; Saxenian, 1991). These studies that focus on the quantity of supplier-customer network interactions can be studied by the sales firms and industrial customers. Scope, proposed by Roy et al. (2004) is also one of the elements. It refers to the "quality and nature of interaction" which facilitate product innovation generation (Roy et al., 2004, p.64; Saxenian, 1991). Roy et al. (2004) argue that quality and the nature of interaction are subject to the degree of the involvement of organizational hierarchies. The more different rank of personnel and different departments involved, the higher the scope of interactions. However, these studies which focus on the quantity and scope of network interaction are mainly concerned with those big organizations with hierarchical organizational structures. Their ways of external networking are seen as differing from SMEs' general networking approach (Ostgaard and Birley, 1994, 1996; Szarka, 1990) due to the differences in organizational attributes. Although Von Hippel (1999) investigated 3M's network relationship formation in the process of product innovation generation in supplier-customer networks from the

firm's perspective, yet the study examined inter-organizational collaboration of a big organization, e.g. the way of using market research (Freel, 2000). However, the study does not provide a direct assistance to entrepreneurs of the biotechnology SMEs and their customers in network relationship management.

While studies show customers have made a remarkable contribution to product innovation generation in many industries, such as the computer industry, chemical industry and scientific instruments (Rosen et al., 1998; Von Hippel et al., 1999), yet little research has looked into firm-customer network collaboration for product innovation generation in the biotechnology industry. Landry et al. (2002) noted that knowledge-based innovation is no longer regarded as a discrete event or isolated individual behaviour, rather it is a process, particularly a problem-solving process. Rosen et al. (1998) reported that the failure of biotechnological product innovation occurs when new products are implemented to market, so reminding entrepreneurs to pay more attention on customers rather than considering they are not valuable for generating product innovation in biotechnology. The ignorance of customers' needs may cause higher risks and leave scientific efforts and business in danger. Hendry and Brown (2006) examined networking phenomena between biotechnology SMEs and customers from a regional economic perspective and found that customers in local regions contribute to innovative idea generation. In fact, incremental innovations that are derived from the awareness of customers' problems/or needs can be the discoveries of innovation opportunities for entrepreneurial SMEs in biotechnology (Soh, 2003). They enable entrepreneurs to leverage the resources by adding more value to their products or explore other potential opportunities with customers. Incremental innovations are cumulative processes, the profits generated from the products with better functions are useful to SMEs' basic business activities; the profits accumulated can be useful assets in supporting R&D activities. Furthermore, numerous minor technological changes may eventually lead to a radical change one day (Przysuski, 2008).

Given that customers have played a crucial role in the process of generating product innovation, empirical studies show that customers tend to contribute to the idea generation of product innovation (Jack et al., 2004; Kristensson et al.,

2004). Some scholars (Biemans, 1991; Bruce and Rodgus, 1991) commented that the customers' contribution that leads to original, valuable and realizable innovative ideas is useful in the beginning of product innovation generation in terms of creating something new, but it is less useful in the process of new product implementation. During the supplier-customer interactions, technical personnel discuss problems/or needs, propositions and predict problems in product utilization (Clark and Fujimoto, 1990; Leonard-Barton and Sinha, 1993). Based on knowledge sharing and learning in terms of each other's problems/needs and capabilities, knowledge creation is incubated and technical interactions take place (Anderson et al., 1994; Athaide et al., 1996; Hallen et al., 1991) which construct a pathway of generating cognitive components of product innovation.

Although network scope, proposed by Roy et al. (2004) is identified as a useful element in understanding network interactions in product innovation generation, yet the notion of the involvement of high rank personnel in big organizations does not apply to the biotechnology SMEs; since generally bioscience entrepreneurs in the SMEs are the decision makers in both internal and external network interactions (Ahn and Meeks, 2008; Johannisson, 1998). Thus this study argues that the quality and nature of networking are better revealed by looking into what is going on within the interactions. Something intangible is developed when two network partners interact, which bonds them together, that is, the network relationship (Granovetter, 1973, 1985; Jack et al., 2004; Larson, 1992). Pittaway et al. (2004) and Soh (2003) suggested that the determinants of product innovation generation through external collaboration in entrepreneurial SMEs include social/personal and inter-organizational variables. Whatever the variables are, the entrepreneurial pursuit will also decide the benefit sought from collaborative innovation. While some firms seek one reason for going into collaborative innovation, others may be additionally attracted by the potential benefit of increasing the market sizes of their products. The former can be interested in specific knowledge or skills a network partner can offer, the latter can be in the possible potential opportunities brought by the network partner which allow a firm to increase market sizes, open new markets for their products or have access to a broader pool of knowledge. In each circumstance, there is a degree of connection between collaborative product innovation and network

relationships in the networks. The dyadic network relationship development in the collaboration for product innovation is elaborated in Chapter Three.

Product innovation generation takes place when people interact and when information is exchanged concerning customers' problems/needs and possible technological solutions (Rogers, 2003). As highlighted in the foregoing, in recent years the emergence of modern technologies has brought changes in the ways of networking, e.g. the use of email. However, none of the studies have revealed how biotechnology SMEs and customers form and develop network relationships by using virtual modes in the process of incremental innovation generation in the biotechnology industry. Thus, to fill in this research gap, it is the interest of this study to explore the issues such as how supplier-customer network relationships are formed and developed via virtual interactions in generating biotechnology incremental product innovation and how such interactions foster the innovation generation in the biotechnology SMEs. For example, email may play a role in understanding the problems/needs, and this may be achieved by enabling knowledge transfer, information flow and fast feedback in the network interactions, and therefore it may have an impact on the process of product innovation generation.

Chapter Three

Supplier-Customer Network Relationships

3.1 Introduction

The preceding chapter reviewed the concepts and generation of collaborative biotechnology product innovation. The review shows that whether achieved by incremental or radical innovation, pursuing innovation is one of the ways a biotechnology SME can survive, gain competitiveness and growth. The achievement of successful innovation is dependent on the firm's capabilities going beyond its in-house boundary. The changeable and complex business environment requires SMEs to establish and maintain network relationships with network partners that have resources outside the firms (Howells et al., 2003; Prugl and Schreier, 2006). In general, the driver for incremental innovation is likely to be derived from customer demands or responses. As highlighted in the previous chapter, customers are no longer merely buyers, rather they are more likely to be involved in a broader scope of cooperation (Athaide et al., 1996), and the customer-network relationship has been recognised as the most valued network linkage in product innovation generation (Kaufmann and Todtling, 2000, 2001; Pittaway et al., 2004). More interestingly collaborative product innovation is a process of people interactions, including that of biotechnology.

As the foregoing indicated, incremental innovation within supply chain networks has played an important part in SMEs entrepreneurship, indicated by the phenomenon that there are far more incremental innovations than radical innovations in biotechnology and the literature calls for more contributions to the area of incremental innovations (Casper and Whitley, 2004; Cooper, 1994; Olsen, 2006). Accordingly, it is in the interest of this study to explore further the field within such directions, with particular emphasis on supplier-customer network interactions. It appears in the literature that there are several factors playing important roles in the process of generating incremental innovation. In particular, the dyadic relationship between network partners is identified as being an essential building block of product innovation (Huang and Chang, 2008; Ledwith

and Coughlan, 2005; Rothwell, 1992; Roy et al., 2004) in the biotechnology industry (Hine and Kapeleris, 2006; Powell and Brantley, 1992).

The success of innovation collaboration is dependent on the success of the network (Hunt and Morgan, 1994). Indeed, incremental innovations are substantially economic outcomes of supplier-customer network relationships and interactions. Empirical evidence shows that suppliers can successfully commercialize innovations by keeping appropriate linkages with customers. In contrast, ineffective management of these connections can often lead to technological innovation failures in industrial firms (More, 1986). Thus, whether entrepreneurs are capable of managing such dyadic processes may determine the success of incremental innovation. In this sense, the understanding and management of network interactions become vital concerns for managing SMEs' incremental innovation processes. It is appropriate to bear in mind that part of what the interactions bring about is the relationship. The following section shall review the existing literature relating to the supplier-customer relationship process, the key element(s) of a relationship and how the literature explains the impact of these on the generation of incremental innovation.

3.2 Theories of Supplier-Customer Network Relationship Process

The supplier-customer network relationship process has been scholars' research focus for over three decades. Similar to other facets of networking research, studies of the relationship processes have shown the multidisciplinary nature of networking as a research area. Amongst others, the studies examined supplier-customer network relationship processes from sociology (Kanter, 1994; Larson, 1992), organizational development (Wilson, 1995), economics (Dwyer et al., 1987), entrepreneurship (Larson, 1992), contract law (Heide, 1994), industrial marketing (Anderson et al., 1994; Ford, 1980; Ford, 1997) and international marketing (Batonda and Perry, 2003).

Some scholars argued that supplier-customer network relationships follow “stages” as developmental processes, while others contended it to be shown as “states”. Therefore there appears to have been two main themes of theory debated in the area. The following sections will introduce and discuss these theories.

3.2.1 Stages or States?

Ford (1980) proposed that the complexity of supplier-customer relationships has been recognized in the literature and it is important for industrial firms to establish close and long-term supplier-customer relationships. However, little is known about how supplier-customer relationships are established and developed as an alternative to market price determinants; how the relationships change over time and what mechanisms lead to the development of close relationships; what are the factors that can be managed by two network partners? He suggested that sensible management of the relationship development processes enables owner-managers to acquire value and possible outcomes from the relationships. Accordingly Ford (1980) examined the process of supplier-customer relationships by several variables, including experience, uncertainty, distance (consisting of social, cultural, technological, time and geographical distance), commitment and adaptation. Based on these aspects, he suggested a model of a five-stage relationship evolutionary process that consists of a pre-relationship, early, development, long-term and final stage. Ford (1980) highlighted that the development is a relationship investment process by both network actors depending on their certain interests and that familiarity and trust are engendered and saved over time.

Following Ford (1980), a number of scholars have made further contributions to the theories of supplier-customer relationship, comprising various approaches to the subject (Batonda and Perry, 2003; Dwyer et al., 1987; Ford et al., 1996; Ford and Rosson, 1982; Heide, 1994; Kanter, 1994; Larson, 1992; Wilson, 1995). The scholars have developed possible models that describe the change processes integrating different variables in the dyadic inter-firm relationships. Batonda and

Perry (2003) categorized these models into two major theories, "growth stages" theory and "states" theory in their systematic review the relationship process.

Batonda and Perry (2003) noted that "growth stages theory" captures the characteristics of change and describes the process as involving distinguishable steps or periods. They pointed out that the theoretical models of "growth stages theory" had demonstrated the major actions taken by the collaborative firms in committing resources to perform business activities. In other words, the development process is viewed as a progressive change process and it is irreversible, occurring in a consecutive way and over a long period of time (Ford, 1980; Van De Ven, 1992). "Growth stages theory" is represented by several scholars, including Ford (1980), Dwyer et al. (1987), Larson (1992), Kanter (1994), Heide (1994) and Wilson (1995) who have produced different stages models and descriptions of each stage. These models are varied in terms of the number of stages and produced according to different criteria. Batonda and Perry (2003) summarized these models as a five-stage model, consisting of searching, starting, development, maintenance and termination processes. However, they argued that the model is inadequate in representing all of the relationship development processes due to the complexity and dynamics of network relationships in that the processes are more complex and do not always go through clearly defined stage-by-stage processes. Other than Larson (1992), stages theory is mainly carried out by exploratory research and yet to be developed by more empirical studies. This weakness in "stages" theory, pointed out by Batonda and Perry (2003) provided the platform for a different approach of "states" rather than "stages".

Based on the elements of the five-stage model, Batonda and Perry (2003) addressed the need for states theory, which supplied two additional unpredictable outcomes/conclusions to the process. The "states" theory is comprised of searching, starting, development, maintenance, termination, dormant and re-activation status, and the model is proved by an empirical study related to international inter-firm alliances (Batonda and Perry, 2003). The model views the relationship processes as having evolutionary and unpredictable states. The relationships between network actors may be developed in a manner that

shifts from one state to another randomly over time between the commencement and termination (Ford and Rosson, 1982). Batonda and Perry (2003) explained that the term "state" refers to the relationship status at a point in time and each state represents a phase in the relationship processes that may be one of several possible relational developments. For example, a relationship may be developed by regressing from the development phase to the starting phase for various reasons, or it may turn to a dormant phase and be re-activated after a certain time. With the states theory, it does not follow that the relationship development processes are developed in gradual steps of one stage after another. Instead it regards the relationship processes as being unstructured rather than as anticipated progressive processes (Anderson et al., 1994; Ford and Rosson, 1982; Hakansson and Henders, 1995).

It appears that the argument of these two main types of theory lies in their different ontological approach to the world. There is no consensus on which groups of theory, either stages or states, can best explain how dyadic network relationships develop (Anderson et al., 1994; Batonda and Perry, 2003; Hakansson and Henders, 1995). On the one hand, scholars of "stages" theory recognized the need to abstract the basic process of the successful relationships, attempting to explain the nature of the process as an accumulative artefact, whereby particular efforts are needed. They advised owner-managers to learn from the knowledge gained from those successful experiences. On the other hand, scholars of "states" theory attempted to create a one-fits-all theory that includes every type of episode in the relationship processes. While there is considerable commonality in the essence of the two theories in terms of the core steps of the process, the difference is, however in fact, marginal in the way that the scholars of states theory tried to apply the model to all situations. Such different viewpoints lie in their different ontological approach to the phenomenon. In fact, a dyadic network relationship is complex; it is not only related to dyadic interactions between two parties but also factors external to the relationships (Roy et al., 2004). For example, internal factors that affect the relationships can be the ties between network partners, whether strong or weak (Granovetter, 1973a, 1985; Jack et al., 2004), individual attributes attached to different boundary spanning roles and modes of interaction. External factors outside the dyadic relationships that link to the environment of two organizations can be

embeddedness, culture and the technologies that support interactions. All of these factors that are integrated in a system of a relationship are affected by time; as time moves, all of these can change to affect the growth of a dyadic relationship. Hence, a one-fits-all model for all relational situations as “states” theory argued may be too ambitious and thus problematic. What is perhaps more interesting is, to share the successful “stories” so that entrepreneurs and readers in a broader scope may be able to learn from these stories. Building and developing successful network relationships is not only a social and emotional nurturing process (Ford, 1980; Kanter, 1994; Larson, 1992), but also a relational artefact which takes time to evolve (Anderson and Jack, 2002). The following sections of this chapter will further explain this stand step by step through the development of the key element(s). The earlier model of “stages” theory (Batonda and Perry, 2003), introduced in the foregoing is therefore considered and proposed by this study as a framework of supplier-customer network relationship process.

There is an old Roman saying, “*All roads lead to Rome*”, and it is still somehow true nowadays. Relating to the focus of this study, it seems to suggest that there are various ways to make dyadic business relationships work with new product development as an outcome. Kanter (1994) held that no two relationships travel the same path; however successful relationships share certain common features. Whether there are a greater or less number of steps or stages, building a relationship is a nurturing and accumulative process (Ford, 1980; Kanter, 1994; Larson, 1992). An understanding of the essence of the relationship is more important, as it can help owner-managers nurture rather than control it by steps. Given that the significance of collaborative relationships to firms’ innovation and growth has been highlighted in the preceding chapter, the following sections will focus on the issue of key determinant(s) of inter-firm supplier-customer relationships.

By an empirical study of examining the process of supplier-customer network relationship development and how it contributes to entrepreneurial firms’ innovation and growth, Larson (1992) examined the mechanisms of the relationship process and revealed that the supplier-customer collaborative

relationship for economic exchange is essentially a social process of people interaction. Such a process is governed by social control, comprised of several elements, such as reputation, trust, reciprocity and mutual interdependence. These relationship mechanisms are generated on a voluntary basis between two partners in a network. Larson (1992) emphasized that trust is the key element throughout the whole process. The notion of social control was driven by various viewpoints in the field and the more recent literature indicates a tendency to agree with Larson's (1992) insights to the process. These will be discussed in the following section.

3.2.2 The Key Element(s) of Supplier-Customer Network Relationship Process

There is general agreement from scholars that there are several elements, or mechanisms in supplier-customer relationship processes over time, although this is addressed in different ways depending on the research focus and approaches of the scholars. The several elements as mechanisms of the relationship development process are similarly addressed as different variables (Ford, 1980; Wilson, 1995), relational components (Dwyer et al., 1987), key criteria of relationships (Kanter, 1994) or relationship governance forms (Heide, 1994). However, as will be discussed below, it appears that there is considerable commonality with regard to what constitutes the central theme of the relationship process. In fact, Larson's (1992) depiction of the supplier-customer relationship as derived from partners' needs to seek common interests and complementarities, risk and uncertainty avoidance is based on the primary trust set prior to the commerce of dyadic relationships and that trust is a basic element in the relationship process is now well established in the literature.

As highlighted in the foregoing, Ford (1980) suggested five elements of industrial supplier-customer relationship; "experience" refers to personal knowledge of network actor derived from participation or observation, the knowledge can be obtained from previous or existing network relationships, for example, reputation and interactions; "uncertainty" exists because the benefits and the value of

relationship is yet to be identified; "distance" includes social, cultural, technological, time and geographical distance; "commitment" denotes the state of being bound together because of trust, and the last variable, "adaptation", means the change in behaviour reciprocally in response to the network actor. Ford (1980) argued that the supplier-customer relationship can be described as a process in terms of increasing experience, reduction of uncertainty and distance, growth of commitment and formal and informal adaptations over time. Ford (1980) also highlighted that the management of the interaction processes is affected by the network actors' ways of interaction. The theme has been identified in the proceeding chapter; the ways of interactions will be discussed in Chapter Four. The implication is that the owner-managers need to view the inter-firm network relationship process as a complex and dynamic, differing from one to another according to different actors in a network.

Kanter (1994) noted that inter-firm network relationships range along a continuum from weak to strong. The links between two firms can be arms-length, mainly occurring at transactional level. They can be at mid-range, in the case of joint ventures, for example, where each firm pursues opportunities that need complementary resources – the technology of one and the market access of other (*ibid.* p.99). Value-chain partnerships are the strongest and closest collaborations, for example, supplier-customer relationships. Kanter (1994) argued that no two relationship developments follow the same path; however, successful collaborations generally share similarities. Kanter suggested that at a basic behavioural level, a supplier-customer network relationship is similar to a marriage, encompassing romantic, social and economic dimensions, consisting of components of attraction, compatibility, rapport, commitment and trust.

Kanter (1994) argued that attraction is derived from recognition and knowledge of the identity and credibility of the network partner; attraction is the motivation of a network partner entering into collaborative relationship. The motivation is based upon the discovery of compatibility and personal rapport built in the early stage. Kanter noted that although personal and social aspects of business relationships are not the only consideration in forming a network, business transactions often rely on individuals' feelings towards each other. These include

personal and social interests as a good start; also, personal rapport can be a way of reducing tension and uncertainty when relationships develop. This means that affective components play an equally important role in the motivation of network formation and relationship development.

Furthermore, Kanter (1994) found network partners' evaluations of each other's compatibilities, which, from their historical and strategic perspectives occur at the beginning of network relationships, lead to the recognition of relationships value and shared visions. With the development of common experience, familiarity and trust, both network partners are able to commit themselves to the relationship. Kanter (1994) identified that the relationships' orientation shifts gradually along a continuum, from tending towards personalized/or emotional in the beginning to depersonalized/or institutional in the maintenance stage. Nevertheless, Kanter (1994) concluded that a successful relationship is built upon a balance between personal and organizational perspectives.

Similarly, the analogical idea of comparing supplier-customer network relationships to a marriage is employed by Dwyer et al. (1987). Dwyer et al. (1987) examined supplier-customer relationships by the modern contract law theories. Acknowledging the concepts of discrete exchange derived from contract law, however, Dwyer et al. (1987) were critical to these viewpoints. They held that supplier-customer collaborations are not just cold-blood discrete transactions and are not mainly dependent on economic and legal sanctions in order to carry out contractual obligations. They proposed four relational components in the relationships, attraction, commitment, trust and satisfaction that determine the process development. These mechanisms are related to the idea of using a marriage relationship analogy in that a successful network relationship requires reasonably managed network interactions; an owner-manager's ability in terms of whether s/he is able to make the interactions easier affects how the relationships progress and succeed.

Considering relational contract theory, Heide (1994) developed inter-organizational relationship governance theory in marketing channels which consists of four forms: evaluation, adaptation, compatibility and mutual

agreement. Through an empirical study, Heide (1994) found that a network relationship development is a complex process involving reciprocal interactions resulting in trust building over time. The perspectives developed reflect a reciprocal norm of social behaviour between individuals in the relationship process in which economic transactions are embedded (Granovetter, 1985, 2005). They also show that the partners need to enter into and develop the relationship from an organizational perspective. The process is comprised of constant judgements relating to the overall value of relationships from a long-term perspective and the judgements are affected by both organizational and individual factors of the partners.

Wilson (1995) argued that the success of supplier-customer relationships is evaluated based on the relationship performance. He produced an extensive list of variables that determine the performance in relationship processes, including commitment, trust, cooperation, mutual goals, interdependence and power, performance satisfaction, structural and social bonds, comparison level of the alternatives, adaptation, non-retrievable investments and shared technology. Wilson (1995) clarified that such a list is not exhaustive, because more or fewer variables may be added or deleted by other researchers to reflect the situational factors (*ibid.* p.357). The evaluation of relationship performance is dependent on satisfaction on the performance, particularly customers' satisfactions on suppliers' actions, and such satisfaction is influenced by organizational and individual variables, for example, product technology levels and complementary resources. The individual variables can be attitudes, goals and experiences that affect the behaviour during the relationship process. These variables are generated, developed and maintained through communication. Similarly, Batonda and Perry (2003) emphasized the importance of network interactions, which enable the establishment and development of two layers of supplier-customer relationships, personal and inter-organizational. Empirically, Batonda and Perry (2003) recognized that the ties that bind the partners at individual as well as organizational levels are the central subjects which make the international relationships work through the processes and that such ties are bounded by trust. Furthermore, personal and inter-organizational ties are formed, underpinning the influences of network partners' social, organizational and cultural embeddedness

(Granovetter, 1973, 1985); personal and inter-organizational ties work hand-in-hand in network relationships.

It appears that scholars (Dwyer et al., 1987; Ford, 1980; Heide, 1994; Wilson, 1995) have realized that the elements are not exclusive to each other; some elements can be active in one phase and latent in another. Nonetheless, they remain important in the interactions. Amongst all, trust is the only element identified by every study as the main mechanism; this shows the significance of the theme of trust in the relationship process. The elements generally reflect an analogy of an "umbrella" framework of relationship elements, where the theme of trust locates at the top centre of the umbrella. The other connected concepts such as satisfaction, reciprocity, mutual inter-dependency and commitment act actively underlying the key theme or are latent depending on a particular dyadic relationship of a firm. Indeed, Creed and Miles (1996) noted that networked firms have little doubt about requiring trust, and they further emphasized that low trust or failure to generate a high level of trust will certainly cause collaboration failure.

As highlighted in the preceding chapter, innovation processes are interactive and dynamic, and co-operation is imperative so as to overcome the social problems of network interactions and collaboration (Newell and Swan, 2000). As Roy et al. (2004) emphasized, trust is a central relational factor affecting network interactions in incremental innovation in supplier-customer relationships. Trust is also recognized as the key determinant for collaborative innovation generation between parties with specific knowledge and particular interests. Lundvall (1988) noted that to overcome the inevitable uncertainties in product innovation mutual trust will normally be necessary (*ibid.* p.52).

Trust is important in the collaboration for new product development in biotechnology firms, the area on which this study focuses. The product innovations in biotechnology firms do not produce and deliver standard new products as supplier-customer relationships do in other industries. Although components are customized, in fact, new products are often produced and delivered as batches and the production is subject to accurate time constraints

(Jong and Woolthuis, 2008, p.59). Hence biotechnology product innovations encompass higher levels of uncertainty in supplier-customer relationships than other commodity goods. Thus this context of the innovation requires robust trust between parties to cope with the uncertainties and risks involved (for example the possibility of customers' shifting of suppliers) and ensure expectations are met (Anderson and Steinart, 2005).

Furthermore trust is an important relationship mechanism for SMEs. It is an essential instrument to reduce transactional costs (Anderson and Jack, 2002; Dwyer et al., 1987; Nooteboom et al., 1997) which particularly matters to SMEs. Empirical studies found that SMEs' supplier-customer relationships generally rely on social control rather than contracts and that entrepreneurs in SMEs use social factors in business relationships to build trust and manage relationships (Morrissey and Pittaway, 2006; Redondo and Fierro, 2007). In this sense the theme of trust will form the topic of the next section for further literature review. The following sections will examine trust as a process that can be approached from three routes including peripheral, central and habitual routes, and cognitive and emotional/affective perspectives. Four types of trust will also be identified and examined, namely inter-personal trust, relational trust, inter-organizational and contextual trust, which are closely intertwined with the trusting process. The review will also cover trust and generation of incremental innovation. The concepts of interaction mode and micro- and macro-level of the dyadic relationship will be followed and explored as external dimensions of dyads with which firms deal in their collaborative interactions for incremental innovation generation.

3.3 Trust, Supplier-customer Network Relationships and Incremental Innovation

Roy et al. (2004) defined trust in a supplier-customer network context as the extent to which one party may depend on another to look after its business interests (*ibid.* p.68). This is explained by Thorelli (1986) that trust is conceptualized as an expectation or confidence in the continuation of a mutually

satisfying relationship, the actor being aware of what this requires and of the potential performance required as a network member in a dyadic relationship. Research suggested that as a progressive and slow process, trust building is a crucial determinant in influencing the degree and character of interactions in supplier-customer networks (Gambetta, 1988; Gulati, 1995; Joshi and Stump, 1999; Morgan and Hunt, 1994; Roy et al., 2004).

3.3.1 Trust as a Process

As highlighted in the foregoing, a new customer-network relationship is associated with uncertainty and ambiguity. Such circumstances define the presence of trust is essential (Anderson and Steinart, 2005). Scholars argued that trust enables interactions by determining the extent to which a firm is willing and able to interact (Athaide et al., 1996; Dodgson, 1993; Roy et al., 2004). Pruitt (1981) noted that the intention of a party collaborating with another is closely related to trust between them. Morrissey and Pittaway (2006) found that trust enables customers' early involvement in collaborative projects on product innovation; one party that is willing to enter into a network relationship with a trustworthy party tends to take a high risk in cooperative behaviour. Child (2001), Huang and Chang (2008) argued that high level of trust between network partners creates a feeling of credibility and security. In this sense, trust reduces uncertainties, risks and transaction costs in the dyadic interactions of supplier-customer relationships.

Hossain and Wingant (2004) suggested two types of trust, cognitive and emotional/or affective. Cognitive-oriented trust refers to competence and reliability, indicating a task will be accomplished successfully. Trust in competence is a necessary condition to form a supplier-customer network (Larson, 1992; Roy et al., 2004). Emotional/affective trust refers to social relations that allow for one network partner to work with the other (Larson, 1992) and the extent to which one network partner trusts the other's honesty to look after its interests (Jack et al., 2004; Roy et al., 2004; Sako, 1992). Thus, it was also defined by Roy et al. (2004) as goodwill trust in dyadic supplier-customer

relationships. It is likely to be a relational artefact instead of the product of a network (Anderson and Jack, 2002; Anderson and Steinart, 2005). However, trust is also viewed as an organizational artefact; Clases et al. (2003) revealed both forms of inter-personal and inter-organizational trust in their research on inter-organizational relationships. In this sense trust tends to be evident in terms of an expectation of reliability. Roy et al. (2004) proposed that goodwill trust may have an effect on interactions and the generation of incremental innovation in supplier-customer relationships. They held that when there is goodwill trust between network partners the interactions tend to be more informal; knowledge transfer and creation tend to be at a tacit level.

Studies (Chung-Jen and Lien-Sheng, 2004; Huang and Chang, 2008) show that when there is high possibility of future association, in other words two parties have a long-term relationship orientation, a supplier and the customer are likely to be engaged in reciprocal and closely embedded exchanges, as such network partners are able to develop trust and facilitate exchanges of rich information. From traditional views¹² of trust, Lewicki and Bunker (1996) suggested that trust development is achieved along with the growth of familiarity between individuals involved. They categorized three types of trust according to how trust is developed; they are calculus-based, knowledge-based and identification-based trust and which present in the early, development and mature stage of trust development respectively. Such categorization indicates the change in the character of trust over time and that there is a trend from non-emotional/affective involvement tending towards more emotional/affective involvement as inter-personal knowledge of the individuals increases in the process.

Scholars (Ford, 1980; Ring and Van De Ven, 1994) have integrated trust with the dynamics and contingencies of business situations (e.g. degree of risk, geographical or culture distance). Hence, the development of trust varies depending on different situations. Hung et al. (2004) proposed an integrated

¹² Here, the traditional view of trust points to the discussion of the process of trust excluding the issue of modern non-face-to-face virtual networks, it refers to the traditional way people develop trust (Hung et al., 2004).

model of trust building based on the collaboration in teamwork of virtual teams¹³, which includes three routes of forming trust as a progressive process. Firstly, the peripheral route generates presumptive trust, conceptualized as dispositional trust by Greenberg et al. (2007) and swift trust by Meyerson et al. (1996). This generally occurs in the initial encounters of a network where individuals do not have the chance to fully assess the interacting network partners. Similarly Kramer (1999) identified six antecedent conditions of trust and claimed that these conditions have effects on trust formation between individuals. Based on Kramer's (1999) propositions, Hung et al. (2004) argued that except for history-based trust, the rest of the five antecedents, namely dispositional, third parties, membership, role-based and rule-based trust can be viewed as peripheral routes that provide conditions for the initial trust formation (*ibid.* p.5). Reputation and third party referral are viewed as a primary condition of trust in customer-networks (Ganesan, 1994) and are thus located in the peripheral route. A network relationship is determined by the evolution of trust, and in turn the development of trust reflects the relationship status. This route of presumptive trust is the key element of a new network relationship in the primary stage, it is as the foundation for trust development (Greenberg et al., 2007). Nevertheless, presumptive trust is depersonalized and it needs to be assessed in personal encounters before it becomes sustainable (Hung et al., 2004).

Secondly, defined by Hung et al. (2004) as central route, Greenberg et al. (2007) further categorized this second route into two phases, namely inception and organizing phases. The inception phase is activated by the individuals' high motivation and ability to process relevant information (Hung et al., 2004, p.6). According to Greenberg et al. (2007), team members at this stage still have to set rules and norms of behaviour that have not been contemplated before. Due to existing uncertainty and ambiguity, individuals gain information, accumulate personal knowledge and assess inter-personal characteristics through interactions (Hung et al., 2004). Inter-personal characteristics include

¹³ Virtual teams refer to those team members work on the projects across spatial, temporal or organizational boundaries, their interactions mainly rely on the use of information and communication technologies (ICT) such as email, instant messaging, groupware to interact (Hung et al., 2004, p1). Virtual interactions will be discussed in more details in Chapter Four in this study.

competence, honesty and benevolence¹⁴ (Mayer et al., 1995). Hung et al. noted that the assessment of cognitive aspects of trust is deliberately conducted at this stage. Larson (1992) suggested that the exchanges of interests and shared goals are needed in order for the accumulation of individual knowledge to develop trust and relationships.

Thirdly, called by Greenberg et al. (2007) as “organizing” stage, team members assess each others’ competence and continue to evaluate honesty. The assessment can be conducted through joint activities which allow individuals to learn interaction patterns. There is increasing inter-personal knowledge gained at this stage and individuals identify benevolence and other inter-personal characteristics. Uzzi and Dunlap (2005) found that inter-firm owner-managers rely on regular social interactions to develop and form high levels of trust; little or no social interaction does not produce a network formation. Social interactions allow for familiarity and increasing personal knowledge between individuals through socialization, hence reduce the perceptions of vulnerability caused by risks, uncertainties and potential opportunistic behaviour (Rocco, 1998). As such, a network relationship is developed and ties are built.

The literature shows that trust is related to commitment. Trust leads to relationship commitment (Canning and Hanmer-Lloyd, 2001; Ganesan and Hess, 1997). Two network partners are committed to each other through bonding. Bonding described by previous studies (Anderson and Weitz, 1989; Morgan and Hunt, 1994) seems to constitute habitual-trust (Hung et al., 2004). Hung et al. (2004) suggested that the habitual-enacted route to trust is the third stage of building trust and that trust becomes a habit because of the accumulated and increased personal knowledge based on reciprocity. Habitual-enacted trust is characterized by emotional bonds. Jack et al. (2004) and Anderson and Steinart (2005) define such a bond as having strong ties which are robust. Furthermore, based on an empirical study of investigating trust in organizations, Clases et al. (2003) found that delivering secure performance through proactive behaviour

¹⁴ Benevolence refers to the extent to which the kindness of a person is perceived, aside from profit motive (Mayer et al., 1995).

and personal commitment in network interactions facilitates team members to maintain trust.

It is clear that the foregoing shows that the supplier-customer network relationships as an outcome of interactions are dynamic. It is based on a cognitive as well as emotional form of trust yet its development is built on rules and roles, followed by clear expectations and the presence of competence (Anderson and Steinart, 2005). In the changeable and challenging business environment such conceptual models of trust formation are shown to need an emotional/affective trust as a tie that enables the formation of dyadic network relationships.

In addition, trust is understood as dynamic and changing over time (Anderson and Steinart, 2005) and thus it is shown to be a process; such processes involve initialization, start, development and maintenance. However, most of the studies reviewed in the previous sections have examined trust as a process either in intra-organization collaborations (Greenberg et al., 2007; Kramer, 1999) or inter-organizational collaborations (Hung et al., 2004; Mayer et al., 1995; Meyerson et al., 1996) without being in the context of supplier-customer networks and incremental innovations. Furthermore none of them have investigated trust as such in the biotechnology industry. Bearing in mind the necessity and importance of trust in supplier-customer relationship, the dynamic and changing nature of trust set a great challenge for entrepreneurs to manage in the collaborative relationship process of incremental innovation. A further look at trust building in the literature is needed to gain an understanding of the management of supplier-customer network relationships in incremental innovation. This study shall continue to review and separate four different types of trust from the literature. It is argued that inter-personal trust is critically important in terms of offering a necessary condition which enables the relationship to sustain over time.

3.3.2 Inter-personal Trust

Inter-personal trust refers to emotional bonds between individuals based on their perceptions of each other (Anderson and Steinart, 2005; Strickland, 1958), such inter-personal emotional bonds form the base of trust (McAllister, 1995). Volery and Mansik (1998) suggested that commitment, harmony, security and similarity contribute to trust formation. Mishra (1996) held that the belief in the other partner's competence, openness, concern and reliability constitutes the base of trust. McAllister (1995) suggested that the feature of trust is related to personal characteristics such as reliability and competence. Saenz (2002) suggested that an inter-personal trusting relationship is comprised of intimacy. Intimacy refers to the sense of close connection an individual feels in a close relationship; the depth of self-disclosure between individuals in a relationship determines the degree of intimacy. A high level of self-disclosure in a relationship is associated with a high level of trust (*ibid.*). Intimacy can be found in such relationships as close friends and colleagues in which familiarity has been built (Ferraro, 2004). Thus, inter-personal trust is related to inter-personal characteristics that affect the creation of trust when individuals interact and are in a network relationship.

In the SMEs network relationships context, quite often scholars refer to social capital as personal characteristics that produce trust in network research (Antcliff et al., 2007). Putnam (2000) demonstrated that social capital¹⁵ is an important asset that produces trust between strangers. Putnam distinguished between bonding and bridging social capital, the concepts were then further explained by Antcliff et al. (2007), in that bonding social capital refers to the links with individuals "like me" that is based on homogenous population sharing, e.g. common social class, education, age, ethnic or religious ties that can inspire and support economic activities in certain areas; whereas bridging social capital concerns the links with individuals "unlike me". The concepts of social capital

¹⁵ The concept of social capital is developed in sociology (Bourdieu, 1986; Putnam, 2000); it is also used in various areas such as economics (Neira et al., 2009), entrepreneurship and entrepreneurial networks (Anderson and Jack, 2002; Anderson et al., 2007), political science (Jacobs and Tillie, 2004), public health (Lindstrom and Mohseni, 2009), etc. In the context of developed SMEs, the focused perspective of this study in dyadic relationships, the process of trust building and maintenance through dyadic network interactions are related with both individual attributes and organizational attributes. Hence, social capital is seen to be useful in terms of the concept of bonding and bridging social capital in providing explanations of individual attributes of boundary spanning roles in the dyadic interactions.

help us understand how trust is formed and related to the individual characteristics of the boundary spanning individuals, and therefore the social and economic impact of trust in network interactions of incremental innovation collaboration. Analogically Dosi (1988) used "common experience" to address the role of bonding social capital and pointed out that although difficult, tacit knowledge can be shared by collaborators with "common experience" in new knowledge creation. Similarly Albrecht and Ropp (1984) who described bonding social capital as "same status" found that innovative ideas are generally discussed between individuals of "the same status". The finding is supported by Lincoln and Miller (1979) who suggested that homophily plays a role in the formation of organizational relationships. The literature seems to suggest that bonding social capital in terms of shared experiences and similar individual characteristics such as similar positions, age and education facilitates cognitive trust building in innovation processes, since it enables tacit knowledge exchanges and thus facilitates new knowledge creation.

Through interactions, owner-managers' personal direct knowledge of each other increases and facilitates trust development. Referring to the building of bonding social capital, Uzzi and Dunlap (2005) found that creating inter-personal shared experiences and common perspectives can be achieved in various ways, for example business clubs or communities. As such owner-managers may set up different personal identity dimensions in business relationships and interactions. Stolle (2001) pointed out that identity-based trust includes only people one knows personally as well as those who fit into a certain social identity that one holds (*ibid.* p.205). Uzzi and Dunlap (2005) explained that identity-based trust forms one partner's belief in the other's application of competence, reliability and trustworthiness to the business because of knowledge gained on those aspects are identical in other circumstances. Similarly Lewicki and Bunker (1996) emphasized that identification-based trust existed in terms of full empathy with the other partner's needs and desires. Williams (1988) addressed deep trust generated between people who are socially homogeneous, the nature of the links being what Putnam called bonding social capital. The literature seems to indicate, firstly, building bonding social capital relies on interactions between individuals and increased inter-personal knowledge. Secondly, building the cognitive aspect of bonding social capital can be conducted through the affective aspect. In this

sense inter-personal knowledge and identities gained from the affective aspect enables affective trust building. Furthermore, the formation of affective trust facilitates the establishment of cognitive trust under the condition that one network partner is aware of the other needs/desires, and deep trust may potentially be generated between individuals sharing affective aspects of bonding social capital.

In the case of new customers, trust development is based on repeat day-to-day interactions where face-to-face contacts take place between the boundary spanning individuals of two organizations (Axelrod, 1987; Kanter, 1994; Tushman, 1977; Tushman and Scanlan, 1981). Face-to-face interaction is the best way to trigger a new relationship (Gilmore et al., 2001) and establishing social relations is an essential condition for trusting behaviour (Anderson et al., 2007; Granovetter, 1985). Powell (1990) argued that certain social contexts stimulate cooperation and solidarity/or a state of generalized reciprocity. In case of new network relationships where firms have insufficient knowledge and understanding of one another, repeat interactions develop trust by generating shared common ground, mutual liking and friendships (Child, 2001). Gilmore et al. (2001) noted that maintaining the relationship is dependent on the characteristics of the individuals, relevant influential individual characteristics including personality, age and experience.

Empirically Anderson et al. (2007) explained from the relationships' viewpoint that in trusting a person's honesty, the information and knowledge exchanged would in effect be trusted. People trust information flow from someone who is trustworthy. Thus, trust can be transferred from a trustworthy individual to another. Such function of trust provides valuable sources for tacit knowledge transfer between networked partners who trust each other. Tacit knowledge transfer is crucial for learning (Corti and Lo Storto, 2000; Dodgson, 1993; Lundvall, 1988) and new knowledge creation in the collaboration (Madhavan and Grover, 1998), particularly in high-tech industries like biotechnology (Anderson et al., 2007; Hine and Kapeleris, 2006).

It is clear that although scholars used different terms to describe this type of trust, the widely held view is that it is the individual characteristics that influence trust building in human interactions and relationships that matter. Furthermore in inter-organizational relationships, sharing bonding social capital in terms of common values, goals, personal history, experience, similar understanding and views between boundary spanning individuals can have a role to play in trust building between organizations. Therefore disposition to trust which is also in an inter-organizational context can be determined by the individual characteristics that individuals of boundary spanning roles interpret as important for trust. However, can the way in which individual interaction develops and the process of interaction affect trust? The concept of relational trust will be discussed below; inter-organizational trust will be discussed in the later section 3.3.4.

3.3.3 Relational Trust

As discussed in the foregoing, many studies point out that trust is intertwined with network relationships (Granovetter, 1973, 1985; Jack et al., 2004; Larson, 1992) and this is common sense because the relationships built through interactions are the natural platform for the development of trust (Anderson and Steinart, 2005). How trust is developed determines the progress of network relationships (Ford, 1980; Larson, 1992).

As a relational artefact trust is essentially determined first and foremost by the quality of interaction, therefore inter-personal contacts become an extremely important primary concern (Albrecht and Ropp, 1984; Jack, 2005). Hence anything that facilitates inter-personal interactions should be set as the priority for which the effort is made by organizations or individuals prepared to collaborate with each other. Inter-personal interactions enable familiarity to develop. Because trust governs the relationship for risky and uncertain situations (Larson, 1992; Morrissey and Pittaway, 2006), it requires familiarity as a condition for its growth (Lewis and Weigert, 1985). Trust is easier to build within familiarity but changes may occur in the familiarity that has been built which will affect the possibility of trust development. In such circumstance the presence of

trust is extremely important. When trust exists, those changes in the familiar setting will be better accepted and doubts are unlikely to emerge in the changed situations (Anderson and Steinart, 2005). Greenberg et al. (2007) held that benevolence is the basic inter-personal attribute that allows for social closeness or friendships.

However Hung et al. (2004) stated that although the reliance on prior personal experience in similar situations or on general social norms helps the rapid development of trust, when applied to a specific interaction context it often tends to be uncertain. This will in turn require inter-personal interactions and in particular face-to-face interaction to reset the familiarity and therefore reinforce trust built and to cope with the risk and uncertainty due to the changed situation. Familiarity, just as friendship building, takes time to emerge. In the predisposition of trust for risk taking, past experience can play an important role (Lorenz, 1988). Hence past experience or a durable relationship encourages the investment of trust in future collaboration.

Indeed an individual links to society by various ties formed during the interactions and these ties can be strong or weak. Scholars use strong ties to describe deep trusting relationships between individuals (Granovetter, 1973, 1985; Jack, 2005; Jack et al., 2004). Strong ties are characterized by close friendships or familial relationships that are bound by reciprocation and loyalty (Granovetter, 1973). Although the formation of close friendships can occur, owner-managers in dyadic business relationships who trust each other do not have to be personally close friends. Jack et al. (2004) found strong ties characterized by trusting relationships between owner-managers of supplying and purchasing firms to be loosely-coupled. Yau (2000) argued that strong ties can be developed through collaborative efforts and activities between partners by generating commonality. Sharing common ground infers that both partners conduct joint actions and create similarities. Collaborative actions can include joint products/services design or new markets launching and developing long-term relationships. Similarities can be generated by sharing information, knowledge and technologies with networked partners. The commonality is viewed as ties that bind two network partners in a relationship. In general strong,

compared to weak ties are associated with a high level of trust between the partners; Granovetter (1973) reveals that strong ties within which trust is high are likely to convey good quality of information at the required time. Granovetter (1985) and Grabher (1993) emphasize that strong ties within which trust is high can be important sources of referrals or information for networked organizations.

Hansen (1999) finds that more complex and tacit knowledge is more likely to be transferred between network partners with strong ties rather than weak ones. Scholars (Hansen, 1999; Huang and Chang, 2008; Julien et al., 2004) agree that weak ties facilitate the search process by providing a broader pool of knowledge resources, rather stronger ties set a better condition for the transferring and exchange of complex and tacit knowledge and issues, and therefore new knowledge creation for incremental innovation (Kogut and Zander, 1992; Madhavan and Grover, 1998). Anderson et al. (2007) commented that the exchanges of specific information or tacit knowledge is dependent on whether individuals are willing to give it away and whether the other party is able to take it in.

Indeed delivering sufficient information shows openness and as such information enables one to take decisive action, to have confidence (Dwyer et al., 1987) and it enables predictability (Kjaernes, 2006) and intimacy (Saenz, 2002). People expect not only reliable information but also that the partner delivering the information is trustworthy (Stewart, 2007). These suggest that entrepreneurs exchange sufficient information and show certain transparency in their network interactions with customers, since those facilitate the creation of predictability, a component of trust (Miller and Rempel, 2004). Transparency negates the necessity to investigate one's behaviour, therefore helps to generate predictability and reduce transaction costs (Anderson and Steinart, 2005). Empirically Akkermans et al. (2004) found that transparency, especially in terms of forecasts, product stocks, explanation of business, processes and systems help trust generation and development between firms and customers, thus leading to successful collaboration.

Trust in customer networks also relates to the reputations of firms (Ganesan, 1994). Larson (1992) noted that individual as well as organizational reputations and/or identities within the industrial community in which a firm operates are important elements of building trust as well as the formation of ties. A trusting relationship between two firms is also formed from past experience and the friendships of those individuals who acted as boundary spanning roles in organizations (Anderson et al., 2007; Powell, 1990; Thorelli, 1986). However reputation is not sufficient to allow for the presence of deep trust. It might create primary (Larson, 1992) or swift trust; the rest will be dependent on the continuing adaptation to unpredictable situations (Ford, 1980).

Individual interactions, available information, transparency and reputation contribute to trust building and development. Larson and Starr (1993) also emphasize reciprocity, a balance between relationship investment and taking risk, and obtaining a partner's performance as pay-off is the basis of building trust and ties in successful network relationships. In summary this section has discussed that relational trust is developed through inter-personal interactions. It appears that firms are encouraged to make time and undertake efforts to build and develop trust. Individuals need social relationships or an organizational setting as a condition for a trusting relationship (Granovetter, 1985). However any one of the elements contributing to trust discussed above do not work in isolation, rather they intertwine to facilitate trust building and development. For example, the factors of the available information and transparency of the firm are intertwined. Hence it is argued that trust is a complex and multi-dimensional concept, comprised of varying components with different facets. Furthermore while relationships between two organizations are built at inter-personal level, the elements of trust such as reputation and transparency also have their manifestations at inter-organizational levels as these elements require particular organizational settings to function.

3.3.4 Inter-organizational trust

Network relationships of SMEs mainly rely on social control rather than contract and inter-personal trust built from entrepreneur's social networking is blended with trust at inter-organizational levels (Zontanos and Anderson, 2004). Ring and Van de Ven (1994) emphasized the importance of socially embedded inter-personal relationships in generating trust at the inter-organizational level. Clases et al. (2003) found that past experiences gained in inter-organizational relationships contribute to the creation of inter-personal trust. The owner-managers' reputation in the industrial community indicates credibility and expertise as well as the core competence of the organizations (Larson, 1992; Ring and Van De Ven, 1994). The quality of innovative products a firm produced is dependent on the treatment of these individuals involved. Hence individual characteristics of entrepreneurs become crucial, as do their strong ties and the other elements like transparency and available information that directly reflect certain individual characteristics of entrepreneurs.

Nevertheless developed SMEs can, and in many ways do, facilitate trust building (Madhavan and Grover, 1998). Scholars (Larson, 1992; Powell, 1990) noted that mutual interdependence is one of the preliminary determinants of a successful inter-firm relationship. Such interdependence is derived from mutual interests, shared goals and reciprocal exchanges during interactions between two firms. Mutual interests and reciprocity are generated on a voluntary basis rather than by hierarchical command or simple market prices (Powell, 1990). According to Larson (1992) knowing the people and their capabilities are two primary considerations in entering into a collaborative relationship. As discussed in the foregoing, competence trust refers to a firm's skills and capabilities that can be relied on to carry out particular activities relevant to its role (Larson, 1992; Roy et al., 2004). With this view, entrepreneurs' reputations of particular competences, skills or know-how that are known in industrial communities are useful and extremely relevant to help potential business partners identify their needs and thus shape the emergence of mutual interdependence.

Based on an empirical study concerning networking behaviour within dyadic relationships in 34 SMEs in England, Columbia and Canada, Tjosvold and Weicker (1993) argued that prior to common goals being set, there are no clear ties to stimulate two firms to work together. Thus common goals are developed as a result of interdependency of two firms; such goals are set by evaluation and integration of the firms' complementary resources. Having common goals allows owner-managers to express their views freely, consider the other partner's view with open-minds, disclose important information, and develop empathy enabling one firm to see situations from the other's perspective or seek other ways for mutual benefit (Tjosvold and Weicker, 1993). When two firms have common goals, the bond between them is strong, as they are aware of the expectations and confident that one party will look after the other's interest and that they are committed to each other in working the same business goal. Reciprocal exchanges are formed as they develop business rules and norms through mutual adaptations suggesting that the relationship is viewed as long-term (Kanter, 1994; Larson, 1992; Wilson, 1995). As such, the two parties are motivated to progress the relationship for mutual benefit.

The interactions, in turn, facilitate both network partners to learn from each other and exchange emerging ideas with each other. Such processes and sharing experience strengthen their determination for collaboration, motivate them to be further involved in reciprocal exchanges and enhance their relationship (Powell, 1990). Network actors interact and explore the relationship in order to make the decision on whether to form the network relationship. Such decisions are made not only based on presumptive trust formed in the beginning that the partners are confident with one another's competence for solving the current problems, but also potential problems as they come along. Madhavan and Grover (1998) stated that such confidence of future trust comes from the manifestation of competence. They suggested that trust in technical competence increases with the repeat interactions and exchanges of feedback about little yet progressive project successes.

Familiarity emerging as a result of interactions enables network partners to be aware of each other's organization settings. Customers tend to work with those

owner-managers who have already shown some familiarity with their firms (Mohamed, 1992). This indicates that tacit knowledge is embedded in specific business relationships whereby both parties adapt to each other continuously to exchange tacit knowledge and enable the generation of incremental innovation (Roy et al., 2004). Familiarity with organizational routines is the antecedent of tacit knowledge transfer (Nonaka, 1991; Nonaka, 1994).

Child and Faulkner (1998) found that mutual trust can be facilitated as information and knowledge are exchanged in collaborative projects. Such processes create the conditions in which new knowledge is generated (Nonaka, 1994; Tushman, 1977; Tushman and Scanlan, 1981). Saxenian (1991) found that a trusting relationship between firms enables the exchanges of "sensitive" information in interactions, such as costs, sales predictions and business plans. Trust reduces the risk and uncertainties and promotes confidence in either party acting to look after the other's business interests without undertaking opportunistic behaviour. It is unlikely a supplier will put itself in a vulnerable situation by sharing some sensitive information with a trustworthy customer (Doney and Cannon, 1997). The valuable and private information¹⁶ exchanged may not be available or easily accessible through public domains (Uzzi and Dunlap, 2005) since it is stored privately by one party. Hence specific information obtained through trust allows firms to develop innovative ideas without the need to assess the behaviour of the other party, thus reducing time and costs in developing new products (Albrecht and Ropp, 1984; Tracey and Clark, 2003). Such a process is also a learning process that enables firms to develop organizational competence for new product development.

In addition, competence trust formed in the technical area can lead to shared technical and social bonds (Turnbull et al., 1996). The action of sharing sensitive information also entails that network partners set the relationship to involve

¹⁶ Uzzi and Dunlap (2005) use term "private information" for the information gathered from personal contacts, the information that generally cannot be found in the public domain, such as unpublished scientific knowledge, information on a potential new product or competitor. Private information is subjective as it is produced and possessed by individuals and not verified by other independent parties. Hence, the value of the information varies from one to another. Whether one can obtain such information is dependent on trust between the individuals. Public information is easily available from various sources, including Internet. Because public information is available and accessible, thus it provides significantly less competitive advantage than it used to (Uzzi and Dunlap, 2005).

personal and moral commitment which goes beyond single business exchanges (Dodgson, 1993). Uzzi and Dunlap (2005) and Uzzi (1997) found that connecting in multiple ways allows the managers who know little about each other to have more information in various aspects, e.g. business, clubs, communities, so creating a shared experience, common perspective. Socialization, in other words, a networking approach to new product development is the base of tacit knowledge exchanges between the individuals (Nonaka, 1994).

In a supplier-customer network relationship, scholars also emphasized satisfaction, which is as a result of interactions contributing to trust development. Dwyer et al. (1987) and Wilson (1995) emphasized the importance of satisfaction in a supplier-customer relationship process where business partners, especially suppliers, must deliver a high-level of basic satisfaction. The delivery of quality services and products shows the capabilities and know-how of suppliers in certain areas, thus increasing customers' confidence and trust (Lefebvre and Lefebvre, 1996).

In an inter-organizational setting, whilst two firms are mutually dependent on each other in the form of certain resources in a network, either party is also an autonomous unit for its own business operation. Each has its own benefits to seek and commercial goals to target from the relationship. Hence contracts as a form of legal governance are used in most inter-organizational dealings (Williamson, 1979) for the purpose of enforcing contractual obligations (Heide, 1994). Heide (1994) conceptualized it as role-based trust. According to Anderson and Steinart (2005), it is a type of depersonalized trust because it is predicated on the knowledge that a firm plays a certain role in the network rather than on capabilities, disposition, experience or personal intention of the boundary spanning individuals involved. Although SMEs are found generally relying on social control as relationship governance through social networking, in other words, organizational behaviour is seen to be overlapped with managers' individual behaviour (Gilmore and Carson, 1999). However, in the established SMEs organizational attributes do appear to matter in business transactions as firms tend to be more formalized in terms of the setting of organizational rules and norms (Carson and Gilmore, 2000; Morrissey and Pittaway, 2006).

Therefore it is clear that in the inter-organizational relationships trust relates to, at least partially, the regulations either set by legal or industrial professional system as the constrains of certain behaviour. Studies (e.g. Volery and Mansik, 1998) found the important role that law and formal contracts play in trust. At least partly they create a certain confidence and security from the power of law (Luhmann, 1988), although the reliance on them by the firms can be voluntary. Thus, signing a contract can mark a signal of high level of commitment from a firm.

As far as the maintenance of supplier-customer relationships is concerned, studies found that incremental innovation occurred where there is close and strong ties. In these relationships both parties have a long-term perspective and have developed robust trust over time (Doney and Cannon, 1997). According to Roy et al. (2004) in such circumstances less repeat explanations are needed in interactions, because the "proven competence would mean less frequent but more higher quality and valuable interactions" (*ibid.* p.69). They proposed that greater quality but fewer interactions would lead to incremental innovation. Frazier (1999) explained that the antecedent requirement for quality interactions to occur is that such trust must be reciprocal, in that the supplier will be able to provide and customer will be able to use the product ordered. These studies (Doney and Cannon, 1997; Frazier and Niehm, 2004) of existing supplier-customer relationships highlighted that trust, built as a result of past close and stable relationships, may be the main driver for a customer to select existing suppliers for further collaborations. However, these studies did not investigate the trust that is incorporated into collaboration for incremental innovation processes.

The above discussion of inter-organizational trust reaches the similar conclusion that different aspects may affect inter-organizational trust, such as familiarity, information and knowledge exchanged, while inter-organizational trust blends with inter-personal and/or relational trust through interactions. Such a relationship artefact sets conditions that enable available information and tacit

knowledge to be exchanged. Hence it becomes clear that trust can lead to the collaboration necessary for incremental innovation.

3.3.5 Contextual trust

In some cases the context in which trust is being generated affects the formation and development of trust (Anderson and Steinart, 2005; Kramer, 1999; Lewicki and Bunker, 1996; Lewis and Weigert, 1985; Meyerson et al., 1996). Context refers to the settings in which trust is taking place or individuals are making decisions to trust; such context can be constituted by various aspects regardless of the presence of individual characteristics, strong ties and type of inter-organizational settings. The notion of context is useful to the understanding of trust in supplier-customer relationships. Dasgupta (1988) explained it is impossible that an agreement between network partners covers every circumstance, thus in order to engender trust one needs to know the context other than the other partner's disposition of trust. We may trust an individual's competence in a certain context; however we may not in other situations (Good, 1988). For example, in the case of a good gardener who is also a close friend, we may trust him to create a beautiful garden, but we may not trust him to be capable of looking after a baby. Hence the garden acts as the context attached to a trusting relationship instead of the baby.

Indeed, Zucker (1986) argued that there is a presupposition in trusting relationships, where the context can be relevant to rules and expectations. In the biotechnology industry, bio-science community events may help provide a trusting environment for trust to be established in the beginning of a network relationship. In supplier-customer network relationships where incremental innovations occur, customers have expectations of buying new or improved products based on new technologies/or changes, and then make decisions on purchases. Meanwhile suppliers have expectations for purchasing actions from customers. Both network partners set the relationships from a long-term perspective (Roy et al., 2004). Hence, the partners need to meet each others' expectations in order for the establishment of a successful trusting relationship.

As highlighted in the foregoing, there are different types of trust identified. Context is a crucial factor that determines all other types of trust (Anderson and Steinart, 2005). It can be argued, inter-personal trust has a different meaning and role to play in different contexts, relational trust, as an artefact resulting from interactions, is a necessary condition of network collaboration to cope with the risks, uncertainties and complementary resources needed (Yau et al., 2000). Inter-organizational trust determined by inter-organizational setting defines the boundary, purpose and outcomes of inter-personal trust in network relationships.

3.4 Mode of Interaction: The Ways by which We Interact

In a network, firms connect to one another through the interactions between boundary spanning individuals (Tushman, 1977; Tushman and Scanlan, 1981). It is individuals as human beings who substantially articulate a network. Boundary spanning individuals are actually the ones who operate a dyadic relationship. Scholars have argued that interactions are not only a way of communicating to others but also a way of nurturing and forming relationships with others (Albrecht and Ropp, 1984; Madhavan and Grover, 1998; Nonaka, 1991; Nonaka, 1994; Roy et al., 2004).

Studies show that as modern technologies increasingly advance there is increasing recognition and exploration of alternative modes of traditional face-to-face interaction. For example, corporate websites, where interactions are taking place between organizations and customers, have gone beyond online promotion and advertisement (International-Trade-Centre, 2009; O'Leary et al., 2004). These websites have integrated with the supporting institutions' websites and databases of industrial communities and those organizations are able to interact with network parties by means of discussion forums. Roy et al. (2004) extended the traditional way of understanding the modes of interaction, for example face-to-face or telephone, to include modern modes of interaction, such as email, electronic data exchange and web-based business-to-business systems. People use some modes of interaction to interact with one another in everyday life and

work. We can see that modes of interaction cannot be separated from the relationship processes.

A first time supplier learns about a customer's needs through the modes of interaction. For example, a science entrepreneur of a biotechnology firm may meet a customer through networking such as research programs, or attendance at business meetings (Liebeskind et al., 1996) and this could be the initialization of a collaboration for incremental innovation. Interactions also occur during the encounters of the relationships process. Indeed, Madhavan and Grover (1998) argued that the interactions are the basic means by which trust can be constructed in innovation collaboration.

No matter what type or how small the innovation project, all entrepreneurs need to interact through any one of modes of interaction in a network. Anderson et al. (2007) held that modes of interaction can transmit the knowledge needed in the innovation process. The mode used has impact on its ability to transfer certain knowledge (Polanyi, 1967). For example, face-to-face interactions facilitate tacit knowledge transfer, the key to generating new knowledge for new product development (Madhavan and Grover, 1998). In addition, in a supplier-customer network of a biotechnology SME, the action of interacting and getting to know each other is facilitated by the mode of interaction. Owner-managers need to note that the interactions that involve informal relationships are richer than those limited to formal relationships (Hakansson, 1987; Roy et al., 2004). The type of mode varies in terms of the capacity of media richness. A particular chosen mode and the context in which it is used affect the formality of the interactions (Orr, 1990). It can be said that the type of mode chosen affects how the process of product innovation generation goes in a dyadic supplier-customer relationship. For example, in the case of an entrepreneur who expects to develop trust through an informal relationship with a customer, if he/she did not use the appropriate interaction modes in approaching the business partner this may affect the relationship progression and even influence its outcomes.

In certain contexts, some interaction modes are preferable to others. In some situations if two network partners have built a close and stable relationship based

on trust, entrepreneurs may prefer to use less costly, speedy electronic modes more often in the interactions for maintaining relationships. It is understandable that in general bio-science entrepreneurs have very busy schedules and they do need to consider a balance of costs and time in managing relationships. Strong, robust trust may alter the patterns of the use of interaction modes in tacit knowledge exchanges, learning and therefore incremental innovation (Dodgson, 1993). In order to manage effective interactions, Roy et al. (2004) argued that the IT adoption and integration of two firms can affect the interactions on product innovation generation in supplier-customer relationships.

3.5 Supplier-customer Relationships and Environment: Micro and Macro Levels

Scholars discussed so far have reached the consensus that trust is the key driver for two network partners entering into a dyadic network relationship as a way of creating new knowledge and value. In a review of the relationships of networked firms however, Beije and Groenewegen (1992) argued that networking is a complex process and a multidisciplinary subject in human societies. Accordingly they suggested that to understand the networking phenomenon, the social context in which network actors are embedded should also be examined. More specifically socio-psychological, cultural and geographical proximity aspects should be viewed together in the analysis. In this sense, Batonda and Perry (2003) have tried to relate the network relationship process directly to a social context, including cultural aspects relevant to networked firms in the collaboration. Batonda and Perry (2003) held that Granovetter's (1973, 1985, 1992) concepts of strong and weak ties are useful in providing a broader prospect, concerning the embeddedness of a network. This implies that a network has its history as well as connections to the environment within which each member is embedded. In the similar vein, Johannisson (1986) interpreted a network in a broad sense of having a "fuzzy boundary". However neither Granovetter nor Johannisson offered a systematic explanation of a dyadic network relationship process of entrepreneurs as their studies have not incorporated the insights into the formation and development process.

Turnbull et al. (1996) noted that any business-to-business supplier-customer relationship must constitute relevant factors at a micro-level within the dyad and at a macro level beyond the dyad. This view is shared by Roy et al. (2004) who considered the notion of embeddedness in a dyadic supplier-customer relationship context. They argued that whilst a close and stable relationship with trust as its foundation is important for supplier-customer dyad, network connections characterized as "loosely coupled" links of each partner are also considerably important because they affect incremental innovation generation in the network.

In the biotechnology industry where the locus of innovation is found in bioscience networks, such networks are characterized as "loosely coupled" (Powell et al., 1996; Weick, 1976). Orr (1990) maintained that in high-tech organizations, informal networks are generally in the form of professional communities of individual technicians. Such networks allow entrepreneurs who can understand and create a specific sort of knowledge to find better matched organizations that can offer a certain knowledge input. The links through weak ties can create customer referrals, supplier referrals, sources of information and advice. Hence an entrepreneur's heterogeneous ties provide more chances for resource and information diversity (Jack et al., 2004; Monsted, 1995).

Bearing in mind the concept of embeddedness, Batonda and Perry (2003) studied the cultural dimension in the process of network relationships by examining dyadic interactions in inter-organizational network formation between oriental and western cultures; the major finding indicates that owner-managers of oriental cultures tend to activate inter-organizational networks from personal relationships/or contacts. This can perhaps be explained by Fukuyama (1995) who suggested that trust building is affected by the social context in that there is a difference in terms of legal systems, social values and norms between oriental and western cultures, and these affect individual beliefs and the way trust is built. Although Batonda and Perry (2003) have investigated the cultural impact upon the process of inter-organizational relationships, their study did not incorporate it into the incremental innovation and trust process.

As Johannisson (1995) reminded us, “considering the origins of networking as human interaction in social anthropology, the lack of awareness of cultural contingencies in network analysis is astonishing. Cultural differences matter in organizational research and more so in network research.” (*ibid.* p.217) He pointed out that quantitative methodology can only deal with limited national differences. Hence cultural aspect that affects trust building and inter-organizational relationships is worth considering and by a different methodological approach. As indicated in Chapter Two, product innovation in biotechnology has increasingly become an international collaborative phenomenon. As such, this study holds that cultural differences may impact on an entrepreneur’s use of interaction modes in his/her trust building process which will consequently influence knowledge transfer and new knowledge creation in incremental innovation.

3.6 Empirical Studies of SMEs Customer Network Relationships

As indicated above, the varying theories of supplier-customer relationships are merely different ways of depicting and understanding a phenomenon in that they are both general to all of dyadic supplier-customer relationships and specific to the particular relationships of a SME. Scholars agreed that building and developing a supplier-customer relationship is a nurturing and accumulative process and trust is the key of making it work (Ford, 1980; Larson, 1992; Wilson, 1995). A trusting relationship leads to the collaboration necessary for incremental innovation (Madhavan and Grover, 1998; Nonaka, 1994; Roy et al., 2004). Sociologists would argue that the necessity of trust derives from the human nature of the individuals involved wishing to reduce uncertainty and risk and seeking affiliation, therefore acquiring a sort of “secured” and reciprocal collaborative relationship (Albrecht and Ropp, 1984; Kanter, 1994; Larson, 1992). Social-psychologists held that trust derives from the boundary spanning individuals with some similar characteristics working together in a network (Antcliff et al., 2007; Putnam, 2000). However, organizational researchers

argued that trust emerges from a mix of the effect of both individual and organizational predispositions (Carson and Gilmore, 2000; Gilmore et al., 2001; Roy et al., 2004).

Indeed, it appears that the topic of supplier-customer relationships covers a broad scope and involves overlapping areas and concepts. While micro- and macro-level explanations of a phenomenon show the complexity, the influence of many factors affecting individual, organizational and environmental aspects of a relationship show the dynamics and complications. There may not be only one but several elements contributing at any given period to any dyadic relationship and the factors can change over time. These form a great challenge for scholars attempting to explore any theory on the topic empirically because it can be difficult to manipulate various factors. Yet there are contributions made by the previous empirical studies some of which tested the theories highlighted in the foregoing or which studied certain aspects of the supplier-customer relationships as they are linked to innovation generation, buying and selling, relationship management and learning. These empirical studies are shown in Table 3.1 in the next page.

Table 3.1 Empirical studies of SMEs Business-to-Business Customer Network Relationships

Author	Purpose	Method	Respondents & Data collection	Findings
Larson (1992)	To investigate social control in partnership collaborations for innovation and growth	Semi-structured interviews with open-ended questions	Firms including SMEs in telephone equipment, clothing, computer hardware, and environment support industries	Social dimensions of the transaction are central in explaining control and coordination in the exchange structures. Three phases of network dyads are developed, each with particular and important social aspects.
Lefebvre and Lefebvre (1996)	To investigate how SMEs' intangible capabilities affect and process innovation in manufacturing firms	Mail survey with standardized questionnaires Likert scale	Small manufacturing firms in plastic, chemicals, metal, electronics, food and furniture	SMEs' technical skills, effective customer relationships in terms of improvement of corporate image or of quality service in the form of more dependable, faster deliveries affect technological process innovation.
Deeds and Hill (1996)	To examine the number of external alliances and the rate of new product development	Mail survey with standardized questionnaires	Firms including SMEs, pharmaceutical companies, non-profit research institutes and universities in biotechnology industry in the U.S.	The more strategic alliance (including customer-networks) with external parties a firm has, the higher rate of new product development, however too many alliances diminish returns.
Carson and Gilmore (2000)	To investigate how SME owner-managers develop experiential learning based on existing knowledge, experience, communication and judgement	Semi-structured interviews with opened ended questions	SMEs in the UK	SMEs experiential learning is enhanced through knowledge, experience and communication and judgement with existing and new customers.
Freel (2000)	To examine the function and geography of customer network to innovation collaboration.	Mail survey with semi-structured questionnaires	Manufacturing SMEs in the UK	The importance of social dynamic. Familiarity and trust facilitating collaboration, the relative perceptions of added value through co-operation. Innovative firms were significantly more likely to have taken design, development and product improvement activities in partnership with customers. It does serve to underline the importance of user involvement during the early stages of the innovation process (Gardiner and Rothwell, 1985).

Table 3.1 Cont'd: Empirical studies of SMEs Business-to-Business Customer Network Relationships

Author	Purpose	Method	Respondents and Data collection	Findings
Gilmore et al. (2001)	To examine the impacts of SMEs' characteristics on supplier-customer network interactions	Semi-structured interviews with open-ended questions	45 SMEs in engineering, textiles and food industries	The composition of SMEs' owner-managers network moves between personal and business relationships. Networking process is also a learning process in which competence can be built, refined and developed.
Fuller and Lewis (2002)	To investigate the meaning of relationships to owner-managers of small firms and how their interpretation affects relationships strategies	In-depth interviews with semi-structured questions	SMEs across industries in England	Customers are viewed as the most important to SMEs. Trust, discussions, expectations, and service are identified as the main theme in the relationships. Social controls play an important role in relationships and the management of the firms.
Leonidou and Katsikeas (2003)	To examine the effect of SMEs' foreign customer strategies on building business relationships with exporting manufacturers	Mail survey Likert scale	US SMEs nationwide	The degree and focus of foreign customer strategies affect considerably different working relationships with export suppliers.
Michael (2003)	To examine the degree of SMEs' awareness of customer relationship to growth and competitiveness	Mail survey with semi-structured questionnaires	SMEs in manufacturing, high-tech, packaging and distribution, electrical engineering and finance sectors in Wales	Customer relationship is important in contributing to SMEs' growth and competitiveness
Lindman (2004)	To investigate the ways SMEs establish and manage customer relationships	Semi-structured interviews with opened questions	SMEs cross industries	Customer relationships are established based on personal networks of owner-managers. Maintaining customer satisfaction through collecting feedback often by personal contacts. Face-to-face visits in combination with personal phone calls are the key form of interaction to maintain the relationships.
Macpherson et al. (2004)	To examine the organizational capabilities of innovation that have facilitated firm growth	In-depth interviews with open-ended questions	High-tech manufacturing SME in England	Customer relationships contributed to the firm's innovation in terms of supplying complementary knowledge and skills.

Table 3.1 Cont'd: Empirical studies of SMEs Business-to-Business Customer Network Relationships

Author	Purpose	Method	Respondents and Data collection	Findings
Bradley et al. (2006)	To examine the use of supplier-customer relationships in SME entries to foreign markets	Likert scale with regression analysis	SMEs in computer industry	Suppliers' positive attitude towards supplier-customer relationships depends on the length of the relationships; a positive attitude is more likely to enable SMEs to acquire new foreign customers.
Morrissey and Pittaway (2006)	To explore SMEs behaviour in customer-supplier relationship	Mail survey with standardized questionnaires	Steel-based manufacturing SMEs	Owner-managers considered investing resources in the development of c-s relationships as a means to create trust. Trust is perceived by respondents as goodwill trust. This paper identified that goodwill trust is important in customer supplier relationships.
Redondo and Fierro (2007)	To investigate the impact of size on firm supplier-customer relationships	Mail survey with structured questionnaires	Agro-food SMEs, specifically wine producers	Trust is an important element in SME supplier-customer relationships.
Hall and Bagchi-Sen (2007)	To examine factors that may influence innovation performance and strategies in the biotechnology industry	Mail survey with open-ended questionnaires	Firms including SMEs in biotechnology in the US.	The success of new product development benefits from customer network relationships.

Larson and Starr (1993) suggested that a SME's network interaction varies depending on the stage of the enterprise's development. Generally those developed SMEs that have gone through the start-up phases possess several layers of relationship exchanges. Larson and Starr emphasized that while entrepreneurs as individuals continue to manage and shape relationship exchange processes, the linkages between a SME and its set of essential organizational relationships are less likely to involve only interpersonal commitments between individuals (Larson and Starr, 1993, p.8). As indicated in Table 3.1, focusing on the developed SMEs, some scholars investigated supplier-customer relationships by revealing owner-mangers' behaviour through mail surveys of questionnaires. For example, Morrissey and Pittaway (2006) found

that trust is perceived as important and owner-managers viewed the investment in the relationship development as a way of creating trust. Cambra-Fierro and Polo-Redondo (2008) revealed that a long-term perspective, as the relational orientation, is an important element. However, the quantitative methodology used constrains the abilities of the studies to explain what trust means and both studies appeared to have identified the importance of one facet of trust, goodwill trust.

Other scholars have taken a qualitative approach to investigate SMEs' attitudes towards, and ways of establishing and managing relationships. These studies mainly identified the elements of what are considered as important in the relationships, for example Fuller and Lewis (2002) identified trust, expectations, service and communication and Lindman (2004) found satisfaction is the main theme. However, none of these studies incorporated trust into the relationship processes. The only scholar who examined the relationships processes is Larson (1992). Through case studies by in-depth interviews, Larson (1992) explored the way organizations, including both large firms and SMEs, establish and manage customer relationships. As highlighted in the foregoing, Larson (1992) identified that several elements including trust are social controls in governing the relationship processes. However, the study has not investigated trust formation and development in the innovation processes.

Most of the remaining researchers shown in Table 3.1 have investigated supplier-customer relationships in connection with other factors, including firm capabilities and process innovation (Lefebvre and Lefebvre, 1996), organizational learning capability (Carson and Gilmore, 2000), firm growth and competitiveness (Macpherson et al., 2004; Michael, 2003), foreign market entry (Bradley et al., 2006), likelihood of product innovation (Freel, 2000; Hall and Bagchi-Sen, 2007), rate of product innovation (Deeds and Hill, 1996) and two of these studies focused on SMEs in the biotechnology industry (Deeds and Hill, 1996; Hall and Bagchi-Sen, 2007). Other studies have tested certain relationship factors such as organizational attributes, including size, composition of owner-managers' networks (Gilmore et al., 2001; Redondo and Fierro, 2007) and firm market strategies (Leonidou and Katsikeas, 2003).

However, Macpherson et al. (2004) noted that scholars of supplier-customer relationships have had problems in using appropriate methods to examine relationships. Johannisson (1995) agreed by pointing out the dominance of applying paradigmatic assumptions in gaining an understanding of business networking behaviour in general (*ibid.* p.215). Most of the empirical studies in the list have sought the functional aspects of, and the reasons for, successful relationships and these have relied on scholars' pre-assumptions. The results of the studies tend to be investigator driven, and thus perhaps less likely to capture the essence of the respondents' network relationships and its association to the other aspects. It is clear that there is a scarcity of research looking into the processes that provides the dynamics of the relationships, and none of the studies has incorporated the relationship processes into SMEs practices of product innovation generation. This study attempts to examine the customer network relationship process in the context of incremental innovation generation as addressed by entrepreneurs' narratives and as such offers an in-depth understanding of the relationship process and the impact on SMEs' incremental innovation generation.

Some scholars hold that there is as yet no comprehensive theoretical framework of supplier-customer relationship of SMEs (Gilmore et al., 2001; Morrissey and Pittaway, 2006; Ogbor, 2000). The review in section 3.6 has shown the complexity of the area, indicated by various perspectives carried out by the empirical studies relating to the relationship per se. Moreover, the supplier-customer relationship is shown not only as the functional instrument enabling SMEs to achieve innovation, but also it is a factor in many other prospects of business: learning capability, foreign market entry, growth and competitiveness.

Conclusion

It is apparent that the review in this chapter indicates that supplier-customer network relationships is a complex topic involving a broad range from the basic organizational need for complementary skills and knowledge to the understanding of people and their capabilities, for example reputation, identity, etc. Network research has reflected on the theories and attempted to categorize the processes, explain the underlying essence of trust and trust as a process, consider different approaches, types of trust and modes of interaction, and demonstrate the links between these factors. Most of them however have not looked at incremental innovation but rather processes more generally.

Scholars have realized the complexity of human behaviour and the difficulties of producing a one-fits-all universal theory of the supplier-customer relationship process. They have become aware that the supplier-customer relationship is a dynamic concept reflected by practices that differ from one firm to another and one circumstance to another. Nevertheless, the existing literature has dealt with this complexity by identifying factors and analysing the relationships and firms accordingly. While such contribution has offered remarkable explanations to the field, it is clear that the area concerning the dyadic process of supplier-customer relationships of SMEs in the context of incremental innovation, of particular interest in the biotechnology industry needs to be investigated.

This study argues that the essence of the dyadic supplier-customer relationship process may be a process of trust formation, development and maintenance. Due to the complexity and dynamics of human behaviour which are intertwined with many layers of factors in the environment, the success of the network relationships requests multi-dimensional trust. Such trust that integrates the facets of inter-personal, inter-organizational, relational and contextual trust provides a relationship condition that is necessary for the collaboration for incremental innovation. Trust needs to be created for the supplier-customer relationship to occur and develop (Lindman, 2004). Trust building, as a progressive and accumulative process, enables a firm and the customer to work together in a network. The generation of product innovation is related to a process of trust development that allows for information flow, mutual learning

and manifestation and application of both explicit and tacit knowledge of two network partners. The formation of multi-dimensional trust also represents the emergence of strong ties through interactions over time. Such interactions, in turn, are connected to understanding common interests and shared goals at one time and over time, thus maintaining the trust that has been developed. Trust built with existing customers can be a great advantage to securing further innovation collaboration where customers may have the choice of selecting existing suppliers.

Trust building and the consequence of trust development in the dyadic relationship processes varies from one case to another and one situation to another, because the interactions in dyads are substantially the articulations of both individuals and organizations. Moreover, the complexity within the relationships can be different at any one time and can change over time because of various attributes and environmental factors involved. One notable change in the environment is technological advancement in the societies, which has an impact on the attributes at each level. Hence, the preliminary trusting relationship built and developed might be derived from the searching on the Internet, understanding of common interests and mutual goals, reputation and identity, etc. However, this will depend on the individual's capabilities such as experience, knowledge and skills and attitudes. Additionally, trust building and development might also be related to SME's available resources to support the interactions in terms of modes of interaction used.

It is perceived that there is a broad range of supplier-customer relationship process theories, however there is not yet a comprehensive theory of trust as a process that determines the relationship process, particularly in SMEs context although many studies have indicated the factors of trust. None of the research has incorporated the process into incremental product innovation practices and none in the biotechnology industry. Although there is some understanding developed in recognizing the dynamics of trust and explaining the routes to trust building and development, none of the studies has systematically examined the trust process and the link to its components and factors. There are several areas identified which need to be explored, including: (1) how presumptive trust is formed and how the process links to virtual interactions between suppliers and

customers in a network that generates incremental innovation; (2) as a relational artefact, how trust is built, manifested, changed and how virtual interactions impact on the process of trust; (3) although bonding social capital has been identified as being important in facilitating cognitive as well as affective trust building, little if any research has investigated different types of bonding social capital influencing trust building, development and maintenance, how bonding social capital is developed and sustained, and how virtual interactions impact on the development and sustainment of bonding social capital; (4) how trust is maintained through virtual interactions.

Hence, it emerges that there is a need for more studies which offer insights into the process and to provide a deep understanding of the dynamic interactions of supplier-customer relationships, incorporated in the practices of product innovation generation, of particular attention to SMEs in the biotechnology industry. This study will address these recognized gaps, to capture the key elements of the supplier-customer process and the role of virtual modes in the interactions and incremental innovation generation. The proposed phenomenological approach through getting close to the entrepreneurs and enabling them to talk about their collaborative relationship experiences will aid the researcher to gain a deep insight into the interactions and their contributions to the management of the collaboration process.

Chapter Four

Supplier-customer Virtual Interactions

4.1 Introduction

The preceding chapters have discussed product innovation generation through collaboration and particular attention has been paid to incremental innovation in supplier-customer networks. A networking approach to collaborative incremental innovation has become a trend among firms in the recent years and it has brought great advantages to industrial suppliers, especially SMEs. The generation of collaborative incremental innovation is substantially a process of people interactions. The key elements of incremental innovation, the relationship processes and the determinant, the factors and how those networking elements shape the processes of collaboration and product innovation have also been demonstrated.

As indicated in Chapter Two, a recent trend shows that biotechnology SMEs' external networking has expanded from local/regional to global scope, and there has been a mix of local/regional and global networks emerging in bioscience entrepreneurs' collaborative product innovation. Due to a complex and turbulent environment characterized by uncertainty and technological changes (Dodgson, 1993) and time and geographical distance involved in the dyadic interactions, biotechnology entrepreneurs confront great challenges in managing innovation processes while entering into and developing network relationships with customer networks. Roy et al. (2004) noted that innovation generation has been increasingly viewed as a multidisciplinary activity connecting to a multiplicity of firms, situations and settings.

It has been shown that biotechnology SMEs possibly enter an innovative network with a customer by a peripheral route commencing with pre-deposition of trust, for example corporate websites, scientific publications, word-of-mouth; or by a

central route of inter-personal interactions, for example attending research programmes, conferences and business meetings. Entrepreneurs bring cognitive aspects such as tacit knowledge, individual competences and capabilities for new product development as well as affective aspects such as honesty into a network relationship. Apart from direct reasons related to the intentions of a new product development, entrepreneurs may also have other underlying motivations for entering into innovation collaboration; looking for complementary resources, expanding markets, improving organizational competences, knowledge and skills or simply expanding existing networks in order to create more potential entrepreneurial opportunities.

Prior to the initialization of joint activities related to new product development, both entrepreneurs and customers thus bring some pre-dispositional trust and expectations into new network relationships; the business interests they will express, what they will do, the adaptations they will make and benefits they will obtain. As indicated in the previous chapters, as technologies continue to advance it appears that some studies have looked into the means undertaken by biotechnology entrepreneurs to access global knowledge-based community networks, for example the mass media of scientific publications (Fontes, 2005; Gittelman, 2007). Network partners may use electronic modes in their networking processes for developing new products (Roy et al., 2004). As noted in the previous chapter, the network relationship processes and trust building differ from one another, similarly networked partners' virtual network interactions also vary from one to another. Acknowledging that SMEs' interactions with customers are conducted by entrepreneurs who are boundary spanning individuals, it may be possible that there is a general framework which shows the ways by which entrepreneurs and customers interact with each other virtually, e.g. how entrepreneurs engage in virtual interactions to progress a trusting relationship. This chapter will thus explore more details on the elements of virtual interaction which consist of and shape the relationship processes. To begin with, an overview of network interactions will be addressed.

4.2 Conducting Network Interactions

In examining supplier-customer interactions in incremental innovation, Roy et al. (2004) distinguished three sub-dimensions of the quality of network interactions, namely quantity, scope and mode. As highlighted in Chapter Two, the first dimension, *quantity*, although relevant has however been well studied (Dwyer et al., 1987; Ford, 1980; Saxenian, 1991); the frequency of interactions increases as network partners get more and more involved in the collaboration (Leonard-Barton and Sinha, 1993). The second dimension, *scope*, related to organizational hierarchical issues of personnel involvement in networking process, is not applicable to the networking in the SME context and this dimension has been addressed in Chapter Two. The third dimension, *mode* of interaction refers to the quality of interactions that is not covered by quantity and scope (Roy et al., 2004). In order to understand interactions using virtual modes, this section therefore mainly focuses on discussing the modes of network interaction. As will be seen, scholars hold different views on what constitutes modes of interaction.

Roy et al. (2004) suggested that the various modes of interaction can be seen as being located in a broad spectrum. At one extreme there is the formal legal contract where network partners look for safeguards of protecting themselves by laws or regulations. At the other extreme there is the informal cafeteria in which entrepreneurs may be gathered together in a relaxed social atmosphere. The remainder of the modes lie in between the two extremes and include letters, faxes, emails, meetings, electronic data interchange and web-enabled business-to-business systems.

Ala-Rami (2007) conducted an empirical study of the modes of interaction, including email, phone call, Internet, formal and informal meetings and found that these modes, particularly email and face-to-face meetings are critically important to owner-managers in inter-firm collaboration for product innovation. In fact, the broad range of modes create difficulties and perhaps even confusion for entrepreneurs in understanding the functions due to the various dimensions and structures involved. Attempting to simplify the typology, this study makes a

distinction between face-to-face and non face-to-face interactions, and defines all of the interactions that use non face-to-face modes by machines, for example a computer (Kim, 2002) as virtual network interactions. Roy et al. (2004) acknowledged that some modes can be preferable to others in a certain context. The matter of how and when they are used will depend on the individual characteristics as well as certain organizational attributes. They held that owner-managers may choose more than one mode in the relationship processes.

Indeed, as indicated in Chapter Three people use one or more modes of interaction to interact with each other in everyday life and work, they cannot be separated from the relationship processes. The modes vary in their capacities of media richness (more detail will be discussed in the later section of this chapter). A particular mode chosen and the context it is used affect the formality of the interactions (Orr, 1990). The interactions attached to informal relationships are richer than those restricted to formal relationships. Moreover, certain informal interactions are found to have greater advantages in generating trust (Anderson et al., 2007) and innovation (Orr, 1990). Scholars (Daft and Lengel, 1984; Lengel and Daft, 1988) emphasize that the richness provided by different modes affects the effectiveness of interactions.

Supplier-customer interactions act as a basic platform for mutual learning, information exchanges (Soh, 2003) and knowledge transfers (Anderson et al., 2007; Nonaka, 1991; Nonaka, 1994). Roy et al. (2004) pointed out that the interactions in supplier-customer relationships lead to adaptations (Anderson et al., 1994; Ford, 1980) and the formation of ties that allow for stable and close relationships. These relationships, characterized by strong ties and trust are shaped by norms and rules. They enable familiarity and empathy, and allow for incremental innovation attempts, therefore innovation generation (Nonaka, 1990; Nonaka and Takeuchi, 1994; Polanyi, 1967).

It appears that the interaction processes are particularly beneficial when the network partners are geographically close to each other. The further the distance, the less possible is the management of face-to-face meetings (Fontes, 2005; Powell et al., 1996) and certain virtual interactions may have to be considered.

Thus a distant geographical location may be a problem for using face-to-face interactions for tacit knowledge transfer (Dosi, 1988; Polanyi, 1967; Roy et al., 2004).

As highlighted in Chapter Two, biotechnology SMEs operate in a turbulent environment which is becoming increasingly competitive and globally connected. The interactions between biotechnology entrepreneurs and their customers do not only take place through dyadic relationships, but also extend across networks and on a global basis. The recent trend has shown that biotechnology firms have access to global networks through virtual interactions (Fontes, 2005). Scholars argued that network theory is, to some extent, useful and applicable to business in the Internet era (Achrol and Kotler, 1999; Sheth, 1996). As discussed in the previous chapter, trust has been identified as the key theme of supplier-customer network relationships. Accordingly this study argues that virtual interactions may have a role to play in the relationship processes and contribute to the formation and maintenance of trust processes, which are critical to the collaboration for incremental innovation. Before going into the detail of virtual interactions, first it is sensible to review the existing literature in order to gain an understanding of the nature of network interactions; this will help us capture the deep meaning of virtual interactions.

4.2.1 Transaction, Communication or Networking?

What constitutes a network interaction? It is perhaps comprised of a set of elements, namely physical features and the richness of interaction, activities, and actions of interacting through text, data, images, voice, individuals and places.

From an economic perspective, Williamson (1979) suggested that network interactions are an economic concept of transactions and that firms perform activities to exchange resources needed. He held that a transaction means the exchange of goods or services from one owner to another. This can include raw materials, components, investment goods, money, personnel, information, knowledge and opinions (Beije and Groenewegen, 1992). Economists' focus on

interactions is on the exchanges of transactions themselves instead of exchange relationships. However, as discussed in Chapter Two, interaction in the innovation generation process is a multifaceted concept, involving actors and relationships simultaneously as transactions occur.

Chapter Two also highlighted that the exchanges of information and knowledge are important for the generation of incremental innovation, since such exchanges are the base of new knowledge creation. Scholars (Albrecht and Ropp, 1984; Olkkonen et al., 2000) argued that such cognitive aspects relating to economic transactions of innovation are only part of the interactions; actors as human beings are active entities in such processes. Indeed, no innovation is merely based on instrumental actions alone (Hellstrom, 2004). It is obvious that economic transactions cannot be separated from the actions of exchanges of thoughts and messages.

Hellstrom (2004) argued that the interactions in the innovation are “essentially about action directed towards achieving mutual understanding between networked parties” (*ibid.* p.636). He further reminds us that the inclination and mutual understanding between two network actors do not mean that there will be convergence of common interests. This indicates that entrepreneurs cannot fully control the progress of network interactions as stages, since they are not in control of all factors involved. Technological infrastructure is one of the factors supporting the use of certain modes of interaction. Other factors may include customers’ attitudes, preferences, knowledge, skills and individual behaviour and these are affected by situational, social and cultural factors. However, in spite of various factors, different modes can be used to produce an interaction that consists of various dimensions. If a customer is not available to pick up a phone call, then an email may be sent as an alternative to inform and explain a potential meeting which will be arranged. Hence, entrepreneurs can only influence, not force, the ways of interacting with customers whereby innovative ideas are exchanged, the information of new products requested/or suggested, the quality of new products assured and customer satisfactions created.

Accordingly Redondo (2007) suggested that owner-managers may design fluid communication between suppliers and customers, since customers need to express their requirements, while suppliers communicate about their products, their characteristics and their abilities to satisfy customers' needs (*ibid.* p.243). Nevertheless, it is through communication that two network partners express their interests and expectations which enable the awareness of needs in the relationships. Communication involves a sender and a receiver; there is art as well as techniques attached to the action of communication in order that the sender transmits the ideas and thoughts smoothly. Hence, communication includes a sender with a communication goal and this is pointed out by Roy et al. (2004) as the difference between communication and network interaction.

Although the two concepts are similar, Roy et al. (2004) emphasized that different from communication, network interactions may not have a business communication goal (*ibid.* p.64), but all the interactions construct the atmosphere of the relationships (Hakansson, 1982). For example, a sociable greeting of "How are you?" to a customer in an exhibition can bring up a dialogue and which may not have any specific communication objective, but the dialogues might open a discussion for innovative ideas. Some scholars noted that an interaction is not only a means of communicating, but more of nurturing and forming relationships with others (Albrecht and Ropp, 1984; Madhavan and Grover, 1998; Nonaka, 1991; Nonaka, 1994; Roy et al., 2004). Such relationships can be close, deep and bound by strong ties with trust as the key feature.

As discussed in Chapter Two, interactions in innovation generation are viewed as a social action that people generate relationships at both individual and organizational levels (Beije and Groenewegen, 1992). At the individual level, two network actors get to know each other in terms of reputations, personal characteristics, values, views, personal experiences, ideas and friendships all of which form an identity of competences and trustworthiness, and develop familiarity. Such individual interactions need organizational settings as a context and reasons to form collaborations.

At an organizational level, SMEs network interactions often overlap with those at an individual level such as reputations, credibility and competences. Mutual interests and shared goals are expressed through inter-personal interactions. In other words, inter-personal communication, addressed in the foregoing, acts as a platform as well as an instrument for exchanging information, knowledge and other resources for an organization. Communication serves as a base where relational activities take place and which generate value; this value can be incremental innovation or other new resources. Meanwhile such interactions also create ties at one time and over time. In this sense, this study argues that network interactions are broader and richer than communication, involving multiple dimensions.

This is manifest in situations where, for example, firms interact with various network actors in external networks, including customers, to access resources (e.g. information, knowledge, markets and networks) needed in order to pursue innovative opportunities and reduce uncertainties. Furthermore, network interactions enable trust building and development (Jack et al., 2004; Madhavan and Grover, 1998). Such interactions are affected by situational, including contextual and structural (Olkkonen et al., 2000) and relational (Anderson and Steinart, 2005) factors that define the role and norms in a trusting relationship. Contextual factors can be at macro- and micro-level. For example technological development in the business environment where network partners operate is a macro-level contextual factor, while personal characteristics and situational factors affecting the participations of a network are micro-level factors. Network interactions do, in turn, affect contextual and structural characteristics of a relationship. Thus, it can be said that incremental innovation is an outcome of a networking process, achieved by building and developing a trusting network relationship.

The entrepreneur's networking with boundary spanning individuals of a buying firm can involve a broad range of interactions, including those with full access to available personal knowledge, to the initial encounters where there is limited access to personal knowledge and thus references of reputation or a third party referral may be obtained. While the former can be viewed as the central route to

trust in Hung et al.'s (2004) model and achieved by having face-to-face interactions, the latter can be considered as the peripheral route and achieved by indirect interactions (Kim, 2002). Face-to-face interactions include those with individuals in certain contexts, while virtual interactions can be through hyper-texts of emails, electronic voice and the virtual images of the video-conference.

Entrepreneurial networking enabled by various modes is influenced dramatically by the emergence of new technologies (Oh et al., 2009). These new modes of interaction have made our lives easier by enabling network interactions across time and locations (Crossman and Lee-Kelley, 2004). How do they relate to the relationships processes? The following section will go through more detail concerning virtual network interactions and the elements such as hyper-texts, electronic voice and computer messages that contribute to network interactions. The question to be borne in mind is how such interactions facilitate trust building in network relationships in the challenging environment.

4.2.2 Virtual Interactions

Social psychologists view that the links between an individual and the use of virtual interactions are complicated; as virtual interactions are conducted by interacting actors in non-visual circumstances and mainly based on affective dimensions of hyper-text, electronic voice or images (Mcquillen, 2003). Virtual, as an alternative to face-to-face interactions represent a complex system, not only using virtual channels but also involving an entrepreneur's relationship management (Lee and Jones, 2008). Yet, entrepreneurs interact via virtual modes as much as they do in a real sense (Handy, 1995). We can perhaps think about how many and how often we send emails on a weekly basis. Emails can provide any time and anyone alternatives to face-to-face interactions (Davenport and Pearlson, 1998; Tuck and Panteli, 2003), and quite often we shift using hypertext, electronic voice and face-to-face interactions in contacts.

According to the definition of inter-personal interaction in the foregoing, face-to-face interaction has been viewed as the richest in the extent of inter-personal

interaction, surpassing all sorts of virtual interaction (Kim, 2002). Hence, the examination of the interactions in the virtual world has been carried out by making comparison with those of face-to-face by many studies. Scholars (Boudourides, 1995; Kim, 2002) held that the difference between these two basic categories lies in their different psychological and sociological impact. It appears that scholars held two types of viewpoint towards virtual interactions; Kim (2002) classified them into two main theoretical perspectives, namely impersonal and inter-personal perspectives. The following section will focus on addressing these viewpoints and discuss their implications and usefulness to this study.

4.2.2.1 Impersonal Perspective

Scholars (Culnan and Markus, 1987; Walther et al., 1994) have claimed that virtual interactions are impersonal. They held that compared to face-to-face, virtual interactions have an insufficient degree of inter-personal interactions. Within this perspective, there are different theories arguing that virtual interactions are impersonal from various aspects. These theories include “Cues-filtered-out” Theory, Media Richness Theory (MRT) and Social Presence Theory (SPT).

“Cues-filtered-out” Theory (Sproull and Kiesler, 1986), an early theory in the area, assumes that the lack of non-verbal cues in virtual interactions causes difficulties for individuals in interacting with each another. The studies (Mcquillen, 2003; Sproull and Kiesler, 1986) argued that virtual interactions lack gesture, nods, tone of voice and facial expressions, and the physical cues that are involved in face-to-face interactions. It means that virtual interactions rely solely on verbal behaviour (Mcquillen, 2003). Kim (2002) pointed out, apart from the lack of non-verbal cues, virtual interactions also lack of capacity to convey shared social norms and rules between interacting individuals, which can cause users to appear to be more aggressive and impulsive (*ibid.* p.4). As such virtual interactions may not be appropriate for those relationship situations where intimacy, harmony and friendship building are needed between individuals.

Following “Cues-filtered-out” Theory, MRT (Media Richness Theory) and SPT (Social Presence Theory) are developed in an attempt to explain the effectiveness of virtual interactions and they have become mainstream theories representing the impersonal theoretical perspective (Kim, 2002; Sinclair, 2005).

MRT was founded by Daft and Lengel (1984). Based on the concept of information and knowledge transfer, the foci of MRT are the characteristics of different interaction modes and how they affect the capabilities to process information and knowledge in different modes in organizations. From an information processing perspective, information richness is defined as the ability of information to change the understanding within a time interval (*ibid.* p.560). The theory has two key assumptions: (1) individuals expect to reduce uncertainty and ambiguity in the information processing in organizations; (2) some modes of interaction chosen for certain work in organizations are better than others.

In examining media richness, Daft and Lengel (1984) used the term “media” to describe the “mode” defined by this study. They argued that media characteristics affect the richness of a media in four aspects, immediate feedback capability, the ability to convey multiple cues, language variety and the extent of personal focus. Daft and Lengel (1984) compared the richness of traditional media of face-to-face and phone call with email and other written media. They concluded that the better the ability to offer timely feedback and personal attention, the richer a medium is. Richer media are also better in conveying what can be brought up by language and personal feelings (Daft et al., 1987). They classified email as a lean media, although it allows for feedback, yet the time of reply is not controllable by the sender. In addition, an email message lacks a personal focus because it cannot more fully convey personal feelings and emotions.

Daft and Lengel (1984) suggested a range of media from lean to rich, with written text-based media as one extreme as the leanest and face-to-face the richest media; in between there is a continuum of different media providing increasing capability of media richness. Rich media such as face-to-face and

telephone enable immediate feedback, the great advantage of face-to-face interaction being the capability to convey non-verbal cues. Telephone calls convey cues such as tone of voice and inflection, hence it is a rich medium compared to written media (Daft and Lengel, 1984). Similarly, Sitkin et al. (1992) identified two dimensions of a medium’s capability to transfer information or meaning of messages; they are the data carrying capacity and symbol carrying capacity. Data carrying capacity relates to a medium’s capability to transfer information or knowledge, whereas symbol carrying capacity relates to a medium’s capability to carry information about the information or about the individuals who are interacting. There are more contributors, e.g. Saenz (2002) and Dennis and Kinney (1998) who also focus on the capacity of the media and the impact of these media. A summary of MRT is shown in Table 4.1.

Table 4.1 A Summary of Media Richness Theory (MRT)

Mode rating Criteria	High	Medium	Low
Speed of Feedback	Face-to-face Video-conferencing Synchronous Telephone call		Email
Non-verbal cues	Face-to-face	Video-conferencing	Synchronous Telephone call Email
Content Tailoring	Face-to-face	Video conferencing Synchronous telephone call Email	
Emotions/or personal feelings	Face-to-face	Video conferencing Synchronous telephone call	Email
Objective data transfer	Email	Video conferencing	Face-to-face Synchronous Telephone call

Adapted from (Newberry, 2001)

The implication of MRT is that entrepreneurs need to select the appropriate media in terms of the match of media richness and the need for information processing in order to reduce uncertainty and ambiguity in network interactions. Since rich media reduce ambiguity by facilitating multiple interaction cues for clarity and explanation of issues, they support subjective messages, but rarely transfer large amount of data. Therefore, it is suggested that entrepreneurs use rich media such as face-to-face or telephone call to handle ambiguous situations for explanation, clarification, negotiation and discussion of subjective matters,

while lean media in the form of written text such as email is mostly used for the exchanges of large amount of objective, quantitative and objective data; hence it may be appropriate to use them in the situation that needs to reduce uncertainty (Daft et al., 1987).

MRT is useful to this study, since it points out the impact of situational factors on virtual interactions and these factors are part of the supplier-customer relationship processes influencing network interactions in the collaboration for incremental innovation. For example, as discussed in Chapter Three, cognitive trust building appears to be the focus of the early stage of network relationships and this is generally processed by the network partners' identification of common interests, and the formation of shared goals. These interactions are carried out through demonstrations of competence and reliability on work-related issues, and by means of information and tacit knowledge exchanges. In such processes virtual interactions, such as emails, may have a role to play.

Another mainstream theory within impersonal perspective is Social Presence Theory (SPT). SPT was formed by Short, Williams and Christie (1976), which examines the social presence that different modes of interaction can offer. The main assumption of SPT is that social presence is a critical factor in influencing social effects in individuals' interactions. Short et al. (1976) defined social presence as "the degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships" (*ibid.* p.65). They suggested that it is social presence which produces the quality of interactions and this is related to two social psychological concepts: intimacy and immediacy. Intimacy concerns closeness, friendship, familiarity between two individuals in the interactions. Immediacy refers to the quality of being immediate, which has an impact on the psychological distance between two interacting individuals. The two dimensions are indicative of the interpretations of the degree of perception that an individual has as a real human being in interactions. In this sense, face-to-face interaction that conveys non-verbal and social context cues is higher in social presence than those virtual interactions that convey less non-verbal and feedback cues. Lower social presence, messages conveyed in virtual interactions are impersonal and less affective (Sinclair, 2005).

Examining the effect of virtual modes from a sociological aspect, SPT has brought the notion of humanity into the study of virtual interactions. William and Rice (1983) claimed that the effects of social presence, caused by different media may have impact on individual motivation to use different media. This seems to suggest that face-to-face is more appropriate for socialization than virtual interactions. In this sense, it may be problematic to use virtual interactions in trust building in the beginning of the relationship processes in incremental innovation, since they will perhaps affect the building of emotional ties and tacit knowledge transfers, the key for new knowledge generation.

Although SPT has brought a social perspective into the field of virtual interactions by considering individuals as novel entities, nevertheless SPT has considered the negative side of the impersonal effects of virtual interactions. Yet on the other hand, scholars have argued that the lack of non-verbal cues can perhaps bring some advantages to the interactions. Rice and Case (1983) noted that the shortage of support for social context cues in virtual interactions enables individuals to be more work-oriented than face-to-face interactions by avoiding distractions caused by non-verbal cues. Similarly, Weisband and Atwater (1999) claimed that too many social and non-verbal cues can distract individuals' concentration on the content of messages, since they may produce extraneous information, for example, the appearance in face-to-face interactions or accent in telephone calls. As such, accuracy and focus of interactions on self and others may be reduced by a rich mode. These studies (Rice and Case, 1983; Weisband and Atwater, 1999) have brought a new dimension – context - while examining scholars' views towards the impersonal perspective of virtual interaction. In some contexts, richness provided by some modes of interaction in terms of non-verbal cues in creating social effects may not be needed. Relating to the focus of this study and what has been discussed of trust as a process in Chapter Three, this seems to suggest that in a relationship process when trust is established, in other words, strong ties and a close relationship are in place, virtual interactions via email may be used as the main networking pattern for work related issues.

However, none of these studies has looked into the nature of work-oriented issues conveyed through virtual interactions and linked it to a network relationship process. Under some circumstances when social presence is not a critical factor in influencing network interactions, a rich mode (e.g. face-to-face) may still be needed due to other factors involved. For example in a relationship when trust has already been in place between network partners, a rich mode of face-to-face interaction is nevertheless needed due to the needs of exchanging certain tacit knowledge in order to deal with equivocality and complexity of the content. In other words, rich interactions are not only required for conveying network partners' social presences, but also incremental innovation practices in the relationship processes. Hence, this study argues that the use of virtual modes is not only dependent on the richness offered by the virtual system itself, rather it should be put in the context of the relationship processes of incremental innovation. The richness needed in the interactions may vary in different situations and at different phases of trust development.

These theories, discussed in the foregoing assume that the more cues received, the better interactions the individuals enjoyed (Kim, 2002, p.5). Kim (2002) argued, those theories (e.g. Cues-filtered-out, MRT and SPT) that highlight the impersonal perspective of virtual modes have only examined the quantity of the cues exchanged and set them as the criteria for judging the effectiveness of inter-personal interactions. Indeed, those theories have mainly focused on the capabilities of virtual modes and viewed virtual systems as static physical facilities with functions of transferring different information or social presence. However, from an ontological perspective Kim (2002) argued that the quality of interactions cannot be evaluated by quantitative data and that the exchanges of many verbal and non-verbal cues do not necessarily correlate with how intimate the individuals are. Kim raised a question: what if they exchange meaningless cues? Hence, apart from the amount of cues and codes exchanged, the qualitative elements such as content of the messages should be considered when one discusses the effects of interaction.

In a similar vein, from a communication aspect Yates and Orlikowski (1992) criticized MRT for failing to consider the style of communication as an important

influential factor. They argued that the same mode can convey messages with different communication styles; similarly the same style can be used in different modes. For example, email can convey messages with a style of formal business letters, memos and informal notes. The point they made is that, it depends on what type of style is used in the hyper-text. The exchanges of communication can be rich even if the mode itself is not rich. More scholars (Lee, 1994; Sinclair, 2005; Walther, 1992) argued that social presence in virtual interactions should be examined from an interpretative perspective.

The following section will take a look at Walther's (1992) Social Information Processing theory (SIPT). Differing from impersonal perspective, scholars of SIPT viewed that virtual interactions can produce social effects. In other words, virtual interactions can create inter-personal closeness and intimacy which are generally perceived as the outcomes of inter-personal interactions through face-to-face contacts. Kim (2002) used Inter-personal Perspective to emphasize the social effects that can be created by virtual interactions.

4.2.2.2 Inter-personal Perspective

Social Information Processing theory (SIPT) was produced based on an examination of the social effect of asynchronous computer conferencing in relationship development in team work (Walther and Burgoon, 1992). Walther (1992, et al. 2005a) argued that the users of virtual interactions can adapt the constraints of non-verbal cues by pervading the text-based messages with both work related and social information. Walther (1992, et al. 2005b) suggested social presence in virtual interactions can be found in social features in the languages and verbally transmitted messages. This can be utilized as the main instrument for developing inter-personal relationships. Walther (1992) also recommended that individuals show affirming verbal messages, frequent interactions and allow more time so that the interacting partners can accrue work related and social information about each other, and develop relationships. They further pointed out that virtual interactions can achieve inter-personal effects similar to face-to-face interactions, albeit more slowly. Walther suggested that

time and the frequency of message exchanged are the key tools to overcome the restriction of variety and number of cues in virtual interactions. SIPT attempts to explain that intimacy and close relationships can be built through virtual interactions by focusing on the style of writing in electronic text.

In a similar vein, Sinclair (2005) proposed that a degree of intimacy can be generated by both verbal and nonverbal cues, such as eye contacts, facial expressions, humour and language used that show concern and care. Sinclair (2005) argued that emotion can be conveyed through speech and associated cues, which can be verbal, written and nonverbal (*ibid.* p.55). Thus, she suggested that story telling can be an approach to relationship building, since it can be rich in its capability to convey vast meaning and gather memorable information, regardless of whether it is in face-to-face or virtual interactions. In this sense, instead of physical cues the content and language used in virtual interactions can have emotional impact psychologically. The implication is that the meaning and the impact are dependent on the ways in which individuals create the interactions (Sinclair, 2005). For example, organizational stories telling of organizational culture, staff, general goals and strategies and social life, all disclose the portfolios of enterprises as well as individual owner-managers and may help generate intimacy or immediacy between the interacting individuals.

In an attempt to combine scholars' two types of view on impersonal and interpersonal perspectives, Sinclair et al. (2005) suggested that verbal stories are best employed in dealing with ambiguous matters, for example organizational strategy or plans, while written format stories can be used for moderately complex issues such as organization goals, value or product introduction. Such an interpretative approach for conducting virtual interactions is advocated by Lee (1994), who held that the method of examining virtual interactions should integrate interpretation of the content.

This section has discussed two perspectives, representing scholars' two different standpoints towards virtual interactions. While studies of the impersonal perspective (e.g. the early "Cues-filtered-out" theory and MRT) mainly concentrate on elaborating the characteristics of virtual systems and are mainly

from an information processing discipline, those of inter-personal perspective (e.g. SIP) focus on exploring what we can do to adapt the constraints of lacking non-verbal cues in virtual interactions and encouraging individuals to exploit their own potential by incorporating human interpretation into virtual interactions. As such, virtual interactions can be seen as being inter-personal rather than cold-faced. In fact, these two theoretical perspectives, proposed by Kim (2002) are not contradictory; rather they examine virtual interactions from different angles due to scholars' different academic backgrounds. Nevertheless, those studies have shown that there were more attempts to investigate the field from different disciplines and our knowledge is increasing. As discussed in Chapter Three, trust in supplier-customer relationships in the incremental innovation process will form the focus of this study. Thus the next section will explore the literature relating to virtual interaction and trust.

4.3 Virtual Interactions and Trust

In recent years, virtual trust is shown as the interest of many studies ranging from psychology (Mei-Lien and Fan-Chuan, 2008), healthcare (Luo and Najdawi, 2004), organizational studies (Markus, 1994) to entrepreneurship (Birchall and Giambona, 2007; Lee and Jones, 2008). Without seeing the person(s) face-to-face with whom we are interacting, how can we build and develop trust, which is necessary for the collaboration in incremental innovation?

4.3.1 Impersonal Perspective and Trust

It is the impersonal characteristics of virtual interaction that some scholars argued caused difficulties with virtual trust (Anderson and Steinart, 2005; Gallagher and Kraut, 1994; Nardi and Whittaker, 2002). As highlighted in Chapter Three, a network that is initially derived from a presumption of trust through virtual interactions is founded upon beliefs about the competence of potential network actors and based on the notion of common interests and shared business goals. This cognitive aspect based trust, which Newell and Swan (2000)

argued is conditional, however, is only based on the circumstance that there is no clear reason for mistrust. As such, presumptive trust is functional, but shallow (Anderson and Steinart, 2005), since the presumptive trust is not tested by inter-personal interactions (Meyerson et al., 1996). Prior to obtaining inter-personal knowledge and making decisions on the trustworthiness of network partners, individuals act as if they trust each other based on a presumptive trust.

Bos et al. (2002) pointed out that because this form of cognition based trust is merely positioned as one dimension of a relationship, it tends to be fragile and thus, temporary. In this sense, if the expectations of network competence continue to be realized as satisfactory, presumptive trust can sustain network interactions (Anderson and Steinart, 2005). Other scholars have argued that in the case of new network relationships, trust development is based on repeat, day-to-day interactions that require face-to-face meetings between the boundary spanning individuals (Axelrod, 1987; Kanter, 1994; Tushman, 1977; Tushman and Scanlan, 1981). As indicated in Chapter Two, tacit knowledge is difficult to transfer due to its tacit nature and such exchanges are generally facilitated by a rich mode of face-to-face interaction enabled by geographical proximity (Anderson et al., 2007; Lawson and Lorenz, 1999).

Face-to-face interactions are viewed as the best way to initiate affective trust in a new relationship (Gilmore et al., 2001), an imperative condition for trusting behaviour (Anderson et al., 2007; Granovetter, 1985). Powell (1990) suggested that certain social contexts stimulate cooperation and solidarity/or a state of generalized reciprocity. In case of new network relationships where owner-managers have insufficient knowledge and understanding of each other, repeat interactions develop trust by generating shared common ground, mutual liking and friendships (Child, 2001). Relating to the formation of emotional/affective trust, Jarvenpaa and Leidner (1998) commented that interactions in the virtual world, with the lack of visual cues and social context make trust building difficult due to interaction diversity and uncertainty in the virtual context. Based on an empirical study of team members' liking of each other in an experimental setting, Weisband and Atwater (1999) found that if team members do not have the

chance to interact face-to-face, it may impede the development of liking and perhaps trust among team members (*ibid.* p.637).

Based on MRT and SPT, scholars who studied trust in network relationships have exposed their views on trust development in a virtual world, whereby there seems little room to enable cognitive and affective trust to develop via virtual modes. In examining the use of virtual offices within firms, Davenport and Pearlson (1998) pointed out that the dependence on virtual interactions, particularly those that are text-based and asynchronous (e.g. email) is viewed to hinder employees developing good collaborative relationships (Davenport and Pearlson, 1998). As far as maintenance of trust is concerned, Handy (1995) noted that trust cannot be maintained in a virtual world; the interactions via email are not the same as watching the eyes of others (*ibid.* p.41). Yet it appears that some recent research (e.g. Walther et al., 2005a; Wilson et al., 2006) on trust in virtual teams suggested that trust can be developed through virtual interactions over time. This notion is mainly based on SIPT and will be discussed in the following section.

4.3.2 Inter-personal Perspective and Trust

Walther et al. (2005a) argued based on SIPT that given enough time, long-term group members can reach trust and sociable states. Since social information exchanged virtually is slower than face-to-face interactions, it takes longer for group members to develop trust in a virtual world, but the level of trust reached is similar to that in a face-to-face context (Wilson et al., 2006).

Jarvenpaa and Leidner (1998) examined 29 global student teams with 6-8 members in each team using virtual interactions over a 6-week period. They found that a high level of trust is developed between team members that had exchanged sociable content in the messages, the exchanges were frequent, and team members showed interest in and proactiveness to each other's responses, and gave instant feedback. In contrast, those virtual interactions with little proactiveness and social content in the messages resulted in low levels of trust.

Through a quantitative study of temporary virtual team collaboration among university students, Wilson et al. (2006) and Weisband and Atwater (1999) investigated trust development in students' synchronous computer text-based interactions. They found that trust can be eventually developed among team members through virtual interactions, yet more slowly. Thus, Wilson et al. (2006) argued that trust development in widely distributed teams can be the same as those teams with geographical proximity. Weisband and Atwater (1999) went further to question whether face-to-face interaction is needed in trust development.

Some studies have examined the behaviour of individuals interacting in a virtual environment. In a study of virtual interactions and trust development, Iacono and Weisband (1997) argued that a proactive manner in the interactions encourages trust in virtual teams. They investigated trust development and performance in 14 virtual teams assembled by university students for three weeks. In their study, trust was defined by an individual's state of having motivation to initialize and respond to his/her teammates in relation to work related issues during the interactions. The mode of virtual interaction the study examined was synchronous computer messages. They found that high performing teams used fun messages in virtual interactions. Teams with high performance also integrated work related issues, informal content of non-work related fun and contacts and technical information in their virtual interactions. A similar result is also found by Panteli (2005). However, Iacono and Weisband reminded us that work content is an important "ingredient" and determinant in developing trust in virtual interactions. Some individual's behaviour of delaying discussion on work issues, and of interacting less frequently, can lead to teams' low performance.

Rocco (1998) conducted an empirical study under an experimental setting. The study examined whether trust can emerge in virtual interactions. The mode of virtual interactions investigated was synchronous email used by group members in temporary teams, comprised of university students. Two stages were set in the study; the first stage investigated the emergence of trust in either pure virtual or

face-to-face interactions in the groups. The second stage investigated whether a pre-arrangement of face-to-face meeting can promote the emergence of trust. The findings of the first stage showed that trust emerged only in face-to-face interactions. Rocco (1998) explained that this is due to mutual adjustment and trust being very delicate resources and rooted in face-to-face relations whereby information flow is immediate (*ibid.* p.496). Purely virtual interactions have created a sort of perception of vulnerability associated with the risk of the team work. Rocco concludes that the greater the risk, the greater the individuals need trusting relationships.

The preceding studies have offered some useful understanding of trust in virtual interactions. However, the respondents investigated in many studies in the foregoing were participating in temporary virtual teams/groups or temporary global teams. They did not know each other and may never work together again in the future. The samples were taken from university students through experimental settings of virtual interaction. Such group members had different relationship contexts from those of entrepreneurs in the biotechnology SMEs, discussed in the literature review. It is doubtful that the understanding of those of team members' collaboration can be applied to a business context (Panteli, 2005). In temporary virtual teams, reputational and professional network effects are very weak, since there were no clearly defined and bounded professional networks and less emphasis on roles (Iacono and Weisband, 1997; Jarvenpaa and Leidner, 1998). Referring to what has been highlighted in Chapter Three, the roles and rules in a network define network behaviour and how trust is built and developed in supplier-customer network relationships. There are other perspectives of trust and virtual interactions, and they will be discussed in the following section.

4.3.3 Other Perspectives and Trust

Other perspectives of the approach to trust in virtual interactions include the factorial perspective where studies examined factors affecting the generation of virtual trust. It is useful to review them as they provide a different approach to

studying virtual trust. Emphasizing the importance of developing shared goals, as a part of the relational condition for trust building, Panteli (2005) found that while the development of shared goals can be conducted through virtual interactions, nevertheless face-to-face interactions are needed. The virtual teams that work well are likely to use synchronous virtual interactions such as telephone and video-conferencing systems. Asynchronous virtual interactions such as email offered less feedback and facilitated understanding less effectively than synchronous technologies. Asynchronous virtual interactions were used for documenting, recording agreements, providing brief and simple updates to work progress.

Focusing on the language of interactions and individual attributes as factors, Lee and Jones (2008) examined entrepreneurs' email and face-to-face interactions in effective entrepreneurial learning in small business start-ups. They compared two groups of entrepreneurs, Science Enterprise Challenge and New Entrepreneur Scholarship, and found that both groups have used gestural, assertive and expressive language, narrative statements and coded behaviour in face-to-face interactions to build strong ties in network relationships by creating meaning from interactions; whereas email was used as a mechanism of bridging weak ties in order to pool useful resources.

Lee and Jones (2008) further examined what lay behind the results, notably that there appeared to be differences in the usefulness between face-to-face and email reported by two groups. While face-to-face interactions are found to be beneficial to both groups, the advantages of virtual interactions are perceived better by the group of Science Enterprise Challenge entrepreneurs who were better educated and more capable of using virtual interactions. This indicates that the extent to which virtual interactions can help the network relationship and trust development process is dependent on individual competences, skills and capabilities in using the tools and techniques, and realizing their usefulness. The notion of including individual attributes is shared by Nardi and Whittaker (2002) who held that to understand the role of virtual interactions, one should also consider individual attributes attached to those who are interacting, as they

affect their choices and use of certain modes of interaction (Nardi and Whittaker, 2002).

4.4 Conclusion

This chapter started by pointing out that although the network interaction of entrepreneurs is different from one another, nevertheless there may be commonalities in the way that network interaction is conducted. There are various ways in which network interaction is conceptualized, ranging from Williams' (1975) notion of transaction to Roy et al. (2004) and Beije and Groenegen's (1992) suggestion of building relationships and gaining resources. It is perceived that the processes of networking are actually a part of the innovation generation processes, enacted by boundary spanning individuals. While many studies of network interaction focused on virtual systems or elements of interaction (e.g. content of interactions), this chapter holds that virtual interaction, as a part of a networking process, may be expanded to entrepreneurial networking in general and throughout entrepreneurs' collaborative incremental innovation processes in particular. Different entrepreneurs network differently, depending on their ways of approaching the network relationships and the individual ability to manage the relationships. Similar views can be applied to their ways of virtual interaction.

A review of the literature on network interaction shows that the modes of virtual interaction are different from one another although they are conceptualized as virtual interactions by various studies. In addition, the contexts in which virtual interactions are carried out are articulated experimental settings where conditions vary from one another. Hence, it is difficult to compare and apply the results to business network relationships. Although the research perspectives proposed by scholars are superficially conflicting, for example impersonal vs. inter-personal perspective, in fact the arguments in these two perspectives are shown to be complementary to each other (Campbell, 1998). Each perspective reflects a different approach and is useful for this study. Although there have been studies of virtual interactions in an organizational setting, nevertheless a

majority was in an intra-organizational rather than an inter-organizational network relationship setting. There is little, if any research which has looked into entrepreneurial networking in customer-networks. Moreover, a review of those studies on virtual trust shows that trust was defined differently from one study to another, for example Jarvenpaa and Leidner (1998) examined the manifestations of trust by respondent's proactiveness and instant feedback, whereas Weisband and Atwater (1999) appear to define trust as inter-personal liking. Hence, the field of virtual interactions related to network relationships is still under-developed until consensus emerges on the key concepts (e.g. trust).

To conclude, this study has argued that SMEs' relationships with new customers consist of several phases, as highlighted in Chapter Three. Relationship process appears to be constituted of several relationship elements, and trust is identified as the key component. The extensive literature review of trust suggests that trust itself is a complex concept consisting of sub-elements, and its emergence and development may be progressive and enabled by network interactions using virtual and non-virtual modes. The literature has indicated that trust has impact on the ways in which collaborative relationships progress. However, the literature on trust as a process has been located in different organizational and relationship settings and is not applicable to network interactions in supplier-customer networks in incremental innovation of SMEs. In particular, there is little, if any, research which has examined trust as a process and relational artefact in entrepreneurial networking process in the context of collaborative incremental innovation and the ways in which virtual interaction may facilitate the trust process. The question therefore follows: how are virtual network interactions conducted and perceived, and constituted as a part of the trust building and development processes in an entrepreneur's collaborative incremental innovation generation practices?

The literature has, however, informed us about what the process of network relationship development appears to be and what trust is in certain contexts through interactions. To understand the phenomenon of network interactions and its impact in the context set by this study, the literature can be a useful tool enabling us to have pre-understanding of, and to explore, the phenomena under

investigation. The next chapter, Chapter Five shall discuss the research methodology and design that assists us to investigate and try to understand this process.

Chapter Five

Research Methodology

5.1 Introduction

Methodology refers to the research strategy that is instrumental in assisting the researcher to investigate the research question and to enhance our knowledge of the phenomena (Guba and Lincoln, 1994; Guba and Lincoln, 1982).

Chapter Two, Three and Four provide a review of the literature. The review shows that our understanding of network interactions in collaborative innovation process is, indeed, to be enhanced. Although a majority of product innovation is incremental, yet little research has investigated incremental innovation, particularly the networking processes of collaborative incremental innovation and that of supplier-customer networks, and none in the biotechnology industry. Innovation generation is a social-economic outcome of people interactions, yet little empirical research has revealed the complexity of the networking processes in the collaboration for incremental innovation, and none of the studies have used a phenomenological approach in studying entrepreneurial networking in such a context. Although trust has been recognized as the most important element in the studies of collaborative supplier-customer network relationships, however, little research has investigated trust in the context of an integration of collaboration and incremental innovation. Moreover, little if any research has focused on the processes of building and developing and maintaining trust, as a multi-dimensional concept and which may be the essence of collaborative network relationships, and how virtual interactions impact on such processes and therefore collaborative incremental innovation. This study investigates these questions by exploring a few aspects:

- What are the key components of network interaction in the process of collaboration for generating incremental innovation in supplier-customer networks?
- How do these components of networking process relate to the process of network relationship and virtual interactions?
- How do virtual network interactions and the process of network relationship relate, and how is this manifested through entrepreneurs' narratives of their experiences of collaboration for generating incremental innovation?
- How can we understand and what can we learn from entrepreneurs' narratives?

The aim of this study, therefore, is to gain an understanding of the networking process and the ways by which virtual interactions have an effect on the collaborative incremental innovation process. It was then decided to undertake a phenomenological approach of interpretative study as an appropriate and overall approach to the investigation of the research object – entrepreneurial innovation through networking, which is a social behaviour and process with economic outcomes, and thus social-economic phenomena. The understanding will be obtained based on qualitative methods by collecting entrepreneurs' narratives about their networking experiences in the collaborative incremental innovation process. Accordingly the purpose of this chapter is:

- ❖ To consider the methodological issues involved in this study
- ❖ To demonstrate the most appropriate methodology
- ❖ To discuss the detail, explain and justify the methodologies and research techniques

These will be achieved by:

- 1) Showing that the research issues were not suited to an empirical positivist approach, in that qualitative techniques would be most suitable and effective.
- 2) Arguing that the field data collection should be theoretically informed by the literature, and that these data could be analyzed by inductive techniques.
- 3) Addressing the procedures and highlighting the strength and weakness of these techniques.

5.2 Qualitative Inquiry in Entrepreneurial Networking, Network Relationship and Virtual Interactions Research

Scholars (Axelsson, 1995; Johannisson, 1987) noted that networking is a phenomenon. Relevant studies have been from different fields within social science for nearly three decades, these include economic, marketing, communication, organizational management, sociology and regional geography (Pittaway et al., 2004). With increasing research into the use of the network approach to obtaining understanding of business in general and entrepreneurial behaviour in particular, scholars (e.g. Johannisson, 1995) argued that the emergence of network phenomena not only creates a discipline of network approach, but also an area of research that consists of multi-disciplinary studies. In this sense, research paradigms in entrepreneurial networking have been under debate because different people working in the field hold different views. It appears that overall, there are four main groups of research into networking in the entrepreneurship or SME context (Premaratne, 2002).

According to Premaratne (2002), the first group is represented by the studies of economists (Williamson, 1979, 1991), which look into the transactions themselves or properties of the actors in networking exchanges. The second group of research is based on organizational management; organizations are

linked to the environment via network relationships of customer, supplier and other external parties (Pfeffer and Salancik, 1978). Dubini and Aldrich (1991) addressed the view that the SMEs look for and build network links to access resources controlled by other enterprises or individuals in the environment. As such this approach endeavoured to explain entrepreneurial behaviour by the key concepts of organizational management.

The third group is concerned with those studies based on sociology (Anderson et al., 2007; Jack et al., 2004). The focus of the sociological approach is on the basic unit of social structure, made up of nodes (individuals and organizations) and ties between the nodes. Ties can be one or more specific relations, e.g. friendships, commercial, financial or sexual relations, conflicts (Boissevain, 1974). The view and structure of sociological approach to networking phenomena has been used as an analytical technique in SMEs' entrepreneurial behaviour for more than two decades.

The fourth group is the Swedish network approach, derived from Swedish studies of marketing by Hakan Hakansson, Lars-Gunnar Mattson and Jan Johanson at the department of Business Administration at the University of Uppsala in 1980s. This approach views and explains networking phenomena from a marketing perspective. The foci have been, for example, the nature of network relationships and the impact of networking on firms (Anderson et al., 1994; Hakansson, 1982; Hakansson and Henders, 1995; Johanson and Mattsson, 1987). This approach argues that supplier-customer interdependence is the important characteristic of business-to-business relationships, the relationships between industrial firms and customers are often close and long-term although the processes are complex (Wilson, 1995; Wilson and Mummalaneni, 1986).

Premaratne (2002) pointed out that each of these groups of networking research has used various methods. In addition, Premaratne noted that each of these theoretical approaches should not be viewed in isolation. Rather it is the focus of each approach that is viewed as different from one another. In fact, Premaratne (2002) suggested that an inclusion of the aspects that reflect all four approaches should be considered in network research into entrepreneurship/or SMEs.

Whether or not to include all four or more theoretical approaches in a network research depends on a researcher's ontological and epistemological considerations.

An examination of entrepreneurial networking shows that the concept is characterized as multi-dimensional. This is manifested by several aspects: firstly, entrepreneurs as novel individuals have emotions, feelings, personal characteristics and histories. "Social" denotes unique human features such as emotions and feelings. Due to the ways that the human beings are built, entrepreneurial networking is seen a social behaviour which involves emotions and feelings and individual characteristics (Aldrich and Zimmer, 1986; Jack et al., 2004). As human beings each of them is different from others. To understand networking behaviour, researchers are required to explore the ways of looking at the world via entrepreneurs' visions.

Secondly, the environments in which we live are also socially constructed, thus an entrepreneur is also a by-product of a society and embedded in different environments with various links to others, such as family members, friends, acquaintances and colleagues whom are also by-products of a society. Johannisson (1995) noted that "entrepreneurship includes a dual image of the entrepreneur as a person and of his/her way of inter-relating with others" (*ibid.* p.219) Entrepreneurial networking is thus socially embedded (Granovetter, 1973, 1985), such social embeddedness means that an entrepreneur's networking behaviour has an impact on the external environment; and in turn, the external environment exhibits its characteristics through an entrepreneur's networking behaviour and has an impact on the behaviour and networking process. Johannisson (1995) argued that an entrepreneur is a human entity that integrates both individual and organizational images in the interactions with the external environment. Thus, the process of entrepreneurial networking is seen as a social process and yet with economic outcomes; and among all, one of the economic outcomes is entrepreneurial innovation (Anderson and Jack, 2002; Anderson et al., 2007; Jack et al., 2004; Yue et al., 2004), which is the focus of this study and has been discussed in Chapter One. These illustrate the distinguishing features of entrepreneurial networking, which may be different

from other forms of networking, for example social networking for dating, which does not have to have economic outcomes although in some cases social and economic outcomes may be intertwined.

Accordingly Johannisson (1995) argued that entrepreneurial networking is a socio-economic phenomena; and networking of each individual entrepreneur /or a SME to pursue incremental innovation is different from one another, underlying his/her integration of the aspects of network relationships, modes of interaction used, skills and knowledge and abilities. Network collaboration in incremental innovation will be dependent on an entrepreneur's individual characteristics, network relationships and connections, how she/he proceeds and opens up a new relationship, maintains and possibly expands the existing close relationships and how she/he views and responds to the external environment.

Bearing these aspects discussed above in mind, this study considers that entrepreneurial networking is likely to be a subjective behaviour and the insights are arguably not able to be caught by the questionnaires of quantitative studies used by a majority of research in entrepreneurial networking, in which cases the respondents figure scales or tick boxes as the ways of trying to gain a deep understanding of relationships, feelings and emotions (Anderson and Jack, 2002; Anderson et al., 2007; Macpherson et al., 2004). This is perhaps why more scholars called for critical reflections on inquiry paradigms and the increasing use of qualitative research into the networking phenomena of entrepreneurs/SMEs (Chell and Baines, 2000; Johannisson, 1995; Macpherson et al., 2005; Morrissey and Pittaway, 2006).

Ogbor (2000) held that the reasons why the majority of research is obsessed with quantitative data is perhaps due to those attempts of remain consistent with the dominant ideology. Ogbor (2000) further pointed out that positivistic methodology with its intensive supply of quantitative data is inadequate in understanding the phenomenon of the entrepreneurship domain. Hypothetical questions developed correspond to the scholars' ideals and the responses brought out from respondents are there to fit the scholars' own ideals (Astley, 1984). We can see that scholars have realized that positivism underlying the

quantitative approach is not appropriate for the understanding of social phenomena, particularly the understanding of the individual behaviour of entrepreneurs who carry the embeddedness of their living environment while undertaking roles of individuals as well as being within the organizations in their entrepreneurial activities. Schumpeter (1947) held that entrepreneurs are not impersonal non-historical entities; any phenomenon related to entrepreneurship is embedded in a web of historical, social and economic forces, and that should be best investigated through the collection of qualitative data in order that we understand the dynamics and the manifestation of entrepreneurship.

The recognition of the inappropriateness of using quantitative methodology is found in those studies of supplier-customer network relationships, as highlighted in Chapter Three. Those quantitative studies have identified trust/or a facet of trust as an important element in the relationship processes (Morris et al., 2006). However, none of the studies provides insights into the richness of the concept, a multi-dimensional trust, the nature of trust and trust as a process in collaborative network relationships. Scholars (Johannisson, 1995; Macpherson et al., 2004) argued that there is a problem in using research methods to examine the essence of supplier-customer network relationships and their association with other aspects. Those studies, related to the relationships and product innovation are mainly focused on organizational attributes, factorial and functional aspects of the network relationships. More specifically, scholars encouraged more interpretative research in studying the networking process and as such providing the dynamics of the key concept and interplay between the components. In other words, there are perceived desires to gain more insights into the "how" and "why" rather than the "what" and "why" of the network interactions and socio-economic outcomes.

Moreover, a review of virtual interaction literature brings about a major concern over the methods that have been used in those studies investigating the impact of virtual interactions on trust. Various studies are from different disciplines. However the focus of those studies is discrete in terms of the modes of virtual interaction, their interpretations of trust vary and some of them are blurred. The interactions investigated are in different contexts from this study. Nevertheless,

some studies (Iacono and Weisband, 1997; Jarvenpaa and Leidner, 1998) are found to share a commonality of employing research methods, that is, the use of experimental settings (e.g. the studies set limited time and arranged a pre-set environment for investigating research objects – interactions between respondents; in addition, the respondents were mainly students). It is argued that those experimental methods disregard an ontological belief that virtual interactions are fundamentally a human behaviour, and of social science (Lee, 1994; Lee and Jones, 2008). As such, those studies separated the inter-connection of the individuals involved, their relationships and the behavioural context relating to the phenomena. And none of them has examined the impact of virtual interactions on the process of a multi-dimensional trust building and development in a context that is set by this study. This study focuses on investigating the process of networking in the collaboration for incremental innovation in supplier-customer networks, and identifying the role of virtual interactions in the process; it aims to deal with “how” and “why” questions. These questions can be, for example, how entrepreneurs conduct virtual network interactions in their establishment of trust in a new supplier-customer relationship for incremental innovation, why some attributes are crucial and others not when they use a virtual mode in the networking processes; how trust building and development and cultural experience affect their ways of conducting virtual interactions in different relationship stages? This study argues that the employment of a phenomenological approach within interpretative research is appropriate for gathering, analyzing the lived experience of entrepreneurs and provides answers to the “how and why” questions. Before discussing the research design and methodology, the following section will revisit and clarify the research objectives.

5.3 Clarification of the Research Objectives

The research objectives are clarified by focusing on addressing more specific research questions (Patton, 2002, p.104). This entails a study and review of the general research areas of the existing literature. The focus of the phenomenological methodological approach is the question of “what is the structure and essence of lived experience of the phenomena?” (*ibid.* p.104) The literature has suggested investigating an appropriate conceptual structure of the phenomena of innovation since it indicates the key components and their inter-connections. This approach yielded a clue that is helpful for an exploration of the initial research questions. The knowledge of the structure and essence of the phenomena gained from the literature review allows for the emergence of more focused and revised research questions. As the literature shows that collaborative incremental innovation is characterized as social actions, the process actually involves the entrepreneurs building and developing network relationships. In addition, there are indications that trust is a key element/or essence; however, the literature is not clear on how trust is built and developed in the processes of the relationships in generating incremental innovation, and how virtual interactions are related to trust in such a context, as highlighted in Chapter Two, Three and Four. Hence, the research questions can be further specified as:

- What are the key components of network interactions in the process of collaboration for generating incremental innovation in supplier-customer networks?
- How do they relate to the process of trust and virtual interactions?
- How are virtual network interactions and the process of trust related, and how is this manifested through entrepreneurs’ narratives of their experiences of collaboration for incremental innovation generation?
- How can we understand and what can we learn from entrepreneurs’ narratives?

These questions are dealt with by collecting subjective experience from a number of entrepreneurs on how they engage in the interactions in collaborative incremental innovation in customer networks. These subjective experiences form a basis for the analysis, as noted by Patton (2002), the analytical interpretation of the phenomena is grounded in these subjective, lived experiences of entrepreneurs. A summary of the characteristics of this study is shown below:

- The questions of understanding human behaviour/action
- The focus on process
- The investigation of lived experience occurring naturally in reality
- The pursuit of understanding of social phenomena in the life world (the context)
- The notion that there are complexities and dynamics within the phenomena

Each of these points has already been shown as central to this study. It is important to note that according to Wilson (2002, p.7), the methodological focus on the individuals' experience means that this study cannot provide a universal judgement on the ontological status of virtual networking in the general population. Rather, the purpose is to examine how two perspectives, virtual networking as existing and created interactions resonate with the lived experience of incremental innovation among a group of entrepreneurs. The ideas of research design and methods that are used to pick up the knowledge will be discussed in the next section.

5.4 Research Design and Methods

While this study will be shaped by the results, it is realistic to be aware that there are some practical issues, for example time required and other uncertain probabilities that may hinder the research practice. In addition, human desire to understand the world increasingly is an ongoing pursuit; thus, any single research may be arguably deemed as a limited design against the desire (Anderson, 1995). Any chosen method has its drawbacks and various methods

may be available in an attempt to obtain wide and well-balanced data (Chisnall, 2005, p.40). The lived experience, suggested by the phenomenological approach is a form of data/or material; it is one of the sources for gaining an understanding of the phenomena (Van Manen, 1990, p.62). It can be exemplified that in order to capture more fish, a fisherman generally casts a net as wide as possible in a chosen area. Similarly, in the phenomenological approach, the concept of "experience" is broad in the sense that it can include textual and structural descriptions. They are regarded as "lived experience" and research data (Moustakas, 1994). Hence, this study endeavours to capture any lived experience which can be beneficial to the data collection and allow for an interpretation of the phenomena. The literature review assists us to sharpen our inspection and interpretation of the data (Anderson, 1995), thus the broader an eclectic net is spread by a fisherman, possibly the more insightful scene the phenomenological approach may provide.

The phenomenological approach to interpretative study does not possess its own set of methods; rather it embraces the methods of interpretative study which should meet the requirement and objectives of a particular research (Patton, 2002, p.125). Patton (2002) noted, in general qualitative methods include in-depth interviews, participant observation and using documents (*ibid.* p.4). The choice and justification of research methods for collecting the knowledge of networking processes and virtual interactions will be presented in the following sections.

5.4.1 Desk Research

The desk research mainly includes an exploration and review of the literature. This is shown in Chapter Two, Three and Four. In addition, manual and informal sources are also included such as a follow-up search of those references cited by research papers and books relevant to the topic, contacts with the experts on the topic and conversations with other professionals (Moustakas, 1994, p.112). Formal sources such as documents of government agencies, newspapers, and some information published on the Internet, relevant corporate websites and

documents provided by the enterprises that are useful to the research are also used as supplementary data. The next section will focus on discussing the choice of the last two methods for collecting empirical data.

5.4.2 A Preliminary Study

Concerning the research object of this study - entrepreneurial networking in the innovation practices - one of the elements is innovation. Due to the way that innovation is defined in this study (in Chapter Two), the lived experiences of product innovation must be of those with whom new products have been produced and commercialized in the markets. The entrepreneurs would not know whether a new product could be defined as an innovation until its market success. Therefore an experience of an innovation is a past thing. An experience cannot be recognized as the experience of innovation when an entrepreneur is not certain if that experience can become that of innovation. Hence, it became clear that direct participant observation was not considered as the main method for collecting the innovation experience within which entrepreneurial networking occurred. Instead, in-depth interview was chosen as the main research method for this study (a discussion of in-depth interview is in section 5.4.3).

However, although the main data collection method was interview, a basic understanding of the processes of networking practices seemed called for. Thus, a preliminary study was designed. In this way the preliminary study provided a means of understanding the literature and how the networking operated in practice, so the researcher could make much more of it. This preliminary study would allow the researcher to prepare for the interview processes. Participant observation was considered as a method for carrying out the study (The value and problems of participant observation are in Appendix Two). Sampling and gaining access to participant observation will be discussed in the next section.

5.4.2.1 Sampling

Purposive sample was selected based on what was thought as relevant to the research inquiry (Mason, 2002, p.134) and we could learn from entrepreneurs' experiences of network interactions. Thus purposive sampling method was used for both research methods - the preliminary study by participant observation and the main data collection by the interviews, in that the respondents were selected from those who had the relevant lived experience which served for the particular purpose of understanding the entrepreneurial networking processes (Liamputtong and Ezzy, 2005, p.47).

Due to the limitations of the participant observation method, whether it was achievable would be dependent on the access to the firms. Therefore, a basic rule for selecting the enterprises was, to best reflect the research interests and on a voluntary basis. A strategy of combining the sampling process for interviews and for participant observations was adopted. The idea was to arrange and negotiate possible participant observation within the sample of the interviews and prior to the interview processes.

The sample was considered initially to be selected based on feasible access. However, the intention was to explore the patterns and trends in networking in incremental innovation in the biotechnology sector in Scotland, and thus it was decided to investigate the respondents in more than one city instead of an "easy" access basis. It was decided to choose Aberdeen and Dundee to represent the context of Scottish biotechnology sector. Aberdeen has a strong economy; it has been ranked as the UK's most competitive city after London and it is one of the Europe's most enterprising regions to possess a culture of innovation¹⁷. Dundee is well-known for its leading position in biotechnology; it possesses one of the most important biotechnology parks and has a strong entrepreneurial culture in the UK¹⁸. Those biotechnology SMEs in these two cities have reputations for

¹⁷ Projects in Aberdeen City and Shire (2009), <http://www.scottish-enterprise.com/aberdeen-shire-projects>, last accessed 2nd September 2009

¹⁸ Biotechnology Clusters: Dundee Medipark (2009), <http://www.dundee.ac.uk/planning/resources/schools/medpk.pdf>, last accessed 3rd September 2009

generating bio-science product innovations, and they are known as one of world-class biomedical bases¹⁹. The award-winning firms continuously made the biotechnology industry in Scotland at forefront in the UK in general, for example, among those, three firms were located in Aberdeen and Dundee, Aberdeen-based Remedios was the Best New Biotechnology Company in 2000²⁰.

With the support of Scottish Enterprise Grampian, a directory of biotechnology firms in Aberdeen and Dundee was obtained in February 2005. The list was updated and with various biotechnology firms ranging from bio-pharmacy product manufacturing and trade, biotechnology manufacturing and trade, biotechnology product and trade and biotech-instrument supplying to consultancy firms. Since the focus of this study was product innovation, criterion sampling was used to select those firms that had produced biotechnology products and which would provide detailed and rich data relevant to the research problem (Liamputtong and Ezzy, 2005, p.47).

In total 14 firms that met the criteria were selected. In fact, all of them fit in the criteria of small and medium-sized enterprises as indicated by the corporate information. Each firm was approached by a postal letter in early March 2005, indicating the purpose of contact, the aim of the research, and potential participant observation and interviews would be scheduled. The letter also indicated that further phone calls would follow to arrange participant observation and interview schedules where possible. The sample of the letters for arranging the preliminary study and interviews is shown in Appendix One. Two firms declined to participate in the research and 12 out of the 14 biotechnology firms which had been contacted by phone calls responded proactively and agreed to be interviewed.

For the preliminary study, the researcher expressed the intention to carrying out a 7-day participant observation in the enterprises in the phone calls with the first

¹⁹ Leading the world Biotechnology (2002), http://www.scotland.org/about/innovation-and-creativity/features/business/b_Biotech.html, last accessed 6th October 2008

Leading the world Biotechnology (2002), http://www.scotland.org/about/innovation-and-creativity/features/business/b_Biotech.html, last accessed 6th October 2008

few firms contacted. Access was negotiated by providing assistance in the daily business running, for example, secretarial work for free. Among the 12 firms, an entrepreneur who was the owner of a small firm (with 25 employees) showed an interest in offering an opportunity for carrying out participant observations. It turned out later that the offer was made as a result of the entrepreneur's positive learning experience from another researcher in the same institution in the past. Thanks to the previous colleague. Because this bioscience entrepreneur was approachable, the researcher then decided to undertake participant observations within this biotech firm. This served as a tool to understand the networking processes and as a preliminary study for the interview processes.

5.4.2.2 Conducting the Preliminary Study

Participant observation bears the iterative characteristic of qualitative research. The methods of carrying out participant observation include the researcher being a participant, a participant-observer or observer within a range of styles in this method (Mason, 2002, p.91). As the names imply, the observation requires a different degree of involvement in the practice. The choice of these roles on the continuum would depend on the research object. Quite often the researcher shifts from one role to another, which is also dependent on the progress of the research and negotiated access. The method of participant observation in the pilot study would follow a rule, in that the researcher shifted backward and forward between the different roles in the changed situations and collected the data as much as possible.

Eventually, participant observation with 7 days' duration at the site of the firm was arranged. The firm was established in 1985, it had 3 staff at the time of establishment. It had grown over time with 25 employees at the time when this study took place. The firm had product innovation throughout its life time, in total 240 new products had been developed and there were several in progress. The researcher was introduced as a participant researcher to the management team as well as to the rest of staff working in the office, R&D, marketing, manufacturing and finance departments by the entrepreneur. This involved a

process of getting to know each other. The researcher was actively involved in tasks at the firm; for example, printing some documents, packing the leaflets and purchasing office stationery with one of the staff. She also had meals together with the staff at lunch time and had conversations on social topics. After two days, she became familiar and built trust with the entrepreneur, department managers and the office staff. The process smoothed participant observations. Based on the knowledge and skills in management and marketing areas, she then became engaged in business activities every day, such as providing opinions on the design of the corporate website for launching a new product and the design of a new product packaging.

The researcher observed that staff's offices were next doors to each other, the manufacturing premises were located within 10 miles from the office site, and staff of different departments had easy access to each other which provided a base for efficient communication between departments. The working environment had a friendly atmosphere, everyone greeted each other when they met the first time in a day and said "hello" to each other during the day. There were three clerks responsible for general office work. Although the basic job responsibilities had been allocated, yet they had flexible working manner in that they often helped each other with the type of work that had not been officially allocated by the entrepreneur. For example, a clerk who was not responsible for packing the printed leaflets always helped the other two to do so. The office staff often communicated and coordinated with each other during the working hours. Some of them had lunches together and chatted about family events or kids' activities. The relationships between the employees were informal and involving inter-personal friendships.

The owner-managers took multiple roles in their business. For example, whilst being one of the bio-scientists and responsible for R&D development, the entrepreneur was also the key decision maker in the areas of management, manufacturing, marketing, human resource and finance. The management style was informal; the entrepreneur and chief managers were easily accessed between themselves and by the employees for discussing work issues on a daily basis. There was no bureaucracy in the management team, the owner-managers

listened and responded to the emerging problems. The entrepreneur held weekly meetings with marketing representatives, listening to the reports and feedback from the customers. The entrepreneur intimated that a majority of the staff had visited his home as guests and known his family. They also had social conversations such as families, friends and weekends' events during lunch time or other informal occasions.

The researcher was invited to attend a business discussion meeting between the firm and one of the new customers in relation to new product development. The customer was a Chinese firm and referred by an existing supplier who acted as an intermediary. The entrepreneur intimated that the discussion meeting was the second time that he had met the owner of the buying firm, the first meeting being in Shanghai, China when he had gone there a few months ago. There were two chief managers, one of management and another of R&D department whom presented with the entrepreneur, and the manager who acted as the intermediary presented with the client together at the meeting. On the client's arrival, both sides greeted each other by shaking hands with smiles and an exchange of business cards. They were engaged in social conversation such as how the client's trip was, how the weather was for about 10 minutes. During the meeting, tea and coffee were served. After the "warm-up" dialogue, both sides were relaxed with each other. Then they were engaged in technical discussions and presentations related to the potential new products. The R&D manager presented technical details of the potential new products, including how the products were developed originally by the firm, the ingredients, functions, advantages and disadvantages of the products, and the perceived changes to be made in order to meet the customer's requirement. He wrote bullet points and drew diagrams on the presentation board in front of everybody. The client asked some questions, highlighted and confirmed the changes that needed to be made during the discussions. Everybody used gestures and body language to assist the demonstrations and discussions, for example, nodding their heads to show the consensus. There were immediate responses and smooth technical information flow, the boundary spanning individuals understood the technical details through those interactions. The content of the meeting was mainly related to the understanding of the client's requests and making sure the changes to be made

were perceived appropriately, the issues on what and how the entrepreneurs were going to do to achieve these objectives technically.

Following the technical discussion meeting, the entrepreneur invited the client to visit the office and manufacturing premises and the surroundings, while they were walking around the entrepreneur introduced a brief history of the local town and the local culture and customs and his own career, vice versa, both sides listened, and exhibited great interest in each others' anecdotes and stories. The client showed understanding of the firm as the conversations evolved and got closer with the entrepreneur as the information sharing was increasing.

Through these interactions, a harmonious atmosphere was generated. The entrepreneur invited the client for a home visit, as it was within walking distance to the office site. The entrepreneur showed him around such as some paintings and other decorations and the garden, told stories of how his family settled there, and offered tea as part of the hospitality. The client enjoyed the social interactions. He, in turn, invited the entrepreneur and his chief managers to visit his home and go for other social events (e.g. going fishing) next time when they went to see him. In addition to the home visit, the entrepreneur also arranged a dinner in a local restaurant the next day as part of the social events. By that time, boundary spanning individuals were more relaxed with each other, intimacy was generated and inter-personal friendships were developed. During the dinner, the client had wine and a fish dish with local flavour and he enjoyed the taste. They talked about different food cultures and past experiences of Chinese cuisine. The client also invited the entrepreneur for meals in the restaurants in Shanghai, China. Apart from social topics, they also talked about the markets and competitors' products in China which were related to the potential sales of the new products.

During these meetings the researcher acted as a participant observer however without distracting their activities. She interacted with the staff from both sides where necessary, observed the facial expressions, body language, tone of speaking which reflected their networking behaviour and attitude in different circumstances in the collaboration relationship. Field notes were taken during the

participant observations at the office or were taken after business and social events.

During the period of participant observation, the researcher was also given permission to access those emails, exchanged between the entrepreneur and one of the customers located in another country. The emails were exchanged from the outset of a collaborative relationship till a stage when the contract was signed; the duration was about over a-year-and-half by the time of the study. The researcher read those emails several times. She found that in general virtual interactions by email were sent and replied within 2-3 days. They were brief and straightforward to the issues on work-related matters. Although there were social related topics exchanged, for example, the entrepreneur gave the reason of his non-immediate reply to an email a few days after it was sent, being that he went to visit one of his family members in Canada for a couple of days, this was expressed by two sentences in electronic text format. In the replying email, the client did not backup the social topics although other business issues were addressed. It appeared that email acted as a tool for delivering information. There were very limited exchanges on social topics in terms of the detail and depth. The content was mostly related to technical information and limited discussions, the information on the products and business in general. The researcher acted as an observer and took notes in this part of the observation.

Through the process of this preliminary study, the researcher was able to immerse herself in the networking environment and to seize what happened in the networking processes by collecting anecdotes. The outcomes of participant observations include: (1) the researcher obtained practical experience on how a small biotech firm runs on daily basis. The informal management style and flexibilities characterized the small firm as having advantages in the process of developing new products. The easy access and harmonious inter-personal relationships among employees throughout the firm provided efficiency for coordination, obtaining fast feedback, problem solving and decision making, which were beneficial to the processes of product innovation generation; (2) it was identified that networks were important to product innovation generation. The existing supplier played an important role as referral for establishing the

contact in the new collaborative relationship. The development of the new customer-network not only brought the opportunities for new product development, but also new markets and networks; (3) it was realized that entrepreneurial networking was important to the bio-science entrepreneurs. The networking was integrated into the business activities of the product innovation practices. The entrepreneur used social networking as a lubricant to smooth the interactions with business purposes such as technical discussions and demonstrations. Through social networking inter-personal friendships were developed between the entrepreneurs and the client, which was as a result of inter-personal information flow, joint social activities and shared experiences; (4) virtual interactions by email were likely to have the advantages of facilitating technical information flow, providing speed of information exchanges across geographical distances. However, they appeared to have limited capability of providing a high level of interactivity for interactions, and of conveying emotions between the individuals, and therefore have limited capability for supporting social network interactions and those business interactions which involved a high level of knowledge tacitness exchanges in product innovation practices. Participant observation helped the researcher to prompt questions where necessary during the interview processes. For example, if the respondents reported that they had technical discussions, the researcher might further explore "What else did you do during the technical discussions?"

Whilst participant observation was very useful for grasping the processes involved, it took too long to acquire data. The outcomes of the preliminary study have fulfilled the expectations which were set at the outset. Hence, the researcher did not expand the sample size to include more firms. By the time that participant observation ended, the entrepreneurs, chief managers and some staff became familiar with the researcher. She informed the entrepreneur and chief managers in a friendly manner that there would be following in-depth interviews soon after the preliminary study. The next section will address the method of interviews and the processes.

5.4.3 In-depth Interviews

The understanding of the networking processes, which are characterized by a great complexity, should be formed in the context of holistic experiences (Moustakas, 1994; Patton, 2002; Van Manen, 1990). According to Anderson et al. (2007), by means of having a conversation of a good hour or more in-depth interview facilitates the research questions in depth and detail, which can reveal the complexity and interactive nature of innovation processes. Such advantages of in-depth interview in providing the richness of the processes are not achievable by quantification. Such method enables the researcher not only to explore the key areas of investigation, namely the categories and essence of network interactions, but also to gain a picture of how they are related to virtual interactions, the impact of virtual interactions and the outcomes of the interplay on trust in the processes. Liamputtong and Ezzy (2005) noted that the in-depth interview also lets the respondents reflect their lived experiences, share those experiences and make sense of their lives (*ibid.* p.55). Through such a process by which the respondents disclose their lived experiences and give meaning to those experiences, the researcher is able to obtain a deep understanding of the phenomena experienced. Thus, in-depth interviewing is, in fact, seen as a privilege to both respondent and researcher (Anderson, 1995, p.215). Thus, for this study it was planned to collect the lived experience of entrepreneurial networking through in-depth interview with those entrepreneurs who experienced collaborative incremental innovation in their SMEs. More detail of in-depth interview will be discussed in section 5.4.3.3.

5.4.3.1 Sampling

The details of sampling criteria and the processes have been highlighted in section 5.4.2.2. For the source of the sample, there was an attempt to expand the selection of the sample to the Edinburgh region, where the centre of Innovation Excellence was and a major capital city for the world-class

biotechnology SMEs²¹. However, this attempt was not pursued since it appeared at the final stage that the concepts emerging from the interviews had become theoretically saturated (Glaser and Strauss, 1967; Liamputtong and Ezzy, 2005). Scholars (Glaser and Strauss, 1967; Taylor, 1984) suggested that the researcher can leave the field when the data reaches theoretical saturation. Theoretical saturation refers to "a point in fieldwork when the data become repetitive and no major insights are gained." (Taylor, 1984, p.67) It means that further data gathering and analysis will add little new to the conceptualization, although variations may be discovered (Corbin and Strauss, 2008).

5.4.3.2 Interviewing Respondents

Patton (2002) suggested using a general interview guide as a way to approach respondents before interviews were undertaken; the guide helps make the interviewee be informed, as such the researcher effectively uses the limited time available in the interviews (*ibid.* p.342). As highlighted in section 5.4.2.2, there were 12 firms who agreed to be interviewed. Prior to the interviews a two-section interview guide was posted to 11 firms, except the one which had the preliminary study who was given during the studying period. The questions in the first section were designed to gather general information about the entrepreneurs and business information about the firms, for example, date of establishment, number of employees.

The respondents were asked to fill in the first section and to return the questionnaires at the time of the interviews. In addition, the aim of a phenomenological approach is to collect the lived experiences and to focus on respondents' reflections on the experiences. Such reflections include the respondents' interpretation of those experiences and recall of the memories about their relationship processes with customers. Thus it was decided to indicate the topic areas to be covered in the second-section of the interview guide.

²¹ Life Science in Edinburgh and Lothians (2007), http://www.talentscotland.com/view_item.aspx?item_id=46778, last accessed 3rd September 2009

It turned out that among the 12 firms that agreed to be interviewed, one owner-manager was unavailable for the scheduled and re-scheduled interview arrangements, and he eventually decided to withdraw from this study. Given a total of 11 participating SMEs, 11 owner-managers were interviewed, and additional interviews with 6 chief managers who took the role of interacting with customers in different firms were also undertaken. The interviews were completed in a 4-month period between April and August in 2005.

Since this study is concerned with dyadic network interactions between entrepreneurs and customers, according to Johannessen and Dolva (1995), those managers who were boundary spanning personnel were suggested as targets for the interviews. In general the owners/or managers of the SMEs took multiple roles in their firms; they were generally the ones with boundary spanning roles (Larson and Starr, 1993) and were the potential respondents. Furthermore, additional interviews were also held with those chief managers who were also boundary spanning personnel.

In total, 17 in-depth interviews with 11 biotech SMEs were recorded. However, one interview of a small medical firm was discarded since it became clear at the end of the interview that no product innovations occurred in the firm. The firm was set up by, and acted as a medical service provider for a local hospital; the changes related to the products were mostly on packages. It was then decided to omit this interview from the sample. Thus a total of 16 in-depth interviews with 10 biotech SMEs were finalized for the data analysis. A summary of the respondents' enterprises with information in respect of firm size, age, number of employees and number of product innovations since their establishment is shown in Table 5.1.

Table 5.1 A Summary of Biotechnology SMEs in the Sample

Firm	Year established	Business	No. of Employees	Number of Product Innovations
BIT	1985	Biotech manufacturing, service & Trade	25	240 & several in progress
CMBL	1985	Biotech product & Trade	38	No accurate info. & 3/or 4 in progress
Cyp	1989	Biotech manufacturing, service & Trade	7	50 & several in progress
Cly	1996	Biotech manufacturing, service & Trade	63	90 & several in progress
Rmd	1999	Biotech manufacturing, service & Trade	8	2 & several in progress
Alb	2000	Biotech manufacturing, service & Trade	5	2 & 2 in progress
CR	December, 2001	Biotech product & Trade	30	2 & several in progress
KinS	June, 2002	Biotech product, service & Trade	2	40 & several in progress
Hptg	June, 2002	Bio-pharmacy product manufacturing & Trade	20	12 & 3 in progress
PK	May, 2002	Biotech manufacturing, service & Trade	5	1 & 7 in progress

All of the enterprises in the sample have been established for 3 years or over. Apart from one medium-sized, the rest were small-sized enterprises at the time of the interviews. All of them have had product innovation experiences and have been engaged in innovation practices since the establishment of the enterprises. One enterprise was lacking an accurate number of product innovations. The respondent emphasized that it was because that they had developed too many new products with incremental changes. More detail of incremental innovation will be reported and discussed in the next chapter.

Following the schedules set in advance, individual in-person interviews were conducted with owner-managers at the firms' premises except two held in the university's guest room with a provision of refreshment and drinks. The interviews started with a social conversation and brief introduction of the researcher, aiming at creating a relaxed and trusting atmosphere (Moustakas, 1994, p.114). Confidentiality and anonymity were offered by the researcher to encourage open and honest responses (Hussey and Hussey, 1997, p.38). In the interviews, as will be shown in the analysis, respondents not only stated their lived experiences on the topic areas, but also referred to their personal career histories and networks. The interviews lasted between one to two hours. Every


interview was digitally voice recorded. Robson (2002) noted that audio-taping is a common method of recording conversation, and recording interviews can free the researcher from taking notes and rather focus on the interviews; the digital material is a permanent record (*ibid.* p.290). A few key word notes were taken for tracking what had been said by some respondents; the purposes were to formulate the new questions or to elaborate on specific points based on the stories told, and to facilitate analysis by locating important quotations (Patton, 2002, p.383). Yet, in most cases the researcher concentrated on paying attention to the respondents through eye contact, responding to the changes on facial expression, voice and body language. Right after the interviews when the memories were still fresh, the researcher took notes for tracking the important recalls which would aid transcription and analysis. The transcript was produced shortly after the researcher returned from each interview.

5.4.3.3 Style of the Interviews

Liamputtong and Ezzy (2005, p.56) pointed out that scholars used various terms to describe in-depth interviews, such as focused interviews, unstructured interviews, non-directive interviews, open-ended interviews and semi-structured interviews. They argued that these terms basically mean the same method however with some differences in their emphasis. This study uses "different styles" to describe these differences. Liamputtong and Ezzy suggested that "focused interview"/or "in-depth interview" is an appropriate term to describe the interviews in an interpretative study. Indeed, interview as a method can also be used in quantitative studies. However, the style in a qualitative study is different from that used in a quantitative study, it needs be clear that the "style" of interview used is appropriate for this study.

Some scholars suggested that there is a continuum of different styles of interview with structured interview at one end and unstructured interview at the other, and in-depth interview is a part of that continuum (Hussey and Hussey, 1997; Liamputtong and Ezzy, 2005; Patton, 2002), as shown in Figure 5.1.

Figure 5.1 Interview Styles



Structured interview	Semi-structured interview	In-depth interview/or focused interview	Unstructured interview
The fixed, closed questions. The questions have been prepared beforehand. Forced responses of survey interview	Exact wording and sequence of questions are determined in advance. Asking questions in the same way every time of different interviewees	Conversations with topics under discussion	The open-ended and exploratory interview with no fixed interview schedule

Adapted from (Hussey and Hussey, 1997; Liamputtong and Ezzy, 2005; Patton, 2002)

Liamputtong and Ezzy (2005) suggested that structured and semi-structured interviews are not appropriate for interpretative study through the phenomenological approach, rather they are generally used in quantitative research (*ibid.* p.56). They described both methods as behavioural rather than interpretative event because of their ways of handling the interviewing process. Both structured and semi-structured interviews emphasize asking the questions in the same way every time, since it is assumed that a consistent behaviour is needed in order to generate reliable responses. This way of dealing with the interviewing process is related to the need to serve the research objectives of quantitative research, which are different from those of qualitative research. According to Mason (2002, p.66), quantitative research seeks for patterns and regularities based on the emergence of fixed words in the responses, while qualitative research, although it may also look for patterns, however the difference lies in the meaning of "pattern". Quantitative research will follow a set of highly constructed and precise questions, whereas patterns in the phenomenological approach in qualitative research will emerge as a result of a researcher's interpretation of lived experiences, collected through qualitative methods and characterized by flexibility.

In qualitative research, the respondents are viewed as co-producers of the data. The relationship between the researcher and the respondents is taken into account and regarded to be as important as the content and structure of

questioning (Anderson and Jack, 2002). As a method, qualitative interviewing treats the interview as an interactive process. Instead of being passive and distanced from the respondents, the researcher encourages them to talk about the research issues under discussion (Liamputtong and Ezzy, 2005, p.56). The qualitative interview is seen and undertaken as an opportunity to explore the subjective meanings that positivists attempts to strip off. It is true that the researcher consciously and intentionally provokes responses by indicating or even suggesting narrative positions, resources and orientation in qualitative interviewing, because the respondents may not understand the abstract meaning of some questions and give unsure answers. Hence, qualitative interviewing has flexibility allowing the researcher to provoke the respondents' answers as to what is the lived experience for a particular research interest.

According to Liamputtong and Ezzy (2005), most qualitative research is both inductive and deductive and this is reflected on the interviewing method (*ibid.* p.57). Qualitative interviewing is like a conversation with focus on the areas which a study is investigating. On the one hand, to some extent it allows for freedom, in that the respondents talk about their experiences in their own contexts and situations, and these stories are not known prior to the research. It employs the assumptions of grounded theory that aim to shape the understanding of general patterns and important issues via the processes of interviewing. However, on the other hand it is not a completely free conversation, rather with focused topic areas. This study thus employed the manner of qualitative interviewing, that is, in-depth interviewing by conversations on the focused topics. Table 5.2 lists the topic areas for discussion in the interviews.

Table 5.2 Topic Areas for Discussion

Topic areas	Intention for the exploration
Could you please talk about product innovations since the establishment of the enterprise? Which external party is the most important one that facilitates new idea generation?	Is product innovation important, what type of product innovation did they have. Explore incremental innovations and their generation.
Could you please talk about the networking process with customer-network for collaboration of incremental innovation?	Narratives, anecdotes and stories relating to supplier-customer network interactions.
How did you use face-to-face and non face-to-face electronic interactions?	How virtual interactions were used in the process, satisfactory and unsatisfactory experiences.

In order to minimize the researcher's influence and to avoid leading questions, the researcher acted as a quiet listener being close to the respondents, however with reflections in mind concerning the role of investigating (Moustakas, 1994, p.114) during the interviews rather than a completely "close friend". As such, the researcher was able to be alert for any interesting theme emerging and took notes which facilitated the analysis right after the interviews. Whilst listening, the researcher also further explored some stories in more detail where it was perceived necessary. For example, a few respondents talked about the presentations of scientific papers in the conferences, and when one or two of them appeared to put a "full stop" on this episode, the researcher probed: "what else did you do in the conference?" This question produced surprising results, suggesting the theme that had not yet been covered but the respondents thought them as being important in their networking processes in the context. The ways of probing and provoking the additional questions were discussed with the supervisors in advance and benefitted from the researcher's experience in the pilot study; the aim was to minimize possible bias and influences on the responses collected.

5.5 Data Analysis

The analysis of a phenomenological investigation is not an isolated stage that could be disconnected from the process of collecting lived experience. Van Manen

(1990, p.35) and Moustakas (1994, p.85) suggested that the phenomenological analysis of an interpretative study starts during or before the stage of collecting lived experience from respondents. Table 5.3 shows a summary of the research techniques needed in conducting the analysis.

Table 5.3 Approaches to Phenomenological Analysis

Orienting to lived experience	Reflectively examining upon lived experience while “hanging up” presuppositions or pre-judgement of the lived experience of phenomena
Gathering lived experience as research material	Collecting lived-experiences of various forms, such as stories, written responses, daily accounts of events and reflecting upon them
Hermeneutic phenomenological reflecting	Identifying themes emerged from the text/or lived experience, describing and explaining the structural aspects of that experience
Writing, reflecting and rewriting	Producing text as descriptions to materialize themes and explanations to clarify their essence; and approaching the text again and again and linking the parts and whole to arrive at the essence of the phenomena experienced
Balancing the whole and parts	Considering the emphasis of a single section by linking it to the overall research design, and repeating this reflection on an ongoing basis in writing up process

Adapted from (Moustakas, 1994; Van Manen, 1990)

The process of analysis is an integrated process of thinking, reading, categorizing, organizing, writing, reflecting and re-writing. This was commenced from the interviewing stage while the researcher was collecting anecdotes, narratives and stories of lived experience, “bracketing out” any pre-supposition and concentrating on embracing the lived experience of the phenomena; looking for the key sentences that were identifiable and meaningful in indicating individual themes²²/or patterns. There could be many themes arising in a thesis so that a creative work is needed to incorporate them together through a search for meaningful connections between/or among them. These themes would then serve for a structural description, which provides a picture and explains the

²² Theme refers to an element which occurs frequently in the text (Van Manen, 1990, p.78). Other researchers of qualitative research also used code or category to represent the same thing (Mason, 2002, p.153).

processes and behaviour of the respondents who have experienced the phenomena (Van Manen, 1990).

The transcripts were read several times, the researcher then coded them. The phrases used to code the statements were descriptive. Thematic descriptions of lived experience in the phenomenological approach are inductive rather than deductive whereby theories emerge from the descriptions of the experience (Cope, 2005, p.171). Based on these descriptive codes and the understanding of meanings they represented, the researcher further examined the connections of these codes that had been considered initially. This coding process was conducted with the shifts between the parts and whole, and the indexed codes were then categorized to form a descriptive structure of the network interactions. Mason (2002) noted that the coding process also involves the decisions made on what can be counted as data according to the research perspective (*ibid.* p.150).

Then the researcher focused on these themes, which emerged and were coded by brief phrases to see how they were related to each other, attempting to put them into groups based on their meaningful connections. The grouping was conducted upon each interview and across the entire interview transcript. This grouping process involved reading and careful thinking about each individual detailed statement more than once to make sure a code given reflected the meaning of the statement in its context. According to those descriptive categories and possible connections between them, repeat conceptual reflections were exercised and so data analysis was progressed to the analytical stage.

Analytical categories were then grouped to form the key categories which illustrated the phenomena. Such a process of reading, thinking, re-thinking and reflecting enabled the parts of the phenomena to emerge from the data itself. The researcher was involved in a series of activities, which included developing an understanding, reflecting and writing; the iterative exercises themselves formed a creative production and interpretation process (Moran, 2000; Moustakas, 1994; Van Manen, 1990). Marson (2002, p.165) labelled such a process as cross-sectional and holistic data organization, in that the researcher organizes the data between the resultant data bags/or slices and the whole to

the resultant data bags/or slices and the whole again in circle, every time the progressive conceptual, analytical and theoretical thinking enables a deeper interpretation, till data bags/or slices become integrated as a whole in the context of the research design.

More detail of the ways in which analytical techniques are used in this study will be elaborated in the later section of this chapter. QSR Nvivo 2.0, a computer assisted software program for qualitative data analysis (CASQDA) has been used to assist the organization and analysis of data for this study. Before proceeding to the details, first of all, the next section will bring about a discussion and evaluation of the trustworthiness of the research.

5.6 Trustworthiness of the Research

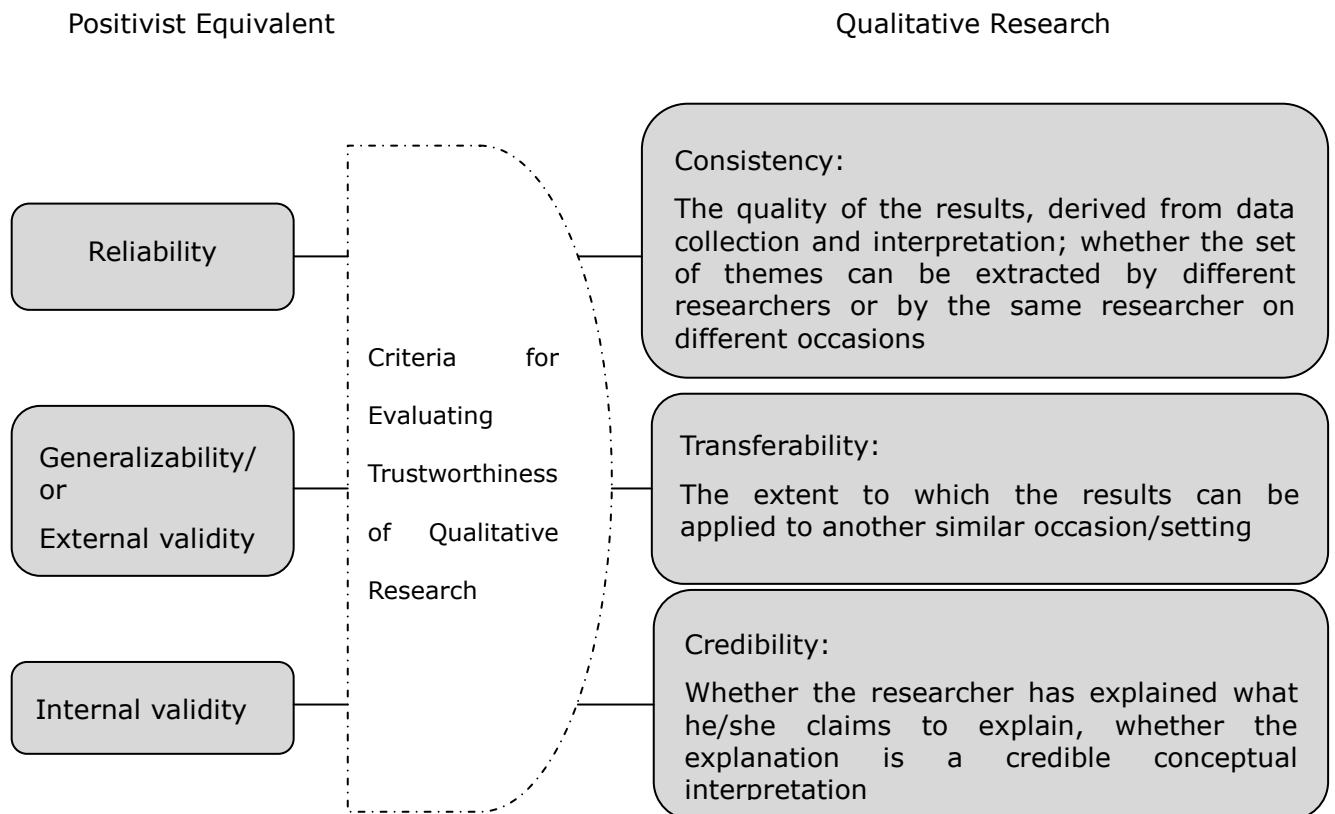
Scholars (e.g. Kirk and Miller, 1986) claimed to judge the quality of a research by its objectivity, in other words, reliability and validity of the components are common in positivist research (*ibid.* p.19). Positivist research locates at one end of the spectrum of research designs. In positivist research, the meaning of reliability is to generate replicability/or repeatability of the results and the ways the results are interpreted; this is achieved by a series of activities engaged in by a researcher, such as getting familiar with the concepts/or problems, developing hypotheses, collecting information in the form of numbers, analysing the result based on statistical data and reporting in statistical languages (Golafshani, 2003; Patton, 2002). On the contrary, the concepts of reliability and validity are not viewed as the accepted criteria for evaluating qualitative research; rather scholars used "trustworthiness" as the language for judging the quality of qualitative studies (Patton, 2002, p.51).

Qualitative research is subjective, reliability is impossible to achieve by generating the same results, through repeat processes conducted by different researchers. In qualitative research, reliability implies the extent of consistency whereby a set of themes can be extracted by different researchers or by the same researcher on different occasions (Seamon, 2000). Mason (2002)

emphasized that consistency, equivalent to the concept of reliability, is important in qualitative research since accuracy of the methods used and research practices are researchers' basic concerns as to whether a qualitative study is worthy of attention. This indicates the need to provide "a sort of account on how you go through the procedure and arrive at a set of conclusions" (Corbin and Strauss, 2008, p.302). Thus it is necessary that the researcher of a qualitative study ensures that the sample taken is reflective to the phenomena investigated, the fieldwork carried out is consistent with the research design, the analysis conducted is appropriate to the research questions, and it is thorough, careful, honest and accurate; any interpretation is based on the evidence (Mason, 2002, p.188).

Validity in quantitative research means that a research truly measures what it attempts to measure (Golafshani, 2003; Hussey and Hussey, 1997). There are two notions involved: external validity (generalizability) and internal validity. External validity refers to the extent to which the research results can be applied to cases/situations beyond those examined in the study, in other words, there is generalization of the results to a total population under investigation; internal validity is concerned with whether the research findings accurately represent what the research claims to investigate (Hussey and Hussey, 1997, p.58). In qualitative research, due to the purpose being to understand/or explain rather than measuring, scholars used transferability and credibility to denote the equivalent meaning of external validity and internal validity, as shown in Figure 5.2. Thus scholars set consistency, transferability and credibility as the criteria to evaluate the trustworthiness of a qualitative study (Golafshani, 2003; Mason, 2002).

Figure 5.2 Criteria for Evaluating Trustworthiness of Qualitative Research



Adapted from (Golafshani, 2003; Hussey and Hussey, 1997; Mason, 2002)

These components developed as the criteria for evaluating the quality of qualitative research are different from those of quantitative research. This study has highlighted transferability, in that the research outcomes may be applicable to another occasion/or setting through the use of purposive sampling. In addition, while the results of the study are context based however in terms of recognizing the essence of lived experiences, the research outcomes concerning the identification of trust, trust as a dynamic and complex process and the connected model which describes the networking processes should be useful for the understanding of networking processes between different groups of scientist-entrepreneurs and their customers, and in various situations and contexts. Moreover, the reveal of the interplay among virtual interactions, social capital, individual characteristics and the level of knowledge tacitness in the processes of network relationships should also be useful to the understanding of the factors

involved in networking processes in the collaboration for incremental innovation in supplier-customer networks in other high-tech sectors.

Consistency is managed by ensuring the quality of interviewing, being empathic to the respondents to generate true and open conversations in the interviews. In addition, an account which tracks the utilized functions of Nvivo 2.0 is created and displayed in Appendix Three in order to generate transparency and openness of the research. Data analysis is carried out by using reflection notes, memos and a fieldwork diary; repeat reading and reflecting on the transcripts are conducted to examine and to ensure the themes emerging are identical and evidence based (Golafshani, 2003, p.601).

Finally, credibility is addressed through four techniques. Firstly, in relation to research design this study explored three layers of networking processes rather than just one or two. The intention was to generate three layers of data from each respondent and thus provide a richer, multi-layered and more credible data package (Fenton and Mazulewicz, 2008). Secondly, with regards to the method of data analysis, credibility is managed through repeat reflective reading, and constant comparisons made to the emerged themes between one part of data and another. The coding process in the later stage is simultaneously a testing process of the previous themes identified (Mason, 2002, p.188-189). Thirdly, triangulation of sources is used, such as enterprises' documents, corporate websites, and corporate reports and news in publications, to develop a complex picture of the phenomena being investigated. A recent trend of using computer assisted qualitative data analysis (CAQDA) indicates an increasing recognition of the advantages of computer programs (Corbin and Strauss, 2008). Whilst providing advantages, computer programs seem to have limitations on what they can do for qualitative studies and all of this is relevant to the analytical process and trustworthiness of the research. The next section will go through these issues and illustrate how CAQDA assists the analytical process.

5.7 Computer Assisted Qualitative Data Analysis (CAQDA)

Although the use of computer software for qualitative data analysis is debated and completely rejected by some researchers, yet computer programs have been used by qualitative researchers in recent years and they seem to show their usefulness to aid data analysis because of the continuous improvement made to the software over time (Corbett et al., 2007; Corbin and Strauss, 2008; Hills et al., 2008; Howcroft et al., 2007; Kirkwood and Campbell-Hunt, 2007; Lee and Kelley, 2008; Marvel et al., 2007; Taylor, 1984; Turcan, 2008). Scholars (Corbin and Strauss, 2008; Liamputtong and Ezzy, 2005) noted that although an analytical computer software program may be helpful, yet the analytical process is a researcher-driven thinking and organizing process. After all, a computer program is a tool, it cannot do analytical work for researchers (Mason, 2002; Patton, 2002).

Nevertheless, computer programs help researchers manage those materials counted as different forms of qualitative data, for example they can categorize text, conduct coding, and keep track of codes and memos (Bhowmick, 2006; Corbin and Strauss, 2008; Liamputtong and Ezzy, 2005; Mason, 2002). Electronic codes are more flexible, easily cut, combined and divided (Corbett et al., 2007; Liamputtong and Ezzy, 2005; Turcan, 2008). The researcher is able to classify a large number of categories in the analytical process more efficiently. The ways of displaying codes in the system allow the researcher to move around the categories and set up hyperlinks between different types of data, for example, the links between the text coded and memos help the researcher think and identify inter-connections, and therefore link ideas between them (Bringer et al., 2006; Corbin and Strauss, 2008; Mason, 2002; Turcan, 2008). As such computer programs enhance a researcher's ability to sort, retrieve, search and manipulate data; they enhance the researcher's creative analysis since computer programs enable him/her to try one way and then another, and to think of alternative explanations (Bringer et al., 2006; Corbin and Strauss, 2008; Turcan, 2008).

However, Liamputtong and Ezzy (2005) noted that not all of qualitative research is suitable to use computer programs for the analysis. Mason (2002) expressed that coding text into stripes by computer programs distances the researcher from the data (*ibid.* p.153). Corbin and Strauss (2008) noted that the ways of using computer programs to obtain the benefits is dependent on how a researcher thinks and goes through the analytical process. Whether a particular aspect of computer programs is useful or not is dependent on the ontological and epistemological assumptions of the research design and that will affect the ways in which computer programs are used (Mason, 2002). Liamputtong and Ezzy (2005) held that there can be problems with "search" results in the computer programs if some researchers expect the programs to do the work of coding and analysis for them, in that coding by searching for particular words can miss out those similar expressions made by other words. For example, the issue of "the process of building up inter-personal friendships" may be expressed by "going out for a meal in restaurant", "how is your family?" or "how is the weather, how is your holiday". The codes will miss out these expressions if the "search" is set to look for the words "inter-personal friendships", the computer will not pick up these expressions that indicate a process of building inter-personal friendships. Thus, "search" function in computer programs may not be suitable for this type of analytical work. Qualitative researchers need to bear in mind that coding categories are consistent with ontological and epistemological assumptions of the research. Table 5.4 summarizes the advantages and disadvantages of computer programs aided qualitative data analysis. Because the focus of this study is to gain an in-depth understanding of networking processes in incremental innovation collaboration, the next section will address the characteristics of such data analysis which is related to "process" and "context".

Table 5.4 Advantages and Disadvantages of Computer Programs Assisted Qualitative Data Analysis

Advantages	Disadvantages
Effective categorize text and coding	Distance researcher is from the data
Keep track of codes, memos and easy access to codes, memos	Distracts from the focus of the analysis
Relationships between codes can be mapped	Dangers of falling into variables analysis
Enable search for text according to certain words, phrases	Search for text according to particular words may miss out similar expression by other words
Create "audit trail"	
Allow for transparency and openness	

Adapted from (Corbin and Strauss, 2008; Liamputtong and Ezzy, 2005; Mason, 2002)

5.7.1 Process and Context related Qualitative Data Analysis

As mentioned earlier, the matter of how to use computer programs is dependent on the ontological and epistemological assumptions of a research design and how a researcher thinks and conducts the analytical work. Corbin and Strauss (Corbin and Strauss, 2008) commented that the evolution of an analytical process also determines the ways a researcher analyzes and uses computer programs (Corbin and Strauss, 2008). Mason (2002) reminded researchers of qualitative research in their analysis concerning the instances in different processes, that if he/she intends to explore the relationships between these instances and the determinants of these instances, he/she needs to be aware of what to do with these categories in the analytical process. Mason pointed out that computer programs aid this process by means of helping researchers to pool some of the relevant data together in a bag/or category so that he/she can explore the connections further, rather than assisting him/her "to manipulate one category against the other as if they were dependent and independent variables" (*ibid.* p.157).

Mason (2002) further provided some suggestions on how to avoid conducting variables analysis, a mistake often made by qualitative researchers during the analytical process. He suggested several aspects to consider, they include: (1)

bearing in mind that the data that have been categorized into different categories should not be treated as static, concrete and isolated pieces of text, rather they are flexible and loose categories of "unfinished resources" which are set in a retrieval system (*ibid.* p.158). Referring to this point, Liamputtong and Ezzy (2005) explored a rule in the coding process, which is to include as many as possible of the texts related to the theme "processes" since they may be shown as interesting or useful for any new discoveries. However, Liamputtong and Ezzy reminded researchers that too many such codes may make data overwhelmed by too much information and result in researchers being inefficient in the analytical process. Hence, the researcher will need to decide what to include in the codes; (2) some texts may not be easily categorized into any category, because the descriptions of behaviour or emotion are always "unfinished resources" or they are just too complex or too specific to be grouped into one category. Mason (2002) exemplified the issue such as "reciprocity": the understanding of reciprocity may be obtained based on the interpretation of a "whole" story, rather than one or two particular quotations. The way that simply taking one or two pieces of text that is/are separated from the whole story may not lead to a comprehensive interpretation of the concept. Hence, the identification of a chunk of text that represents the meaning of an issue needs to be viewed and examined holistically; (3) the last issue is the context or inter-relations that produce the categories of data. The context or inter-relations of or within the narratives, anecdotes and stories will have effects on the understanding of small sections of data.

Having raised these issues Corbin and Strauss (2008) held that in general computer programs enable transparency and openness of the research process, since the researcher can retrace the analytical process and offer an "audit trail" during and at the end of data analysis. In this way, computer programs facilitate consistency (reliability) of a research. Realizing the merits of using computer programs (e.g. speeding up the coding and retrieval process), however, Mason (2002) pointed out that there is still a great deal of time-consuming work involved in the analytical process, such as creating, thinking, interpreting and linking categories. This is advocated by other scholars, for example, Patton (2002) highlighted that the analysis of qualitative data involves a lot of hard work, the process requires creativity and intelligence which produce unique qualitative

analysis. Such analytical work requires researchers to go through a professional training process in order to be able to carrying out any analytical work.

5.7.2 Analysis by using QSR Nvivo 2.0

The computer software Nvivo was selected for this study because it possesses most of the advantages highlighted in the previous sections. The advantages are summarized in Table 5.4. The researcher of this study has gone through intensive training sessions arranged by the institution before the data was collected. The researcher also practised using the software as soon as the data was collected in the early stage of fieldwork. This section will demonstrate the way in which Nvivo is used to assist the data analysis and to enhance the transparency and openness of qualitative analysis.

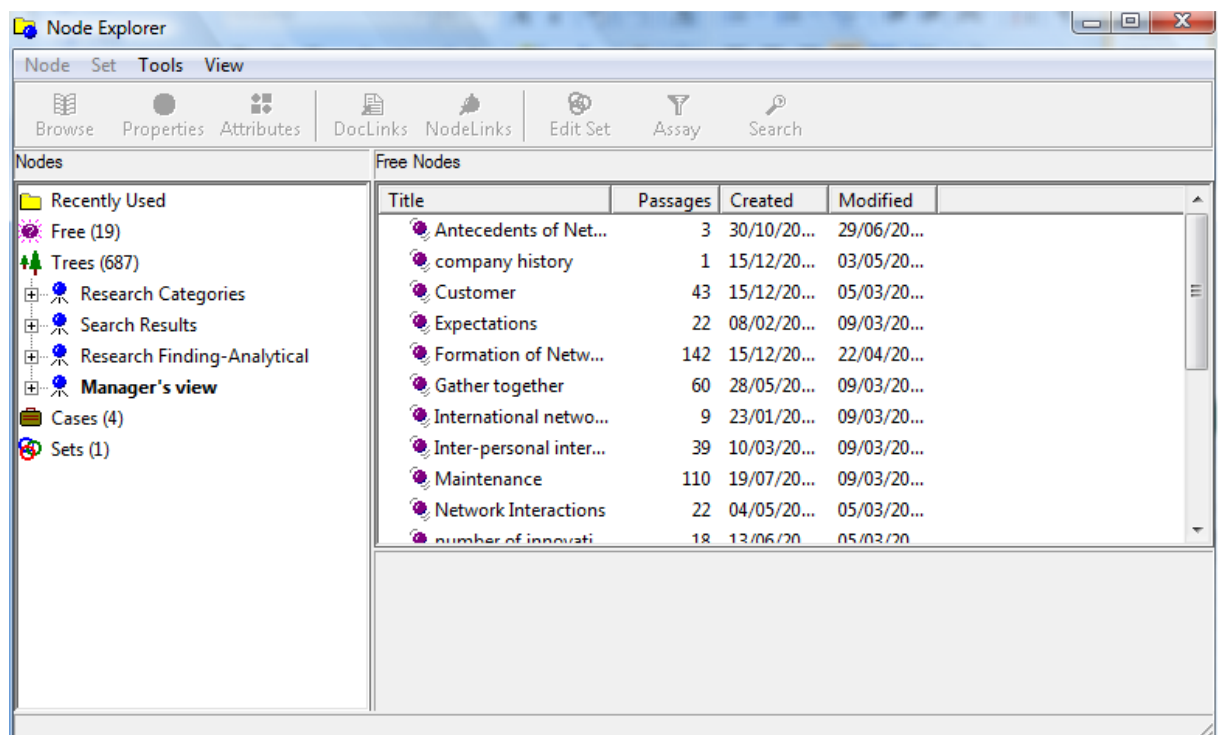
Transcripts were imported into computer program Nvivo 2.0 soon after each interview was completed. Each transcript was skipped through and then followed by detailed reading several times. Figure 5.3 outlines the key interview topic areas as well as the nodes in the initial coding according to a broad categorization.

Figure 5.3 Initial areas of Coding based on Topic areas of the Interviews

Node	Topic areas	Interpretation attempted
Incremental innovations Customer networks	Could you please talk about product innovations since the establishment of the enterprise? Which external party is the most important one that is as the catalyst for new idea generation?	Is product innovation important, what type of product innovation did they have. Explore incremental innovations and their generation.
Network interactions	Could you please talk about the networking process with customer-network for collaboration of incremental innovation?	Narratives, anecdotes and stories relating to supplier-customer network interactions.
Interaction modes	How did you use face-to-face and electronic non face-to-face interactions?	How virtual interactions were used in the process, satisfactory and unsatisfactory experiences.

The initial nodes, representing broad areas of topics were basically set to hold the text related to those “happenings” within these topic areas which emerged as being important to the respondents (Kirkwood and Campbell-Hunt, 2007). These nodes were also themes emerging for further analysis in the later stage of analytical process. During this coding process, each node was placed with a definition and the relevant notes were given and stored in “Property” of each node; the content of notes for each node also included the considerations of its link to other nodes and any emerging ideas as coding and reflective thinking progressed. As coding evolved, some changes were made to the definitions of the nodes and notes written previously. The first few interviews conducted in Aberdeen enabled a development of a few free trees in Nvivo 2.0, as Figure 5.4 shown.

Figure 5.4 Free Trees



The system of Nvivo allows for three types of nodes: free, tree and cases. Detailed explanation of different nodes in the system is given in Appendix Three. Free nodes are coded individually, there are no links established between them. Tree nodes are set for grouping related themes emerging from the data. In the

analytical process, the first few interviews were categorized and coded by free nodes, but as a result of repeat reading and the growth of familiarity with the data, a structure of tree nodes had been shaped as a result of the free nodes' coding. Coding of the rest of the transcripts was more efficient based on the earlier analytical practices, nevertheless the researcher bore in mind to add the new themes which emerged to the existing ones or to group them into free nodes which were then viewed as "unfinished" resources and were prepared for incorporating with more emerging new themes. Nvivo 2.0 allowed the researcher to move around the nodes within a tree structure, and between free nodes and tree nodes in the analytical process. Such a process enabled the researcher to think and reflect holistically by moving backwards and forwards among themes emerging from the data and allowed for transparency of the analytical process.

Cases in Nvivo 2.0 provide a set to hold nodes related to individual issues that may contribute to the analysis. Since the interviews were held with individual entrepreneurs, it was considered initially to put nodes together with text which described each individual entrepreneur's attributes into the cases. However, after a few times' practices a table that was produced by a Word file containing these individual attributes was shown to be more demonstrative. Thus it was decided to use cases to hold those redundant nodes which were considered inappropriate to locate in the tree structured nodes but might be potential resources to the existing nodes at the time of analytical process.

Nvivo 2.0 provides various ways to manage the data in the analytical process, for example document set and attribute. A document set can hold those documents categorized as having certain features or links. A document attribute can be used to mark the characteristics of each enterprise to which each transcript links. Since all of the transcripts were imported into the software and each document was a transcript of an interview, thus document attributes of each transcript were created to characterize the organizational feature of those SMEs in the sample, as shown in Figure 5.5.

Figure 5.5 Enterprise's Attributes Linking to a Document

The screenshot shows the 'Document Attribute Explorer' window for the document 'Alb-I Ja'. The 'Attribute' dropdown is set to 'Business focus/orientation'. The main table lists various attributes and their values for this document.

	Alb-I Ja
Business focus/orientation	Bio-Manu, serv & trade
Company age	2000
Gender	Male
initiative of innovative ideas	customer
Innovation type	incremental
Manager's age	45-
Manager's experience	rich
Number of innovation establishment	2 & 2 progress
Size	5
Virtual Mode	Email

At the bottom of the window, it indicates 'No Row Selected' and 'No Column Selected'.

The information on organizational attributes was used to produce Table 5.1 and conduct the analysis of research findings. Detail of the research findings will be elaborated in the next chapter. The search function in Nvivo 2.0 had not been used as a key method for coding the processes of networking, the reason being that the data analysis of this study is in the similar situations to those discussed in the previous section 5.7.1.

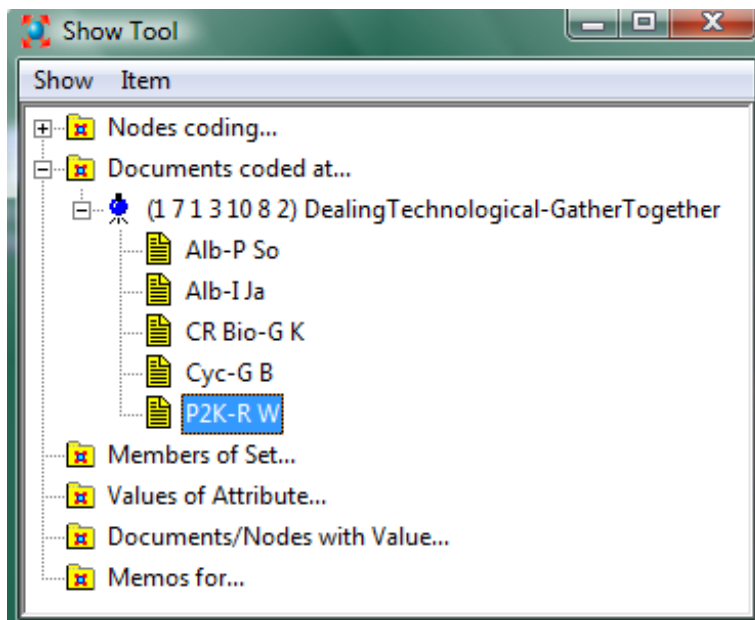
5.7.3 Research Transparency and Openness

As highlighted in the earlier section, computer programs help to create an audit trail, which can be tracked for the development of the analytical process over time, and as such, increase openness and transparency of the analysis (Corbin and Strauss, 2008). This study has utilized several functions to keep an audit trail for thinking, re-thinking, moving around the codes and reflection of the themes. The researcher used memos to note down any ideas/thoughts emerging along the way, these memos were marked in different colours so that they were

easy to be grouped and recognized; hyperlinks were set up between memos and documents, which facilitated thinking, reflection and new ideas creation in the analytical process.

The tree structure of nodes enabled the data to be in a form which shows analytical process and connections between and across nodes, and this has made the logical and creative thinking easier. The “analysis” function of Nvivo 2.0 allowed for explorations of those documents that were coded by a particular node/or nodes, thus assisted the identification of emerging patterns and trends in entrepreneurs’ behaviour coded by a node.

Figure 5.6 Analytical Function



For example, by examining how many and which documents are coded as “Dealing with Technological Requests/Problems”, the researcher was able to gain an understanding of how many and which entrepreneur networked with certain networking behaviour and attitude (Figure 5.6).

5.8 Reflections on Methodological Approach

The researcher of this study had previous experience of working as a product promotion representative in the pharmaceutical industry and which was relevant to the context of this study. She had immature ideas and personal interests in gaining a deep understanding of networking and collaborative product innovation prior to this research being commenced. The undertaking of this study became an opportunity that filled her desire to pursue the personal interests and materialized the expectations of gaining more knowledge of human behaviour and attitudes in the process of innovation collaboration.

Similar industrial working experiences and a certain understanding of professional languages spoken by the respondents in biotechnology, together with the knowledge of entrepreneurial networking obtained from the preliminary study provided great advantages for the researcher to form empathy and build trust with bioscience entrepreneurs. All interviews went on smoothly and the respondents were open and honest in recalling their stories, in some cases the respondents acted as if they were telling stories and narratives to themselves. Such recall processes also provided the respondents with chances to reflect upon the networking processes, several respondents expressed as: "hmmm ... we need to pay attention to our ways of writing emails ...", "we need to improve our websites on ..." during the interviews, we can see that the interviews themselves served as processes for entrepreneurs to obtain external resources and became enjoyable and valuable experiences.

In some cases qualitative researchers may find it difficult to "pick up" sensible themes from massive information in the data, however the manner of guiding not leading, processing feedback and informing the listening awareness allow a researcher to maintain control of irrelevant remarks (Patton, 2002, p.372). Bearing these in mind and acting upon them, the researcher obtained the data as rich as expected and yet not much "watering" information. She perceived that the data obtained had allowed for a deep understanding of networking processes

and essence which led to the insights gained in the virtual interactions in the processes.

5.9 Reflections on PhD Journey

The process of doing a PhD is often seen similarly to a journey, a journey that is filled by emotional, intellectual and spiritual adventures (Dovona-Ope, 2008). There were mountains to climb along the way and there would still be hard work. The journey would need to deal with a several pragmatic areas, such as making decisions on the topic areas to be focused, considering the methodological approach to research, collecting the data and writing up the thesis (Corbin and Strauss, 2008; Crawford, 2003; Liamputtong and Ezzy, 2005; Patton, 2002). In order to develop a literature review and to finalize the topic areas as the research focus, the researcher was involved in a process of searching, intensive reading, thinking, comparing and reflecting on the previous work on the subject: A realization of where he/she was situated in the body of knowledge of entrepreneurship and innovation and business in general was also an outcome of the reviewing process.

As the process of learning and reflecting progressed, the objects of the investigation and how to gather the knowledge became clearer. It was learnt that using measurement tools would not allow for finding an entrepreneur's behaviour and a real world inside him/her. The researcher was aware that the investigation of the entrepreneurial networking processes and the ways in which virtual interactions were used in incremental innovation required her to get close to the respondents and listen to their true life stories and narratives. As a result, she devoted a lot of time and effort to obtaining a systematic view of qualitative methodology, going through different methods, attempting to choose one that was suitable for the research questions and her ontological stands for this study. The decision to take a phenomenological approach was shaped as a result of extensive reading, in that the researcher came across a methodology book written by Moustakas (1994) and an interest to know more about this branch was fulfilled by a further reading of Van Manen's (1990) work. The methodology

of using a phenomenological approach opened the Pandora's box and helped the researcher clarify the puzzles on "how to pick up the knowledge" that she wanted to know while travelling in this part of the journey, that is, capturing the entrepreneurs' lived experience by letting the pictures of the living world emerge from those stories. The researcher learnt and revealed the themes which then formed the understanding of the networking processes and virtual interactions in the collaborative innovation.

Regardless of the methodology chosen, the nature of qualitative analysis determined the analytical process as involving shifting backwards and forwards between parts and whole, repeat reflections and checking the references between and across particular concepts/issues. Moreover, the findings of the research would also need to refer to all of bits/or parts of the research project. In this revisiting and referring process, it was felt that each strip of literature "digested" from the past review had been re-examined and reflected with a fresh mind resulting from the processes of reporting and analyzing the research findings. New discoveries of this study became clear as the research moved backwards and forwards between the literature and the data. The whole process of conducting the project was integrated with learning and obtaining more knowledge and skills, which generated not only the researcher's enhanced competence in doing research but also an overall personal growth. Now the researcher can see things in life as connected (Cotter-Lockard, 2009), see different processes as sharing similar patterns in terms of their evolution, using multiple ways to interpret and to approach the systems.

5.10 Conclusion

This chapter has highlighted the methodological approach for this study, and the gaps in our knowledge identified in the literature review in Chapters Two, Three and Four. It turns to tackle the methods of qualitative inquiry demanded in the field of entrepreneurship research, and points out that to understand "how" and "why" questions of networking processes and essence and thus the use of virtual interactions, qualitative data collection is the appropriate methodology to enable

an in-depth understanding. This chapter has gone over and discussed the phenomenological methods and relevant research techniques that were used in the fieldwork and data analysis. Detail of the sample in terms of size, product innovation and age of the enterprise are summarized in Table 5.1. The rest of the chapter has addressed the idea that data analysis is not a separate part, rather connected to data collection and the design of the whole research. It has highlighted the advantages of computer assisted qualitative data analysis (CAQDA) through the use of computer programs and aspects requiring attention in qualitative data analysis; and demonstrated how the computer program Nvivo 2.0 was used. In the end, this chapter has produced a reflection on the methodological approach and the birth of this study, and the PhD journey. To summarize, Table 5.5 provides an outline of research design and methodology.

5.11 An Outline of Research Design and Methodology

To summarize the research design and methodology adopted by this study, an outline is shown in Table 5.5.

Table 5.5 Research Design and Methodology

Overall Approach Taken		
Phenomenology of Interpretative study		To understand the process and essence
The Sources and Methods		Data Generated
Participant observation		Relevant study material for entering respondents' life-world
The broad literature learnt		General theoretical material
Specific literature reviewed		Knowledge focused on the research areas and the fountain of experience to increase practical insights
The Fieldwork		
Preliminary Study	7-day participant observation in a biotech firm	To understand the networking processes, and prepare for the in-depth interview processes
Sample	16 Interviews with bio-science entrepreneurs in Aberdeen and Dundee	To reach data saturation
In-depth Interviews	<p>Conversation with topics under discussion</p> <p>3 topic areas</p> <p>Interview notes taken, interviews recorded and transcribed</p>	<p>Experiential narrative material as the source of understanding the phenomena experienced by respondents</p> <p>Guiding not leading questions and checking 3 areas are included</p> <p>To increase consistency, transparency and openness</p>
Data Analysis Approach		
<p>Transcripts of interviews imported into computer program Nvivo 2.0</p> <p>Repeated and reflective reading, moving backwards and forwards within the data set, thinking and re-thinking and linking parts and the whole</p>		<p>Effective categorization of text and coding, creation of "audit trail" for transparency and openness</p> <p>Keep track of and easy access to codes, memos</p> <p>To enable themes to emerge from the data, and integrate them holistically within the whole process investigated</p> <p>To view data as "unfinished" resources and retain openness</p>
Return to the literature		Theoretical confirmation or repudiation

Adopted from Anderson (1995, p. 209)

Chapter Six

Findings and Analysis

6.1 Introduction

The previous chapters have reviewed the literature on the generation of incremental innovation, supplier-customer network interactions, in particular network relationships and virtual interactions, and highlighted the research questions underpinning the research objectives. They have explained that a phenomenological approach of interpretative study was chosen as a way to obtain a deep understanding of the processes, by which the entrepreneurs make sense of their innovation experiences. Chapter Five has elaborated the research design and methods of collecting data.

This chapter will report the research findings, associated with an analysis of the data. It will explore four research questions, designed for this study and addressed in Chapter One and Chapter Five. As the analysis develops from the primary descriptive categories to the reveal of the dynamic and complex nature of the collaboration for incremental innovation process, it indeed reflects what has been highlighted in Chapter Five - the iterative nature of data analysis of qualitative research and the tendency to have minor overlaps between certain sections.

The findings and analysis are carried out by providing three layers of data, as indicated in Chapter Five. The first layer of data starts with a series of descriptive categories, emerging from the interviews which refer to the first research question and demonstrate the components of the collaboration process for generating incremental innovation. Following the identification of the key components, the second layer of data is presented and discussed by an exploration of how they are related to network relationships, which refer to the first half of the second research question. The analysis suggests that the

dynamic force that drives the development of entrepreneurs' innovation collaboration with new customers is the building and development of trust in the network relationships. The entrepreneurs adopt different networking behaviour in the trust process according to different network relationship situations. The different networking behaviour can be classified into three ideal types according to the content of network interactions and aspects of trust building and development, or approaches to trust process in innovation collaboration: Technical, Combined and Social Approaches.

To clarify, the research questions that have been specified in Chapter Five are highlighted as below:

- What are the key components of network interactions in the process of collaboration for generating incremental innovation in supplier-customer networks?
- How do they relate to trust and virtual interactions?
- How are virtual network interactions and trust related, and how is this manifested through entrepreneurs' narratives of their experiences of collaboration for incremental innovation generation?
- How can we understand and what can we learn from entrepreneurs' narratives?

Due to the three different types of networking behaviour and network strategies reflected in the trust process being intertwined with virtual interactions, the second half of the second research question related to virtual interactions needs to be discussed together with the third research question. Therefore, to answer the second half of the second and the third research questions, these three ideal types served as a means to investigate the impact of virtual interactions to the process of trust building, development and maintenance, and thus the process of collaboration on incremental innovation. The presentation and analysis of the data of these aspects will serve as the third layer of data, examining the impact of virtual interactions on the trust process at an inter-personal level. The

investigation is based on both of entrepreneurs' network behaviour and the way they seem to make sense of that networking experience.

Finally, the first half of the fourth research question is addressed by showing that it is the entrepreneurial pursuit of generating innovation that serves as the motivation for network interactions and the trust process. The entrepreneurs' expectations and presumptive trust, a series of individual interactions that yield trust building, development and maintenance constitute a dynamic and recurrent networking process in the entrepreneurs' collaborative innovation experience. Each component in the interaction process will differ from one relationship to another and one situation to another, yet the essence of the process remains, influenced by the individual's specific mix of bonding social capital, the process of building and developing trust, individual quality, the use of interaction mode, inter-organizational characteristics and geographical distances between network partners.

6.1.1 Use of Anecdotes, Narratives and Stories

As highlighted in the proceeding chapter, the style of interview used was as "conversation with topics", which means that the researcher carried out dialogues with respondents about their lived experiences of collaboration in incremental innovation. The phenomenological approach suggests that the researcher should "bracket out" any pre-suppositions of the experiences. Since the focus of this study was the networking processes in the context of generation of incremental innovation, hence the product innovation of the enterprises had become the initial topic in the interviews. A general conversation relating to product innovation was derived from the questions like "could you please talk about product innovations ... are they important to your enterprise?" and moved on from there to investigate the incremental innovation experience.

It is necessary to point out the differences between story, narrative and anecdote in the current study. A story is generally a description of a happening or sequence of events; it has an internal logic and a completed body of beginning,

middle part and ending. A narrative has a broader sense, including anything recounted or told from experience, regardless of the extent of detail or whether it has a whole body of different sections as in a story. All of the interviews in this study are narratives and stories of the respondents' lived experience. For example, the response to "could you talk about ...?" inclined to be a narrative, being a response of how they talked about the product innovations in their enterprises. The response to "what did you do..." or "why did you use...?" is also likely to be a narrative or story, whereby the respondents recounted their actions/or a series of actions or motivations, or a brief story of a collaboration process, which can be a narrative of a particular motivation or a story of collaborative product innovation. On the contrary, when retelling their experience of using virtual interactions, as distinct from narratives, a majority of the respondents responded with anecdotes about particular incidents or happenings.

The first few interview transcripts of Aberdeen SMEs were read and studied to identify text which was generally related to Innovation, Relationship and Virtual Interactions. Within these basic categories in a broad sense, "free nodes" in Nvivo were utilized to establish more specific and relevant topics. Then as the connections and linkages emerged to "speak" themselves, the nodes were organized into a tree structure to show the categorization. The tree structured coding was utilized for the initial coding of the rest of the interview transcripts. When new data emerged and either new codes or some re-organizations of the existing codes were needed, the node tree was flexible and could be revised by integrating the new themes. A detailed explanation of various nodes in Nvivo 2.0 is given in Appendix Three. Apart from the primary categories of Innovation, Relationship and Virtual Interactions mentioned above, all of the categories presented in this chapter emerged from the data itself rather than being applied by the researcher. However, it needs to be clarified that not all of the nodes were picked up from the text, e.g. instead of being labelled by a word or phrase which recurred in the transcripts, rather they might be descriptive phrases of the main themes. In the text cited the respondents are referred to by the first letter of their surnames and followed by the reference set to represent each firm.

This chapter thus reports and analyzes the interview transcripts based on a completion of the initial coding and subsequent coding of all of the transcripts. As highlighted in Chapter Five, to enhance credibility, the research findings and the relevant analysis of the networking processes will be conducted by providing three layers of data. The first section of this chapter examines incremental innovation collaboration and networking in supplier-customer networks, and explores the components of the innovation experiences by demonstrating the categories. This is followed by an investigation of the trust process within the networking process and various elements of trust are identified during the process. As a part of networking, the role of virtual interactions in the networking process is discussed together with the impact of other factors (bonding social capital, trust process, relationship stage and the level of knowledge tacitness) and the interplay of the factors.

6.2 Incremental Innovation and Supplier-customer Networking Process

With regards to product innovation, there was consensus in that all of the respondents regarded product innovation as very important to the enterprises. The number of product innovation within each enterprise since the establishment is shown in Table 5.1 in the previous chapter. It appears that the 4 enterprises that had been set up for over 5 years were in the leading positions in terms of the number of product innovation, 4 enterprises that had been established between 3-5 years had more than 2 new products developed and 1 enterprise that had been set up for 3 years had the minimum of 1 new product innovation.

These numbers of innovation among enterprises do not seem to be directly related to different firm size, age or the biotechnologies involved. In particular the complexities of the biotechnologies involved in the innovation processes influence the speed of each new product development being different from one another, as the respondents expressed:

"... side-effects of all these aspects of a drug are a big problem, the major reason why compound development fails to make medicines, new medicines, because of all these aspects and the attrition rate is just under 70%, so 70% of compounds that make through discovery fail to become medicines in the clinic because these reasons ..." (G, CR)

"... to take a drug all the way to the clinic, can take 7 years ... we are very good at the discovery phase which is the first phase, then it's the development phase and clinical phase, we've got molecules now ..." (A, Hptg)

Technological complexities appeared to be one of the main challenges that affect the speed of new product development processes among biotechnology SMEs. The above quotations also indicate that the degree of difficulty involved in developing a new bio-tech product can be different from one enterprise to another, depending on the different biotechnologies that an enterprise used. Hence, purely looking at the number of new products of each enterprise may mislead our understanding of the innovativeness of an enterprise.

What needs to be understood in terms of innovativeness is that the entrepreneurs' behaviour was manifested in their engagement with and attitudes towards their innovation practices. All of the respondents viewed innovation to be crucial to the enterprises and they had been actively engaged in generating product innovation:

"Yes, innovation is important, it's what we are looking for, and defines (our company) over a couple of years. These new products, services, techniques and practices, we were looking to develop ... 'Yes, it is very important; to any organisation it is important, some techniques are more important than others'... " (R, CMBL)

"The aim of the company is that if there is a problem and we can find a solution, we bring them together. If there is a problem, there isn't a solution, let's invent the solution ... so that's why we set it up." (P, Alb)

"So that's innovative approach we are taking, looking at the issues within ... we're looking at the problems within the industry and coming up with the solutions, using an innovative approach. So it's knowledge of ... to generate these tools that then will overcome the current problems of the drug development process. So that's what we do, we'd bring innovation to solve the current problems ... we are innovative." (G, CR)

We can see a sort of passion in the entrepreneurs. It was the entrepreneurial passion of pursuing product innovation that was behind their behaviour and attitudes towards engaging in innovation practices. New product development was shown to be the aim for which the enterprises were born; it constitutes the entrepreneurs' basic business philosophy and the concept of generating product innovation has been integrated into their daily activities and interactions. Apart from those new products that had been successfully developed as shown in Table 5.1, all of the respondents reported at the time of interviews that there were several new products that were in the processes of being developed and they were engaged in product innovation all the time.

"We have over ... patents, over the last several years, we have developed a huge pack of enzyme family; and we have also developed genes and gene products ... so we are innovating, I mean we are dependent on the innovation all the time." (G, Cly)

"Now with the other ones that are in the pipeline, there are quite a few others in various stages of development, none of them yet have been made into products, and we hope that this summer, two of them in development will be able to be sold commercially, so it's beginning to bear fruit." (G, CR)

As far as the type of product innovation is concerned, among all of the new products that had been and were being developed, there were both radical and incremental innovations. In general, however there were more incremental rather than radical innovations:

"We change all the time, it is constant development. It's sort of ... I guess you call it incremental innovation. The next element we are doing will give us a basic line system, but we have already identified 4 more levels of innovation on the basic technology ..." (I, Alb)

"The original is radical, it's in the university, it is patented ... what we had to do when we came out from the university was to scale it up basically make manufacture a larger scale ... Since then they become all minor, because basically it is a whole family of enzymes that we sell. We started off with ... we got from the university, we are gradually adding, and there are still more enzymes ..." (M, Cyp)

As the respondents expressed, incremental changes to the existing products were the main characteristic of new product development after the establishment. Other than one, the respondent commented that customers were the group of the most important external stakeholder to the generation of innovative ideas that led to incremental innovations.

"People who develop products ... relate to the customers ... because with the product technology, they put the customer first, 'what the customer want, and so on' ..." (D, Biot)

"... in terms of the parties that facilitate innovation generation, customers I would say are the first, in terms of the product areas that can be expanded into ..." (I, CMBL)

The other exceptional respondent commented that the innovative ideas of product innovations were generally originated from in-house; nevertheless the respondent valued the customers' contribution to the generation of innovative ideas and incremental innovation:

"A lot of time the creative ideas for the new drug development are coming from the in-house ... we have got customers, for the customers, it's been about the communicating the information ... about what we can do, what

problems we can solve for them, and what they realise we can solve for them, they go away and look to see if they have those problems and come back to us.” (A, Hptg)

It turns out that all of the respondents have had incremental innovation collaboration experiences with customers and a majority of them valued highly the important role that customer-networks played in the generation of incremental innovation. As one of the ways of fulfilling the entrepreneurial pursuit for generating product innovation, collaboration with customers for incremental innovation facilitated product innovation in various ways:

“... It’s how we can generate money from the customers.” (J, CMBL)

The revenue generated from incremental innovation was viewed as important and might be accumulated as part of the resources of generating potential radical innovation. Other respondents also expressed similar views:

“Is there a market? You may see ... well, this is wonderful, everyone will like it, then you go to the market place and discover ... there are barriers, regulatory barriers ... So first of all, identify possible applications, and then determine is there actually a market for you that you can make money in ... so I had many discussion with them, we ended up with this as a new product (showing the electronic tool kit) at a fairly low development cost, but giving an effective tool for our clients.” (J, Rmd)

The collaboration for incremental innovation with customers not only generated the revenue from pre-defined markets for potential incremental product innovations, but also saved costs and shortened the lead time of new products into the markets, and thus reduced the risks involved in new product development processes. Hence, the respondents viewed the collaboration with customers for incremental innovation critically important:

"It was my idea, to collaborate with our client, I researched the market, using the Internet, so virtual networking there ... we have been looking at building this piece of kit, in fact, we had built one under our research and development project for one of our clients at a low price, so we just made it. So I went on to the Internet and did research, and I came up with this company in Germany ..." (J, Rmd)

The above example shows that the entrepreneurs benefitted from and highly valued the collaborative experiences with the customers. Their entrepreneurial pursuit of generating product innovation has been transformed into the proactivity of networking. The various ways which the entrepreneurs used to interact with the customers will be explored in the next section. Such entrepreneurial pursuit motivated and enabled them to enter into network relationships with customers for collaboration in generating incremental innovation.

Having revealed the importance of customer-network to the generation of incremental innovation which serves as a given context, the next section will explore the details of the networking process in supplier-customer networks in the collaboration of incremental innovation.

6.2.1 Networking Process of Incremental Innovation

This section focuses on the first research question "What are the key components of the networking process in the collaboration for incremental innovation in supplier-customer networks?" It examines the key themes which emerged from the interviews: Antecedents of Network Interactions, Linking, Development and Maintaining the Contacts, which are grouped into a series of categories and sub-categories as more sub-themes emerged. In addition, it starts to tackle the second research question, "How do these components of the networking process relate to trust and virtual interactions?" by beginning to reveal the ways by which these themes are linked. In cases when there are several behavioural themes emerging in network interactions, tables have been used to present the data for

comparing and distinguishing different network behaviour. To explore the process, the first concern is “When is the starting point of the interactions in the collaboration?” The responses obtained varied from one case to another. It seems that the entrepreneurs had engaged in some activities prior to the first contacts that were specifically related to collaborative incremental innovation. Although these actions were various, however there were some commonalities that could be identified and classified into a category, named Antecedents of Network Interactions, indicating the key themes of these activities/or interactions.

6.2.1.1 Antecedents of Network Interaction

Some examples of activities carried out by the respondents and their customers might be helpful in explaining how the first contacts developed and triggered the collaborative relationships. These include Corporate Website Visits, Internet Search, Sending Brochures and Letters, Previous Face-to-face Meeting Experiences and External References. These approaches were not exclusive from one another and the respondents might use a combination of them.

6.2.1.1.1 Corporate Website Visits

Corporate websites emerged as one of the ways that entrepreneurs and customers established the links. There were mainly two types of use of the corporate website, namely Network Partners’ Corporate Website Visits and Networking Intermediaries’ Website Visits.

6.2.1.1.1.1 Network Partner’s Corporate Website Visits

Six respondents reported that the Corporate Website Visit was one of the important ways that the enterprises and their customers reached each other, and ended up in collaboration for incremental innovation thereafter. The respondents commented:

"I've a website which is very important..." (A, KinS)

"Obviously there is the Internet, people do searches, and we get lots of hits on our website and pick up new customers ..." (M, Cyp)

The respondents viewed their corporate websites as important platforms which enabled the connections and dialogues. The ways the Internet worked, 24 hours-7 days basis, provided opportunities for the customers to know more about the enterprises.

6.2.1.1.1.2 Networking Intermediaries' Website Visits

Not only had corporate websites acted as platforms for potential network interactions, but also those of network intermediaries. Some networking intermediaries that specialized in the biotechnology industry provided online services to the biotechnology enterprises by enabling virtual interactions on their websites:

"... BPA Europe, Bio-Square, ... a lot ... there are lots of meetings, we go to the partner meetings ... You log on, this particular one is ... it was the last year but we also went this year ... before you go, you log on the website, there is a password ... " (K, CR)

These networking intermediaries generally organized networking events and enabled the enterprises to network with each other. But prior to face-to-face networking events, the websites were designed to allow a potential participant to register with detailed information and become a member of the online biotech-community initially. A pool with an aggregation of firms in the industry was then established. Such online operating systems created a virtual biotech-community. The websites served as platforms for accessing and sharing information among the members.

"... this is what you get at the meeting, but before you get there you look at the companies, these are different companies that are going to attend this bio-partner event, so you look at the person who is attending, and you look at the areas they are in ..." (K, CR)

The web systems contained business portfolios and the specific interests of the potential participants in a particular event so that the others would know who would be attending and what they were looking for in the events. Referring to those activities related to the subsequent beginning of collaboration, the respondents also highlighted their use of Internet search. Internet search was one of the activities the respondents engaged in prior to the initial contacts.

6.2.1.1.2 Internet Search

The respondents reported how they conducted online searches, aiming to look for potential customers. Internet search was thus used as an approach by the respondents for reaching customers:

"(online search) we find tremendous capability through it, just through the search engine; to find the companies we didn't know about, we now deal with companies all over the world ..." (P, Alb)

By using keywords to search the Internet, the respondents obtained the relevant information in terms of the products and target markets of their potential customers prior to the first contacts being made.

6.2.1.1.3 Leaflets, Brochures or Newsletters

Sending leaflets, brochures or newsletters to other companies became a way of exploring potential customers. Three respondents commented that their

enterprises continued to use these methods as a way to explore and access potential new customers.

"I sent out questionnaires ... I tried to figure out whether there was a market for what I was doing, because I knew there was a market as I got requests from people by post all the time ... so I sent a letter to people and said 'are you interested in ... I had a number of points, and this company essentially made a tick list of everything actively ...'" (A, KinS)

"... We now put all the information in the marketing leaflets, brochures, etc." (G, CR)

It appears that the entrepreneurs' intention in sending newsletters and brochures was to look for opportunities to form common interests with potential customers based on providing self-introduction. In addition, past experiences via face-to-face meetings were reported as one of the ways in which collaboration was started.

6.2.1.1.4 Previous Face-to-Face Meeting Experiences

Eight respondents reported that attending scientific conferences, exhibitions, business conferences or business development meetings were important approaches to access the customers. The main purpose of attending these events was to meet people, as shown in Table 6.1.

Table 6.1 Previous Face-to-face Meeting Experiences

<i>"For customers, you'd tend to meet them somewhere initially in exhibitions ..., so I can network in a real sense with people ... as I say the key element is at the conferences or exhibitions, the sole purpose of attending them is to meet and talk with people, the pipes are there ..."</i>	(W, PK)
<i>"We had one of the business development people met one of the Ortanna's business development people face-to-face in one of the conferences ..."</i>	(G, Cly)
<i>"It has to be said, particularly with customers, we tend to meet customers at trade exhibitions, attached to scientific conferences ... We identify the scientific conferences where our customers will be ... they have meetings every year ... all companies are exhibiting and the delegates at the conference will go around and talk, they are all scientists anyway, so they come up and ask for the products ..."</i>	(P, Cyp)

The respondents attended the conferences to meet possible potential customers and explore the opportunities for potential collaboration for innovation. The primary connections established to various extents during these face-to-face meetings acted as relational “seeds” embedded for future connections that were for specific purposes related to new product development, as Table 6.2 shows:

Table 6.2 Making Connections

<p><i>"Some of these big ... conference, just everybody from everywhere, so you know that's the key thing, the initial contact ... you talk to people, very often, people go to these things are pretty open-minded ... I met the guy originally at ... conference ... and he just 'hi, an interesting conference, what do you think', we didn't talk about the business or anything else, just made that contact, and got his card."</i></p>	<p>(I, Alb)</p>
<p><i>"(To know customers) you can't go and knock at the door.....You know who these people are because they have been around in various scientific meetings or business development meetings, what you do is you target ..."</i></p>	<p>(B, Cly)</p>
<p><i>"... For a start, it starts a dialogue ... met him at the conference, now he contacted me ... so it just happens like that ..."</i></p>	<p>(J, CMBL)</p>

The respondents explained that the interactions in these face-to-face meetings might not have specific purposes for particular collaboration for incremental innovation at the time; rather the connections were established for forming a basis for any potential opportunities for the future collaboration. The previous face-to-face experiences served as the way in which individual entrepreneurs obtained inter-personal information about each other. The respondents' comments about establishing links by “knocking at the door” were in contrast to those face-to-face experiences.

Apart from these previous face-to-face meetings, the respondents also reported that past working experience was also one of the sources of face-to-face meeting from which they established network relationships with the potential customers, as Table 6.3 shows:

Table 6.3 Previous Working Experiences

The respondents got to know the customers in the past by working together	Node definition
<i>"our business is built up on networks, I used to work in Brazil and Middle East, so lots of my customers are friends that I have worked with ... so we deal in a lot of networking, both in terms of developing products and sub-products ..."</i>	(D, Biot)
<i>"... The customers I see were those that I dealt with before in a previous company, so it is so much easier ... you know."</i>	(C, Biot)

6.2.1.1.5 External References

The establishment of networking relationships also resulted from third party referrals and word-of-mouth. The respondents reported that their connections with third parties such as the previous colleagues, business partners or business supporting bodies provided the access to the potential customers for collaboration, as shown in Table 6.4.

Table 6.4 Third Party Referrals

The introduction of a third party was a source of access to potential customers	Node definition
<i>"... A sister company of our partner saw our stand, came to talk to me. And first of all (they) thought we could work with them, and then they thought, your technology was more applicable to our sister company, we went from there ..."</i>	(J, Rmd)
<i>"... quite often you have met them through other people and you get introductions, what you do is you know who they are, so their job is to look for people like us, that's their job, so they are looking to meet us ... we would send an introductory message usually by email ..."</i>	(G, Cly)

The respondents approached potential customers identified from the people they had talked with before. This source was recognized as word-of-mouth recommendation, as shown in Table 6.5.

Table 6.5 Word-of-mouth

A type of reference through the passing of the relevant information to either customers or the respondents in the sample	Node definition
<i>"(to know customers) sometimes by word-of-mouth from someone else that some companies are doing something quite interesting ..."</i>	(I, Alb)
<i>".....I got to know them from other people they talked to."</i>	(A, Kins)

Other external references were from various external media information, including business journals, scientific or governmental publications and news, which were reported by 2 respondents, as shown in Table 6.6.

Table 6.6 Media Influence

<i>"The best way to contact the customers is by advertisement in a scientific publication, so we now have published 8 papers on the methodology, and lots of these papers get read and they are quite relevant, usually my customers approach us because they read one of these papers or some comments on these papers, and then approach us ..."</i>	(K, Kins)
<i>"From journals, from news, publications ... a million sources of information, so we got those bits of information all together ... Initially I contacted them, by telephone. Actually I knew who I was contacting, and I knew why I was contacting ... and I knew what their problems were."</i>	(I, Alb)

The information in those publications was generally related to the technologies, products and markets. They became the key references by which the respondents and customers accessed each other. The findings show that what triggered the initial contacts relating to specific products' development was dependent on the emergence of customers' particular problems/or requests and how the entrepreneurs went ahead in solving the problems and satisfying the demand. More detail will be shown in section 6.2.1.3 Linking. The respondents recalled that the time taken for the network relationships to go from the Antecedents to Initial Interactions stage varied from one case to another, depending on the circumstances of the relationships. An initial contact upon which the following network interactions were based could be an immediate action resulting from a website search or could be after a delay which might be uncertain, as shown in Table 6.7.

Table 6.7 Time taken from Antecedents to Initial Interactions

How long does it take from Antecedent to the action taken for the initial contact for innovation collaboration?	Node definition
<i>"we just have done a collaboration with a companywe had one of the business development people met one of theirs ... in one of the conferences, they discussed what we did and what they did ... 2 or 3 months later, we emailed them 'would you be interested in working on X, Y or Z programmes?'"</i>	(G, Cly)
<i>"now we are actually down to the grass root level ... that took a month, very quick, because we addressed particular problems ..."</i>	(I, Alb)
<i>"... quite often you have met them through other people and you get an introduction, you know who they are ... so we would send an introductory message usually by email ... then you'd follow that up with a phone call or email, dependent on what you hear regarding their feedback, maybe a week or 2 weeks later, usually you get from them 'yes, we are interested' or 'no ...'"</i>	(G, Cly)

6.2.1.2 Virtual Modes of Network Interaction

This node was set to explore the use of virtual mode in the network interactions. The use of virtual interaction mode was clearly highlighted by the respondents. This node not only contains the types of virtual mode, but also the descriptions of how they were used and in what context. The node was developed from the respondents' narratives and anecdotes. The reading of Aberdeen transcripts shows that several sub-categories needed to be established within this node in order to distinguish different modes, thus sub-categories of Email, Audio-conference and Video-conference were introduced. The reading of Dundee transcripts indicates that there was one more type of virtual mode that was used and reported by 1 respondent, Virtual Interactions via Corporate Websites, which was then set up as a node and subcategory of Virtual Mode to hold those respective interactions. Finally, a separate node for face-to-face meetings was established next to Virtual Modes node to contain the respective descriptions.

In general, as an interaction mode email was reported to have been used in all of the collaboration for incremental innovation, as was the face-to-face meeting. Audio-conferencing has been used by 5 respondents and video-conferencing by 2 respondents in the collaboration, as shown in Table 6.8.

Table 6.8 Virtual Modes used in the Network Interactions

Virtual Modes Used	No. of Respondents
Email	16
Audio-conference	5
Video-conference	2
Virtual interactions via Network Intermediaries' corporate websites	1

An examination of the detailed responses in terms of the use of video-conferencing showed, only 1 respondent, who was from the only medium-sized biotechnology enterprise, used video-conference with international customers regularly. This enterprise possessed video-conferencing facilities. The other respondent who was from a small biotechnology enterprise used video-

conferencing twice with the customers and the enterprise did not have the facilities, as the respondents showed:

"We'd tend to meet people in some of the business conferences face-to-face meeting do presentations; but we also use video-conferencing, tele-conferencing." (G, Cly)

Due to the prevalence of email usage which emerged from the data, this study will focus on virtual interactions, email as the centre of discussion, and it will be the central theme in the later section 6.2.2.2 Inter-personal trust and Virtual Interactions. The discussion of the use of video-conferencing, audio-conferencing and face-to-face meetings will be mainly for the comparisons with the use of email in this study.

These activities/actions, categorized as antecedents of network interactions, on the one hand, represent a sort of pre-conditional relationship status that the entrepreneurs and customers were in before the collaboration was started, although the entrepreneurs might not realize such relationship status existed in all of the collaboration. The descriptions in the above sections have captured how the entrepreneurs and customers linked together and then worked together thereafter. While examining the activities/actions in detail, the pictures painted acted as a series of snapshots of what happened. Yet what happened within is also featured as a dynamic process, since these activities/actions could lead to the start of network relationships. It was these pre-conditions that emerged from the entrepreneurs' network behaviour that acted as the basis for their network interactions for specific product development. On the other hand, speaking from a holistic perspective of the relationship process these antecedents can also be seen to represent a network relationship stage through which the collaboration goes. The next section will explore how the entrepreneurs and customers started to collaborate on new product development with incremental changes.

6.2.1.3 Linking

This node was a free node initially, set up to contain references to “what do they do” in a series of interactions in terms of the network partners making contacts and replying to each other in the early stages of collaboration. The node was originally named Initial Contacts to hold the references to those interactions that indicated how the respondents and customers linked together. Reflective reading of the data showed that there seemed not only the first contacts but also a series of interaction involved in the early stage of network relationships. These had resulted in both network partners carrying on further interactions. Thus, the node was labelled Linking as a placeholder to hold two sub-categories of references which emerged from the respondents’ conversations. The first sub-category is named as Initial Interactions, which includes the quotations indicating how the first contacts related to how the collaboration started. There were also different themes of networking behaviour which emerged from the data, as shown in Tables 6.9-6.11. The second sub-category is labelled as Follow-up, as indicated in Tables 6.12-14. The analysis of the networking process, including each category and the connection between the categories will be in section 6.2.1.6.

6.2.1.3.1 Initial Interactions

These initial interactions were shown to have different themes of network behaviour in Linking and they appeared to link to the collaborative behaviour for generating incremental innovation. Some of them were related to specific technological problems/or requests, while others seemed to show a different behaviour relating to inter-personal friendships. There were also those interactions that lie somewhere in between these two extreme themes. Thus the initial interactions are separated into three types and categorised into three categories accordingly: Dealing with Specific Technological Problems/Requests, Exploring Business Interests and Creating Inter-personal Friendships. Table 6.9 shows the first category:

Table 6.9 Dealing with Specific Technological Problems/Requests

Initial Interactions in the Linking refer to those references to how the respondents and customers reached and responded to each other, and how the collaboration of incremental innovation was initialized.	Node definition
Dealing with Specific Technological Problems/Requests	
<p><i>"(in the email) They said 'can you develop an acid that shows this compound is affecting ... and working on this particular type of response, that particular problem is like 'yes, we can do that, but we don't know how to do that at the moment.'<!-- so there is an innovation required in order to design and build that acid. In terms of the stage of networking, it would be the initial approach 'can you help us identify this ...' within an email, normally we'd response back 'yes, we can help you with that, but we need to know the technical details of the particular problem.' then I may phone to arrange a particular event, either a meeting or a conference call ... "</i--></i></p>	(G, CR)
<p><i>"...(in the email) what you do is you target ... so we would send an introductory message usually by email with an attachment ... you would tend to have 2 or 3 paragraphs, trying to keep them to a minimum, because people haven't got time to read a lot ... so you just introduce and then attach all the important information you are trying to convey in the attachment ... Generally for a first contact, you'd just have 1 or 2 pages ... dependent on what you hear back, maybe a week or 2 weeks later ... and then you just go to the next stage."</i></p>	(G, Cly)
<p><i>"They use email ... they'd say 'we have a problem, as such and such, can you help?' there is normally a problem with drug metabolism, toxicity, lack of accuracy or they want to measure a particular bio-chemical characteristic ...'... they require a lot of research in order to understand the mechanisms behind a particular problem so that we can help the company ... It starts off with new customers 'Dear Dr.....and best regards'."</i></p>	(G, CR)

We can see that the network interactions in Dealing with Specific Technological Problems/Requests were mainly triggered by specific technological problems, requests or interests. The interactions in this category formed one of the types of network behaviour from which collaboration for incremental innovation was derived. The second theme of networking behaviour is Exploring Business Interests, shown in Table 6.10.

Table 6.10 Exploring Business Interests

Exploring Business Interests	
<p>"... you log on the website ... these are different companies that are going to attend this bio-partner event. Before you get there you look at the companies ... if you want to meet that person, you have got a screen comes up, you click the box beside this person's name, what that does is to fire off a request for a meeting with this chap. There is a little comment box, 'I'd like to meet you because I get interested ...' and then it comes up in his webpage or email ... and then he said 'yes, on note to request ...' ... 'yes', it then goes to the organisation's software."</p>	(G, CR)
<p>"Sometimes you may go to a conference, one of the guys with the Glasgow people went to a ... conference, and we met there ... because this was a close conference, we were asked as ice-breaker to describe what we did ... he described what he did. At the first coffee break, we got together; because we both recognised this mutual benefit here ... if you enter the places they cannot get into, and we are in places possibly they can't get into, suddenly we are connected with lots of people, and then they actually start to search our site..."</p>	(I, Alb)
<p>"we go for a lot of conferences where academic papers are, that will be the most lucrative social ... where like-minded people are, seminars to listen to things ... or more likely we give papers at these seminars, so people come to approach us, whether they like the paper or didn't like, they agree or they don't agree. For a start, it starts a dialogue and then ..."</p>	(J, CMBL)
<p>"For customers, you'd tend to meet them somewhere initially; you'd try to meet them in an exhibition ... the important stuff is actually talking outside the section."</p>	(R, PK)

The above theme of network behaviour, categorized as Exploring Business Interests is shown to be different from that of Dealing with Specific Technological Problems/Requests. The interactions between the entrepreneurs and customers did not commence from dealing with specific technological problems/requests, although there might be possibilities that the conversations ended up with specific issues related to the minor changes of the SMEs' existing biotech products. There seemed to have been processes within those interactions where the networking content was about the exploration of general business in the initial interactions. The third category of networking behaviour emerged as Creating Inter-personal Friendships, shown in Table 6.11.

Table 6.11 Creating Inter-personal Friendships

<p><i>"...The contact of Japanese companies ... we were contacted by them actually, the Japanese companies were looking at the test we did, and the products we made ... they were assessing potential partners in the UK to work with. Before they discuss any work, they will talk about your family or everything else other than work ... but you don't just launch business talk, they don't like that ... we will have a meal ... things like fish ... and 'all the rest whichever aren't very important' (laughs) ... in Japan it's almost like a social thing first ... "</i></p>	<p>(I, CMBL)</p>
<p><i>"I always want to talk to them on the phone, talk on the phone for a minute to arrange a meeting, then face-to-face; it's always the most important thing. That's the trigger for the relationship. The relationship has to be established before you can just 'throw things' ... but that's the way I simply am. I base all my business on relationships, all the big building of relationships."</i></p>	<p>(R, CMBL)</p>
<p><i>"... There are quite a lot people I deal with now I didn't know before, it's about building good relationships ... People buy from people, you have got to get that relationship, the best friends ..."</i></p>	<p>(B, Biot)</p>

These three groups of the theme regarding network behaviour can be viewed to be located in a continuum with two opposite ends between Dealing with Technological Problems/Requests and Creating Inter-personal Friendships, as Tables 6.9 – 6.11 show that there are clear differences between the first and third group of network behaviour. The interactions of Dealing with Specific Technological Problems/Requests were mainly triggered by specific technological problems, requests or interests. These were interactions that formed one type of the behaviour from which the collaborative innovations were derived. Those interactions of the third network behaviour theme, Creating Inter-personal Friendships were related to inter-personal intimacy and friendship building in the Linking. And the second, Exploring Business Interests were located at different points along the continuum between the two ends and which included general as well as specific business information exchanges and social network interactions.

Related to these categories is the observation that the respondents may use different interaction modes in the processes of collaboration in developing the new products, depending on the interplay of other factors such as network relationships, the content of interactions, relationship processes and inter-personal characteristics. This will be explored and discussed in Section 6.2.2.2 in the context of how networking approaches were utilized in different relationship situations in the collaboration.

6.2.1.3.2 Follow-up

A repeat reading of the transcripts was conducted to seek out what happened after the first contacts were made in the networking processes. The first and specific contacts in relation to how the collaboration was derived were shown in the quotations in Tables 6.9 – 6.11 of Initial Interactions in Linking. In those episodes, the repeat reading indicated that there were some follow-up interactions to the initial ones and these are shown under Dealing with Specific Technological Problems/Requests in Table 6.12.

Table 6.12 Follow-up to Networking Behaviour in Dealing with Specific Technological Problems/Requests

Clarification, explanation, confirmation and/or presentation	
<p><i>"... then we started off with 2 or 3 emails, dependent on what you hear back, maybe a week or 2 weeks later, then you'd follow that up with a phone call or email ... You arrange via phone calls to build a relationship with them. Give a short phone call, normally 5-10 minutes, the conversation can include the purpose of contact which is normally straightforward to show the interest of networking ... backwards and forwards ... then as the relationship grows then you have more to say as you go longer, when we arrange to meet the companies and have video-conferences or tele-conferences when we are presenting data, it can be 2 or 3 hours, a half day, just like a meeting face-to-face except one is in America and one is here ..."</i></p>	(G, Cly)
<p><i>"... can you help us identify this or that within an email, normally we'd respond back 'yes, we can help you with that, but we need to know the technical details of the particular problem.' ... we started off with 2 or 3 emails, and then we started to do phone calls discussing over the phone ... then I may phone to arrange a particular event, either a meeting or a conference call, at that meeting technical experts will be there either around the phone or around the table. It's better around the table, but a lot of these companies are far away, so we do it through the phone, remember no money exchanges or any agreement. It's what we can do for them at this stage; so we get together that's basically to understand the problem, the technical detail ... Once scientists know the problem, then we go to handle it basically and think of solutions. That's a big innovative step ... where innovation comes up ..."</i></p>	(G, CR)

The network interactions of Dealing with Specific Technological Problems/Requests in the follow-up were mainly related to clarifications, explanations, confirmations/or presentations of technological detail concerning the customers problems/requests. Those interactions that were conducted by email had gone through a few rounds of message exchanges in the process. Some phone calls and video-conferences were also used as combined interaction

modes for clarity and to facilitate the network actors' adaptation to face-to-face meeting arrangements due to the barrier of geographical distance at the time. The follow-up of network behaviour, Exploring Business Interests is shown in Table 6.13.

Table 6.13 Follow-up to Network Behaviour of Exploring Business Interests

Exploration, confirmation and going over issues of specific business interests	
<i>"... (after online contacts or emails through networking intermediaries' websites) I can get a list to show you. Here (shows one of the lists) it tells you what exactly you are doing every minute of the day for 3 days, it's very intensive way of meeting, but you see, you do all the keynote presentation and then swiftly into meetings, bing, bing, bing ... one after another, and people who are there monitor the time and ensure that you keep on time; because the person is turning up, so it's a very productive way of having meetings. For example, in this particular event, we did 32 meetings in 3 days."</i>	(G, CR)
<i>"... presents at a conference, then there is a social event afterwards, people come and approach him, then they exchange business cards; then usually they get back or the manager commits to send them information ... you get the initial meeting, then emails, then they are interested, then there is another face-to-face, you are serious now ..."</i>	(J, CMBL)
<i>"Particularly important thing for email, if you have met someone face-to-face first of all, it's quite often important to send a follow-up of some thoughts whether that's a phone or email, it doesn't matter, I tend to send an email, it's quite good to send a follow-up after initial contact or the contact just established, and go over the discussion to see if you have missed anything."</i>	(M, Cyp)

The follow-up interactions to the previous networking of Exploring Business Interests were generally exploration, confirmation and going over issues of specific business interests discussed previously. As the exploration of the patterns of using virtual modes between the Initial Contact and Follow-up within this category shows, the follow-up to network intermediaries' website visits was generally conducted via organized face-to-face meetings in biotechnology conferences, whereas those to the previous interactions in bioscience conferences were generally conducted by email and mainly related to going over and confirming the issues discussed in the previous meetings. The follow-up to the theme of network behaviour Creating Inter-personal Friendships in the initial interactions is shown in Table 6.14.

Table 6.14 Follow-up to Creating Inter-personal Friendships

Socializing and entertaining and then business discussion	
<i>"...we talk about their lives, their wives, their firms, because most of our customers are firms, and we know each other, probably have been to the house..."</i>	(D, Biot)
<i>"Me and another senior consultant were in Libya in January ... and in Egypt in February ... so with Scottish Enterprise doing that, with business missions, again we just had the initial contact, once we have that established we would do another; another senior consultant is due there in May, we've got quite a few ... we've given them proposals, and need to sit down and go through with them in more detail."</i>	(J, CMBL)

The interactions in Table 6.14 indicate that in some relationship conditions, the business topics were brought into networking processes following those social interactions between the entrepreneurs and customers. We can see that the respondents stated clearly that there were several rounds of interaction in the Follow-up in all three behavioural themes in the Linking. The detail of three themes of network behaviour which emerged in the interactions will be discussed in section 6.2.1.6 Networking Process.

6.2.1.4 Development

A repeat reading of the narratives of the follow-up interactions shows that there were some changes in the interactions compared to those in the Linking; these changes seem to show a trend of a progressive development of network relationships tending towards the collaboration. The respondents used the descriptions such as "then", "relationship grows" and "develop" to demonstrate the different status of interaction and changes in the network behaviour. In the initial reading, a free node named Development was originally considered for holding the references to those further interactions on "what and how the entrepreneurs and customers did to progress the collaboration". As the categorization is progressed, the free node Development became a placeholder node, consisting of several themes of interaction which emerged from the respondents' narratives, namely Presentation, Discussion and Negotiation, Adaptation, Looking for New Demands/Requests, Socializing and Knowing People, as shown in Table 6.15.

Table 6.15 Development

Presentation, discussion and negotiation	
"... you are serious now, let us go and sit down ... so we travelled to wherever they were ... then came up with more concrete proposal, sent that by email with all the costs and the associated timings ... so over about 3 months we built up a relationship between business development people but also the scientists, we got to know each other ..."	(J, CMBL)
"... we discussed how the collaboration would work, not much financially but more technically, what exactly they wanted to do and whether I would have them do this ... Today it is more mature, because I know better what my customer wants deeply, and we can go quite quickly into the experiment ... so they were feeling very confident if they talked to someone who knew what they were talking about."	(A, KinS)
"... it will be technical experts around the table ... Then they would go back, normally it's an email document but it describes and defines what their problem is, to make sure that we have got it right, and then describe the nature of the solution ..."	(G, CR)
Adaptation	
"... usually there is a choice of solutions, we could do it in this way, we could do it in that way, we could do it a mixture of two ways. If this result happens we do A, if there is a different result we do B ..."	(A, KinS)
Looking for new demands/requests	
"... (in face-to-face meeting) until we get the expert in front of the customer, some of them don't realise they have problems, once experts speak to them, until we ask them 'do you do this, why do you do that?', we'd say 'if you don't do X, Y would happen', they realise they have problems, so from that perspective ..."	(J, CMBL)
Socializing	
"... and set up a meeting, there is a gradation of getting to know somebody ... It makes it a lot easier when you meet someone once you speak to them."	(R, PK)
"Social events out of working time, yea ... we have visitors we'll go for dinners in the evenings stuff like that, for a drink of something ... part of working in the evening is very social ... that's very good (laughs)."	(A, Hptg)
Knowing people	
"...then we started to do phone calls discussing over the phone, then we wrote a proposal and emailed it, went backwards and forwards, so over about 3 months we built up relationships between business development people but also the scientists, we have got to know each other ..."	(G, Cly)
"... as you become more familiar with the customer ... which is the process."	(A, KinS)

According to the respondents' narratives indicated in Table 6.15, it appears that the interactions of three types of network behaviour had commonalities in the network behaviour, which include: Presentation, Discussion and Negotiation, Adaptation and Looking for New Demands/Requests in Development. The rest of the two categories, Socializing and Knowing People were characterized to follow the interactions exhibited as Dealing with Technological Problems/Requests and some interactions exhibited as Exploring Business Interests in the Linking. As this

may be related to Trust in Network Relationship and Interaction Mode, more detail will be discussed in section 6.2.2.2.

The Collaboration node was set up to hold the references to “what happened next” following those interactions in Development. It appears that more changes occurred as a result of the previous interactions, shown in Table 6.16 and those changes signalled a crucial and serious step that made the two network partners get closer and commit to each other for joint activities towards new product development. Thus the node became a placeholder and titled as Collaboration to contain the references regarding those interactions related to the formation of collaboration. The respondents’ narratives seemed to show that there was not much difference among the three types of network behaviour on this point; several key themes emerged in Collaboration.

Table 6.16 Collaboration

References to the interactions of two network partners getting into and progressing commitment to each other	Node Definition
Clarification and revision	
<i>"... we got to know each other, then we went on to the stage where we produced a legal agreement, so that was between me and their business development guys backwards and forwards with the email drafts ... it came to me, to make changes ... and sent it, it was a negotiation via electronic medium ..."</i>	(J, CMBL)
<i>"So that goes back to the customer, they consider that if ... there may be another tele-conference call to amend particular protocols ..."</i>	(G, CR)
<i>"... that is usually done with PDF file or Word file of an email ... sort of thing, when you do contracts, they will be discussed as word documents and amended until we are happy ..."</i>	(A, KinS)
Signing contract	
<i>"... then we got the agreement we were happy with, and got it printed and signed."</i>	(J, CMBL)
<i>"... after that, there will be an agreement in place ..."</i>	(G, CR)

The two main categories of networking in the Collaboration are Clarification and Revision, and Signing Contract. The first category contains those interactions of seeking and preparing for legal agreements. Backward and forward interactions of clarification and revision of the contract drafts indicate the processes of reaching the agreements. Signing a contract emerged as the outcome of the previous network interactions. The quotations presented below show further

changes occurred in the interactions after the contracts were signed, as the respondents noted:

"... They will send us the compound or whatever they want us to develop ... or the information they want us to prepare a report regarding the judgement, so all that discussion is either via email or phone." (G, CR)

"... Innovation is then translating more customer needs into technology that has previously been applied in this area." (R, PK)

Further collaboration was confirmed by the interactions of signing a contract. As a result of the previous interactions, the SMEs (as suppliers) in the sample generally started to produce the new products based on the revisions made to the existing ones integrated with customers' requests. This finding is congruent with Roger (1990)'s references on incremental innovation process in terms of the production of new products, in that the implementation of the legal agreements and the production of new biotech products occurred relatively quickly in supplier-customer network collaboration in incremental innovation.

6.2.1.5 Maintaining the Contacts

This node was a free node created to contain the interactions which followed those of Collaboration; more changes took place in the interactions with customers after the use of new products. The entrepreneurs were involved in a series of interactions relating to the after-sales of new products; these interactions can be summarized into a few groups, shown in Table 6.17. Through the interactions of Technical Training, Gathering Feedback, Providing Advice on Using New Products, Updating Information, Maintaining Links to the Third Party Referrals, Maintaining Links to the Bioscience Community, Socializing and Seeking for New Problems/Requests/Interests, the entrepreneurs and customers remained connected, reflecting a sort of network relationship state of Maintaining the Contacts.

Table 6.17 Maintaining the Contacts

References to the interactions relating to after-sale of the new products	
Technical training	
<i>"on top of that, we do training, sometimes we send myself or Dr... and we often go out to chemical companies, oil companies to give training courses to their staff on the aspects of microbiological analysis, so we may go for a day to a week to the clients' offices ... so again we have a direct face-to-face contact ... but to do the training side, so again just adds the complexity ..."</i>	(I, CMBL)
Gathering feedback	
<i>"We identify the scientific conferences where our customers will be, the ones we choose are the trade exhibitions ... some of the existing customers will come up and talk, say 'hello', give feedback on the products, how they use them and what problems they had. That sort of thing, it's very much face-to-face to be honest."</i>	(M, Cyp)
<i>"We have developed questionnaires which we can send ... they come back with the information so that we can refine what service we can offer ... The speed of the process keeps the costs down which means we can develop our products and focus on the development of products into the key areas as well ..."</i>	(P, Alb)
Providing advice on using new products	
<i>"... once they have used the product/or service, we prepare a report for them, we send it electronically with our recommendations. We are moving towards sitting down with them, because a lot of our recommendations, we can help them implement."</i>	(J, CMBL)
<i>"We have quite a few conference calls with them, they are over in Washington, very effective, but we backup all these by visiting customers mostly ... our chairman will go and visit people, because it's better to sit face-to-face and look at their problems and understand what they really have, because our products sell for a lot of money ..."</i>	(P, Alb)
Updating information	
<i>" ... Every time we bring new products, we'll email details ... sales ... the number of customers they are selling to ..."</i>	(M, Cyp)
<i>" (in face-to-face) we talk about all sorts of thing, we normally start to talk about their particular project we are involved in ... how is it going, where the time lines are ... then we talk about new work coming down the line, competitor activities ..."</i>	(G, CR)
Maintaining links to the third party referrals	
<i>"... as a company with 7 people, we can't maintain contact with all of those people ... we use local distributors, maintain relationships with them ... because most of the market for the products is not in the UK ... we maintain regular contact mostly by email, but we occasionally visit and go out with them or they come here."</i>	(M, Cyp)
<i>"... I have also set up meetings between myself and Scottish Enterprise with the trade missions ..."</i>	(P, Alb)
Maintaining links to science community	
<i>"(by email newsletter) The first one, the European one found us by Bio-Dundee update which was a local e-newsletter, covering clients all over the world ... they have got big mailing list ... It has its own regular meetings, seminars, committee meetings ... every few months they bring out newsletters ... they contacted us."</i>	(M, Cyp)
<i>"could be anything, depends what comes up really, still mainly focus on the business; but there would be elements ... if we have been to a conference where there has been a dinner, we'd tend to talk to people involved, social is involved ... if some of my contacts who know the families if it is relevant you talk about it, but it's not something you can formulate, you talk about whatever comes up."</i>	(R, PK)

Table 6.17 shows the cognitive aspects of network interaction such as technical training, gathering feedback and providing advice on using new products, updating information of what happened in the enterprises, maintaining the links to the third party referrals and bioscience communities after new products were used by customers in incremental innovation processes. Through these interactions the network partners remained in contact. In addition, seeking out emerging new problems/requests/interests for potential collaboration was also the content of network interactions, as indicated in Table 6.18.

Table 6.18 Seeking for New Problems/Requests/Interests

<p><i>"Every time we bring new products, we'll email details ... quite a lot of customers coming with the suggestions on the new products or queries about using the products all those go by email, nearly all emails. So they email us about the questions, we email back, if it's very urgent then occasionally by telephone, but nearly all by email."</i></p>	<p>(M, Cyp)</p>
<p><i>"...when we go and visit, if we are in the area, for example, we'll try to go and see them, because you pick up a new business just because of having a conversation, having a coffee ..."</i></p>	<p>(G, CR)</p>

Table 6.18 shows that in general, email was used as an interaction mode to send and receive information on new products or queries about using new products; while face-to-face interactions generally incorporated social activities attached to the intention of seeking potential opportunities for more innovations. Apart from the cognitive aspect, the respondents also emphasized socializing as one of the themes in the interactions, as Table 6.19 shows:

Table 6.19 Socializing

<p><i>"... if you have got customers visit, when you go out in the evening, you ask what life is like in the US this type of thing. You may have a meal in the restaurant ..."</i></p>	<p>(M, Cyp)</p>
<p><i>"People I know very well ... I can go out with them for a beer in weekend ..."</i> <i>"... when we go and visit ...talk about all sorts of things, we normally start to talk about their particular project we are involved with, so that would be normally the starting point ... then we talk about competitor activities, state of the nation, all sorts of things, but at that stage, you are really relaxed with each other."</i></p>	<p>(C, Biot) (G, CR)</p>

Table 6.19 indicates that socializing could be seen as part of the network interactions in maintaining the contacts after discussions of the cognitive aspect

of the innovations, and these were generally conducted in face-to-face meetings. The content of network interactions in the Maintaining the Contacts might not emerge all together in one meeting or email message, they might emerge in different meetings/or email messages at different times. In addition, these themes are not separate from each other, very often one theme of the interactions is integrated with another. For example the interactions of gathering feedback, and providing advice on using new products or updating information might be integrated with and have taken place in one face-to-face meeting in a conference. It depends on other factors of the collaboration in incremental innovation such as whether customers had complex technological problems, the needs of network relationships and/or interaction mode employed; more detail will be discussed in section 6.2.2.2 Inter-personal Trust and Virtual Interactions.

This section demonstrates the key components which emerged from the data and which were related to the progressive changes in the networking processes. These key components are summarized in Table 6.20.

Table 6.20 Key components of Networking Process in Collaboration for Incremental Innovation

<p>Antecedents</p> <ul style="list-style-type: none"> ○ Corporate website visits ○ Internet search ○ Leaflets, brochures& newsletters ○ Previous face-to-face experience ○ External references 		<p>Linking</p> <ul style="list-style-type: none"> ○ 'Dealing with Technological Problems/Requests' ○ 'Exploring Business Interests' ○ 'Creating Inter-personal Friendships'
<p>Development</p> <ul style="list-style-type: none"> ○ Presentation, discussion & negotiation ○ Adaptation ○ Looking for new demands/requests ○ Socializing ○ Knowing people 	<p>Collaboration</p> <ul style="list-style-type: none"> ○ Clarification & revision ○ Signing contract ○ Implementation of contract 	<p>Maintaining the Contacts</p> <ul style="list-style-type: none"> ○ Technical Training ○ Gathering feedback ○ Providing advice on using new products ○ Updating information ○ Maintaining links to the third party referrals ○ Maintaining links to science community ○ Socializing ○ Seeking out new problems/requests/interests

The preliminary analysis has shown that these categories represent a series of gradual changes in the interactions and have led to the success of collaboration for incremental innovation. Those changes in the interactions demonstrate a process of networking. The next section will discuss the networking processes based on the categories in this section.

6.2.1.6 Networking Process

The discussion of the networking processes in this section is based upon the key components which emerged from the data. The entrepreneurs had some past experiences of undertaking certain actions/or activities, which served as the Antecedents to the initial dyadic interactions. In the section of Linking, through the use of interaction modes (Table 6.9 - 6.14), the entrepreneurs and customers had the initial contacts. There seemed to be three types of behaviour in network interactions in their Linking. Although the network behaviour of each entrepreneur was different from one another, yet according to the main characteristics which emerged in the interactions, they can be categorized into two extreme categories, Dealing with Specific Technological Problems/Requests and Creating Inter-personal Friendships; those of Exploring Business Interests which bore some behavioural characteristics of the above two groups were located in some points between the two extremes.

Network interactions of Dealing with Specific Technological Problems/Requests were derived from customers' particular technological problems/requests or the entrepreneurs' specific interests relating to the potential new products. In the episode of Linking the network actors had clear objectives in the interactions, e.g. the respondents used "target", "particular", "focus on" to describe the interaction objectives which were dealing with technological problems and were attempting to satisfy the demands for potential new technological product development. The backward and forward interactions were mainly the transformation of specific technological information and included explanations of particular technical details. The respondents showed that several rounds of exchanging technical information enabled them to understand problems/or requests, thus they were able to

identify primary common interests and mutual benefits. These emerged as a crucial step to progress the collaboration. The importance of these interactions was highlighted by the respondents, for example "the most important information", "got a product they may want to buy", "very focused on ... technology is extremely important", shown in Table 6.9 and Table 6.12. Apart from emails and phone calls, face-to-face presentations were also conducted for the clarity of the technological details in the Linking.

Another theme of behaviour is Creating Inter-personal Friendships, the other extreme of networking style compared to Dealing with Specific Technological Problems/Requests. This is categorized and shown in Table 6.11 and 6.14. This style of behaviour reflects a different interaction approach and is in contrast to the first one. As its name implies, the interactions were to establish inter-personal friendships and intimacy instead of exploring specific technological problems/or requests or interests in the initial interactions. Inter-personal understanding, friendships and intimacy building were the key characteristics of the interactions. The respondents attended social meetings or events and exchanged inter-personal private information such as talking about "family", "wives" and focused on getting familiar with and gaining inter-personal knowledge of each other. Although general business information might also be exchanged in the interactions, the respondents seemed to highlight the affective/emotional aspects as the focus which served as the characteristics of the interactions of this style in the Linking. They indicated that a considerable effort and time were invested in the interactions of affective/emotional aspects before collaborations were incorporated with the discussion of technological issues and were able to proceed. For example the respondents described "a large amount of face-to-face meetings", "write to ... and send to ... and visit ..." to indicate the interaction processes, as shown in Table 6.11 and Table 6.14 and these seem to illustrate that this approach involves a lengthy process of developing inter-personal relationships in the beginning of the networking process.

However, going back to examine the interactions to explore the idea of the categorization further, it turned out that not all of the network behaviour fits

neatly into one or the other category. Rather many fell somewhere in between those two extremes. In practice, network interactions classified as such may not bear all the behavioural characteristics. Yet, the classification serves as exemplifications by which to capture the characteristics and behaviour of the network actors. For example, if we compare 5 network relationships of behavioural style of Dealing with Technological Problems/Requests and 4 of Creating Inter-personal Friendships to 7 of Exploring Business Interests, it shows that the latter 7 relationship examples seem to present neither the characteristics of network behaviour of Dealing with Technological Problems/Requests nor those of Creating Inter-personal Friendships. As will be indicated below, a majority of the cases of behaviour style of Exploring Business Interests were not totally located in the middle but possessed certain tendencies of Dealing with Technological Problems/Requests or Creating Inter-personal Friendships in terms of the network behaviour exhibited. These in-between cases nevertheless appear to possess certain characteristics to some extent of either behaviour style, in that the entrepreneurs did not seem to focus on solving technological problems/requests nor did they focus on generating inter-personal friendships in the Linking, shown in Table 6.10 and 6.13. Although being different from the two styles of network behaviour, the interactions of Exploring Business Interests share some similarities of both styles and had certain tendencies to incorporate both socializing and technological discussion.

An investigation of the details of network interaction in the Linking also shows a behavioural characteristic emerging from 5 relationship narratives of Dealing with Technological Problems/Requests and 2 of Exploring Business Interests, in that the exchanges of general business as well as specific technological information were to some extent limited in the initial contacts, as the respondents described: "trying to keep them to minimum ...", "exchange of a little bit of information ...", "not going to tell them everything ..." (I, Alb). This seems to indicate that the information flow in network interactions is related to the network relationship progress. In the early stage of the collaboration when network partners were in the process of getting to know each other, the information flow is constrained by limited trust between boundary spanning individuals. More detail of trust process will be discussed in the next section 6.2.2.

In addition, tacit knowledge exchanged at this stage was also limited in terms of the depth and scope of technical details, for example the respondents used “the technical details of the particular problem ... so we get together, that’s basically to understand the problem, the detailed, the technical detail of the problem”, “... require a lot of research to understand the mechanisms behind a particular problem ...”. The tacit knowledge that had been exchanged was mainly to form the entrepreneurs’ understanding of the technological problems and to offer the preliminary explanation of solutions. This showed a general picture of how the entrepreneurs would go about the innovation in the early stage of collaboration, since there was some work such as brainstorming, literature search and thinking of more specific and detailed solutions which followed and involved more tacit knowledge to be exchanged later.

Comparing network interactions of all three behaviour styles, it is clear that there is a pattern showing a progressive and developing process in the relationships. This is demonstrated by the changes between the interactions in initial contacts and follow-up, the respondents used “initially ... and then”, “then... at this stage”, “it’s what we can do the work at this stage ...”, “you have more to say as you go longer ...” to express the changes in the processes. Thus, from a holistic perspective of the networking process Linking may be viewed as representing a relationship stage, characterized by limited information flow, tacit knowledge exchanges and limited inter-personal knowledge. Within this stage network interactions were dynamic, complex, with different behaviour focus and changes over time. Hence, the insights gained within the stage can be viewed to reflect a relationship state – dynamic and complex. The interactions that enabled the dynamic and complex relationship status have generated relationship outcomes. These outcomes include the awareness of technological problems/requests and general business interests, the identification of common interests and mutual benefits, and they are shown in Table 6.9 to 6.14 Initial Interactions and Follow-up of the Linking, for example “... ‘I get interested ...’ ‘yes’...” (G, CR), “... to show the interests ... presenting data ...” (G, Cly), “can you help us identify this ... basically to understand the problem ... go and think of solutions” (G, CR), “... ‘do you do this sort of thing?’ ... we adapt the test to them ...” (J, CMBL). The

entrepreneurs' proposals for technological solutions to customers' requests that would result in revising the existing products were the crucial steps towards the generation of new products.

As far as the use of virtual interaction mode in the processes is concerned, it appears that there were clearly differences between the themes of Dealing with Technological Problem/Request and Creating Inter-personal Friendships in the Linking stage and in that email exchanges emerged as the main virtual interactions of the Dealing with Technological Problems/Requests, and face-to-face meetings in social context were the main interactions of the Creating Inter-personal Friendships. Those interactions of the style of Exploring Business Interests were mainly conducted through face-to-face meetings in the context of bio-science community or other social context; virtual interactions through network intermediaries' websites also helped the selection of potential customers prior to the meetings. More details of the use of virtual interactions will be presented in section 6.2.2.2.

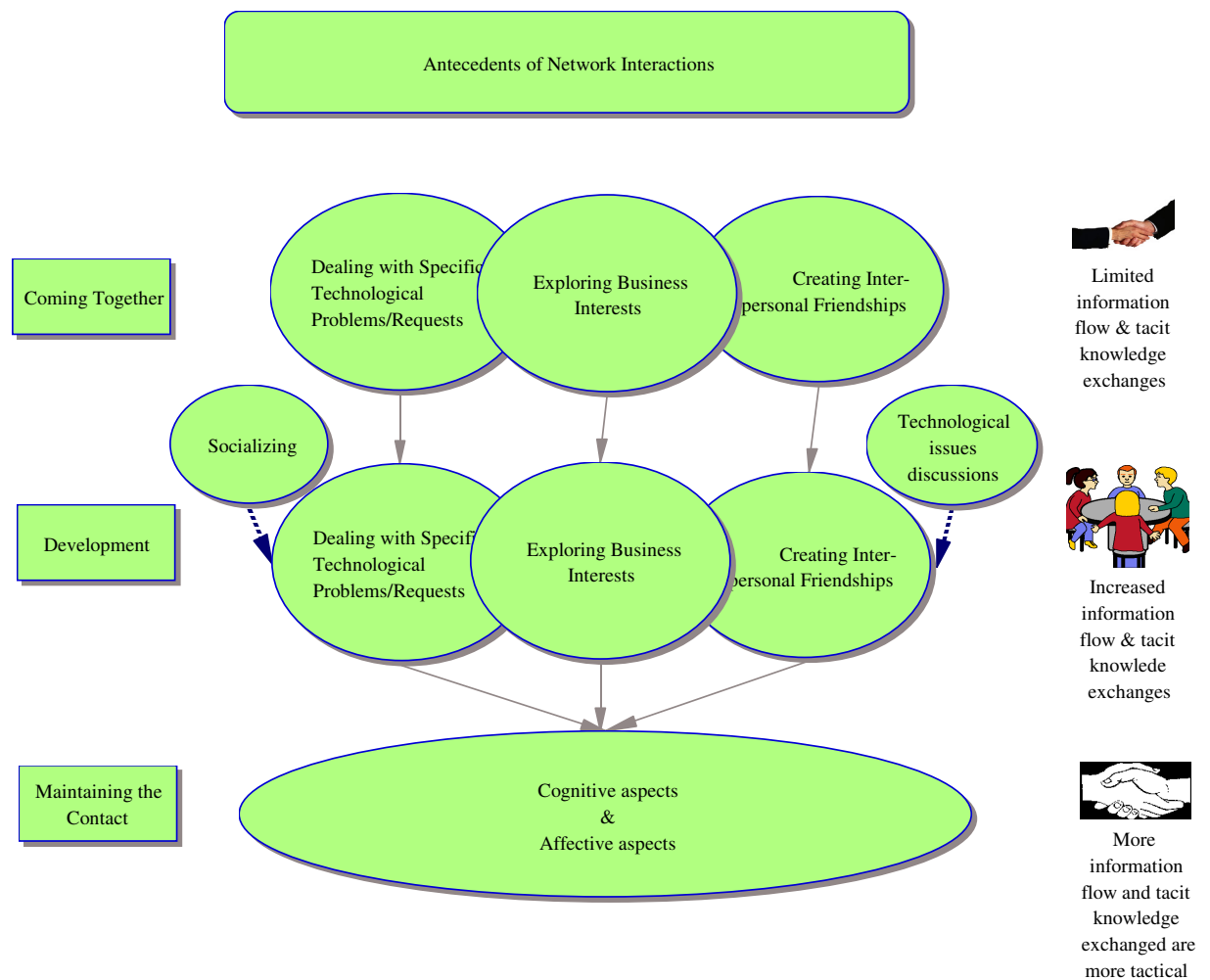
Changes also took place in the interactions after the Linking; the entrepreneurs were actively engaged in a series of interactions in the Development, for example presentation, discussion and negotiation to progress the collaboration, shown in Table 6.15 and the previous explanations. In the Development, two notable characteristics of the interactions, Socializing and Knowing people, followed those of Dealing with Technological Problems/Requests and one case of network interactions characterized by the Exploring Business Interests style in the previous stage, the Linking. Through frequent network interactions of cognitive aspects of incremental innovation, technological issues in the Linking stage, the entrepreneurs and customers got closer to each other and the network interactions in the Development then integrated with social information exchanges and shared social activities. These changes in Development were characteristic of those network relationships having the network behaviour, Dealing with Technological Problems/Requests in the Linking stage.

An examination of the interactions of those relationships that were characterized as Creating Inter-personal Friendships in the Linking, shows that cognitive

aspects of product innovation were integrated into the interactions in the Development; for example the discussion of technological issues and proposals, shown in Table 6.15. We can see that boundary spanning individuals gained more information about the individuals they were dealing with in terms of cognitive and affective aspects of incremental innovation.

Referring to tacit knowledge exchanges in the Development, it was shown that comparing to the Linking, there were more tacit knowledge exchanges occurring at this stage, and this is demonstrated by the complexity and depth of technical knowledge transferred in the interactions, for example, the respondents emphasized "... you are serious now, let us ... sit down ... then came up with more concrete proposal ...", "... describe the nature of the solution ... there is never a straightforward answer ...". The outcomes of these interactions in the Development were the production of legal agreements and signing contracts which led the networking to the next stage. The entrepreneurs and customers maintained the contacts after the sales of new products, and several themes revealed further changes in the interactions. Figure 6.1 indicates the discussion of the changes taking place in different network behaviour at different stages in the networking process.

Figure 6.1 Networking Process in Collaboration for Incremental Innovation



In Maintaining the Contacts stage, the network relationships that had different themes of behaviour in the previous stages share great similarities, indicated in Table 6.17. The interactions were related to both cognitive and affective aspects of generating incremental product innovation. Cognitive aspects of interaction include technical training, gathering feedback, providing advice on using new products, updating information, maintaining links to the third party referrals, maintaining links to the bioscience community and seeking out new problems/requests/interests, whereas affective aspects of the interaction consist of socializing. It appears that there was more tacit knowledge exchanges in Maintaining the Contacts, this is manifested by the complexity and depth of technical knowledge involved, for example, the respondents expressed "... to give the training courses ... the aspects of microbiological analysis ... to the clients'

offices ... have direct face-to-face contacts ...", "to sit face-to-face and look at their problems and understand what they really have ...".

However, the interactions of the cognitive aspects were not completely carried out in separation from those of the affective aspects in Maintaining the Contacts. Some interactions of maintaining links to the third party referrals, maintaining links to the bioscience community and seeking for new problems/requests/interests were shown to integrate with affective aspects of Socializing. More detail of whether and how cognitive and affective aspects were integrated in network interactions will be discussed throughout the rest of sections in this chapter. It seems that they are related to the trust process, different network relationships, the interplay of trust and interaction modes and individual characteristics. The outcomes of networking in Maintaining the Contacts appear to have impact on the entrepreneurs' future product innovation from a long-term perspective; for example the links remained as the interactions were carried on. In general, the interactions in Maintaining the Contacts appear to be less frequent than those in the Linking, the respondents described: "... regular meetings or seminars ... every a few months they bring out a newsletter ...", "... if there is a conference for us going to ..." (G, Cly), "... if you have got customers visit ..." shown in Table 6.17.

As discussed earlier, comparing network interactions in the initial contacts and follow-up in the Linking, some changes occurred in the follow-up. It emerges that changes also occurred in the interactions in the Development and Maintaining the Contacts. Network interactions in each of these categories appear to have generated different outcomes respectively. These outcomes exhibited a progressive process of collaboration, in that boundary spanning individuals commenced interacting with each other with limited knowledge and the information flow was limited. As frequent interactions were carried on, the formation of common interests and identification of mutual benefits were the outcomes of the Linking. Based upon common interests, boundary spanning individuals interacted further and the processes allowed for more information flow and increased knowledge in terms of both cognitive and affective aspects of generating incremental innovation. Collaboration was the outcome and signalled

the network partners' commitment. This was followed by the production of new products and customers' purchase of new products. This sub-process appeared to occur quickly in incremental innovation processes in supplier-customer networks once collaboration was confirmed. The subsequent network interactions were shown not only to have an impact on incremental product innovation at the time, but also the entrepreneurs' future innovation practices from a long-term perspective, such as more incremental innovation and other entrepreneurial opportunities embedded in the established customer networks. Hence, speaking from a holistic perspective of the collaboration, the progress includes several relationship stages, namely Antecedents, Linking, Development and Maintaining the Contacts; and each stage contains a dynamic and complex relationship state which was characterized by a changed content of network interactions. What has been discussed in the foregoing is a series of snapshots of each state at a micro-level of network interactions. Detailed analysis of network interactions at macro-level will be included in those sections from 6.2.2.2 to 6.2.2.5.

So far we have gained an understanding of what the process of collaboration in incremental innovation is by revealing the key components and by examining how the process is progressed. If network interactions with changes in the process have led to the success of collaboration for generating incremental innovation, then a question arises, "why is the process of collaboration a staged process?" A review of the literature in Chapter Two and Three has suggested that part of what network interactions generate is network relationships and trust is identified as the key element in determining the success of collaborative relationships. As the presentation of the second layer of the data, the next section will further examine trust. In doing so we may be able to understand the "how" and "why" underpinning the networking process, emerging from the data.

6.2.2 Trust in the Networking Process of Incremental Innovation

A reflective reading of the data related to the development of interactions suggests that there was an emergence of trust throughout the process. The discussion of this section will demonstrate the presence of trust and how it

evolves as a process. The investigation is carried out by an examination of the elements of trust, emerging from network interactions in the collaboration. First of all, the investigation will focus on the manifestation of trust in the Linking stage, and then it will study trust in the Development and Maintaining the Contacts stages. The analysis of the trust process is conducted not only by discussing the manifestation of trust, but also by linking the relationship context in terms of networking development process within which the elements of trust are manifested.

6.2.2.1 Process of Trust

The presumptive trust (e.g. reputation, individual identity) that was limited and shallow in the Linking is manifested by the evidence of customer's willingness to interact and their expectation of/or confidence in the entrepreneurs, these are shown in Table 6.9 - 6.11. As noted in the earlier sections, there are three main styles of networking behaviour in the Linking, namely Dealing with Technological Problems/Requests, Exploring Business Interests and Creating Inter-personal Friendships. Reflective reading shows clearly that customer expectation emerged as presumptive trust in all three types of behaviour, and that there were two types of expectation, as shown in Table 6.21.

Table 6.21 Expectation

References to the anticipation of network partner in the Linking	Node definition
Expectation of solving technological problems/or requests	
"... the US ... came back, 'can you deal with this particular problem' and that was on the email, we went back and said 'yes, this is what is going to happen, this is how it is going to break down, this is what is going to come out of it', because that helped, one word, response was quick. So you know that actually makes us think, so it actually helps in some way ... "	(I, Alb)
"... (the customer) ask us if we can help them with their particular problem, so that's asking for help. Now we'd normally say 'yes' on that ... in terms of innovation, the step requires innovation, innovative thinking ... They use email or phone ... "we need to know the technical details of the particular problem."	(G, CR)
"... you get a request focused on the problem and the solution, not the price."	(A, KinS)
Expectation of business collaboration	
"well, the customer obviously has to have a need ..."	(P, Alb)
"When the Japanese companies came over to Aberdeen, they were assessing potential partners in the UK to work with ..."	(I, CMBL)

Customers' expectations included solving particular technological problems/ requests or other business needs in the beginning of network relationships. These expectations were work-related issues, in other words, the cognitive aspect of trust. The motivation of customers and the entrepreneurs entering into a collaborative relationship was derived from a cognitive aspect of trust. Such presumptive trust was necessary to initiate network relationships and interactions in the beginning of collaboration when there were uncertainties and ambiguities between the partners.

Uncertainties and ambiguities were caused by the nature of the collaboration for incremental innovation. On the one hand, network relationships that were related to new product development were oriented in the biotechnology industry. The importance of product innovation to an enterprise created relationship uncertainties in the beginning of collaboration. Network partners were cautious about sharing some critical technological information which might be important to the generation of innovation and technological know-how which could be the core competences of an enterprise. This was typical where a network partner was in a relatively superior position in the relationship in terms of technological inputs and/or possessed unique technologies in certain areas of biotechnology industry. As the respondents expressed:

"... we maintain the secrecy and confidentiality of our technology, we protect our technology ..." (A, Alb)

"... if you open up too much, everybody understands what you are doing, and innovation can be stolen very quickly ..." (P, Alb)

We can see that the collaboration had its unique characteristic, that is, the relationships context of product innovation within the biotechnology industry. The context within which network interactions took place appears to have a critical role to play in influencing the information flow and knowledge transfer in the beginning of the relationships. Hence, the presence of trust and trust building and development are extremely important. The limited information flow and

knowledge transfer were due to the lack of trust between boundary spanning individuals at the outset of the relationships.

On the other hand, relationship uncertainty counts due to the fact that the network partners had little knowledge of each other at the time. There were questions of individual reliability and honesty, and therefore associated risks:

"... asked all sorts of question, very searching, 'how are you, what's happening', and all the rest of it ..." (I, Alb)

'... we know for a fact, our chairman was with ... and in their office about 6 weeks ago, prior to his going, they phoned (a company that was a third-party) and said 'who are the guys, who is ...? Are you doing this?' and they check this out." (P, Alb)

These two main sources, bio-product innovation and relationship uncertainties seem to suggest that the presence of inter-personal trust and its development were essential for the relationship development in the early stage; more detail of inter-personal trust will be discussed in section 6.2.2.2.

The presumptive trust that was cognitive was formed based upon various activities/actions in the Antecedents, highlighted in section 6.2.1.1. The entrepreneurs generally combined ways to build trust with customers:

"... some customers ... will check the website out or they will speak to (a third party) ... the company that does our testing DSTL, they are one of the top listing testing house ... so quite often the customer will say 'who is doing your ... agent testing?'" (P, Alb)

The corporate websites enabled the delivery of relevant information regarding products, markets and organizations to customers and facilitated the formation of customers' understanding of the enterprises. The existence of a corporate

website itself and the fact of presenting the organizational portfolio to the public to some extent indicate the legitimacy and credibility of an enterprise:

"(the company's website) which everybody can see ... We spoke to BP ... everyone can see it in the company ..." (C, Biot)

The entrepreneurs built credibility through third-party referral and positive word-of-mouth. We can see that the entrepreneurs generally used various approaches to build trust as well as making decisions to trust:

"... two or three ways, from previous experiences, so we touch people there; we've contacted some key government agencies that pool the companies together so as to make sure that they get the right contacts; and we go up online and check out the websites that you can register your company with via the service. Again if we have to go and visit them to do it, it'd be too expensive, so we can do it online through each website." (P, Alb)

"so in terms of new business, the customers come, they know what we can do, which they got from the website, market material, from other people they talk to, yea we go out, actively market and present the company; we present at scientific meetings, so it's a whole marketing push, to tell people what CR can do, so the customers who come to us know what we can do ... There are customers who don't know what we can do, but they are sufficiently motivated to give us a call, ask us if we can help them with their particular problem ..." (G, CR)

The example shows that the decisions to trust were made upon a combination of approaches, for example past experience was used as one of the sources of connection to customers and it also became the stock of knowledge for evaluating trustworthiness. The third party of "key government agencies" was employed as a reference. Internet Search reflected the entrepreneurs' proactive attitude to innovation opportunity and trust. The knowledge and information obtained were at individual as well as inter-organizational level and upon these

the entrepreneurs were able to judge the trustworthiness, make decisions on whether to trust and whether to be engaged in further interactions.

Nevertheless, the presumptive trust which was formed through various sources was limited at the start of the relationships, as respondents commented:

"... in the initial stage, everybody would be much more guarded ..."

We can see that the presumptive trust was shallow at the start of network relationships. The network partners were not open to each other. The discussion of the Linking in the last section also highlighted the limited flow of information. If a network work relationship was to be sustained, the presumptive trust would need to develop. The next section will examine how trust is built and developed in the networking processes.

6.2.2.1.1 Trust Building

An investigation was made into those interactions in the Linking in order to reveal how trust was built. As shown and discussed in section 6.2.1.6, there were two extremes of network behaviour in the beginning of network relationships, Dealing with Technological Problems/Requests and Creating Inter-personal Friendships, and Exploring Business Interests is located at different points between the above two and blends the characteristics of both. These different styles of networking appear to reflect the entrepreneurs' different ways of building trust, based on presumptive trust.

6.2.2.1.1.1 Technical Approach

The two-extreme categories of network behaviour, in fact, represent two approaches to trust building. As discussed in section 6.2.1.6 Networking Process, the style of network behaviour in Dealing with Technological Problems/Requests

in the Linking focuses on cognitive trust building. There were 5 network relationship examples which bore the characteristics of such a pattern. It was clear that network partners were highly motivated and capable of transferring the relevant technological information. The entrepreneurs formed the awareness of customers' expectation through the exchanges of technological information, as Table 6.22 shows:

Table 6.22 Awareness

Awareness of expectation of solving technological problems/requests	
<i>"... they had two particular problems over there and couldn't deal with, we have come up with potential solutions ...we went back and said 'yes, this is what is going to happen, this is how it is going to break down, this is what is going to come out of it ..."</i>	(I, Alb)
<i>"... the customers come ... 'can you help?' there is normally a problem with drug metabolism, toxicity, lack of accuracy or a measure of a particular bio-chemical characteristic of their compound.' ... 'but we need to know the technical details of the particular problem.' then I may phone to arrange a particular event, either a meeting or a conference call ..."</i>	(G, CR)
Awareness of legislation of developing technological products	
<i>"... we want to develop the products which are environmentally safe to use, we are very aware of what is under-appreciation and the potential our products have, we are aware of what the green-house content of our products is ... we do try to produce these products that have these ..."</i>	(D, Biot)

The entrepreneurs demonstrated the reliability of their technological competence in accomplishing the tasks by showing their understanding of customers' expectation of solving technological problems/requests and providing the explanations on proposed solutions in professional and technical language.

Their explanation and demonstration of technological issues showed their in-depth understanding of the relevant technologies, understanding of the legislation in developing technological products and experiences of practical technological knowledge in the industry, as the examples in Table 6.23 show:

Table 6.23 Reliability of Competences

<p><i>"... there was telephone conversation first of all, then face-to-face meeting. So we had answered those questions, taking from there ... 'yes, this is what is going to happen, this is how it is going to break down ... response is quick ..."</i></p>	<p>(I, Alb)</p>
<p><i>"... in terms of new business, the customers come, they know what we can do ... to tell people what CR can do ..."</i></p>	<p>(G, CR)</p>
<p><i>"... we are talking about drug development programmes that have serious scientific input, so it's not like just buying a pen or something like that, so what you have to do is you send them ... you know who these people are because they have been around in various scientific meetings ... give presentations on a more formal basis."</i></p>	<p>(G, Cly)</p>

The demonstration of reliability in competences not only occurred at the start of the relationships but also before the initial interactions. As discussed earlier the building of trust had actually commenced in those actions/activities in the Antecedents and the network actors had formed the presumptive trust prior to their interactions in the Linking.

To develop network relationships, creating customer satisfaction was also an element of trust building. Being capable of understanding what customers' needs were, possessing the awareness of technologies, the awareness of legislation and demonstration of reliability in competence yielded customer satisfaction and confidence in worked-related issues, as Table 6.24 shows:

Table 6.24 Creating Customer Satisfaction in Work-related Issues

<p><i>"Once you meet them, and are happy about, phone them up again or email ..."</i></p>	<p>(M, Cyp)</p>
<p><i>"... complementary, we give them differentiation and added value ..."</i></p>	<p>(J, Rmd)</p>

As Table 6.24 shows, customer satisfaction came from the discovery of complementary resources, provided by the entrepreneurs and which customers did not have in terms of entrepreneurs' capabilities and technological competence that created value. Customer satisfaction generated the confidence and willingness for further interactions, they then became an element added to the property of trust that has been built over time. As such, the property of trust grew to be richer and functioned to enable customers to have more expectation and to move the network relationships forward.

Based on the flow of technological information and knowledge, both network partners were able to identify their own complementary resources, and thus common interests and mutual benefits. The formation of common interests and mutual benefits was the key point of the entrepreneurs and customers getting closer, in the meantime it signalled the formation of bonding between network partners. As the respondents indicated in Table 6.25:

Table 6.25 Bonding by Common Business Interests and Mutual Benefits

<p><i>"... we got together; because we both recognised this mutual benefit here." "... ask us if we can help them with their particular problem, so that's asking for help. Now we'd normally say 'yes' on that ..."</i></p>	<p>(I, Alb) (G, CR)</p>
<p><i>"If someone I haven't met before, I'd talk, identify the interests, the products, and applications of the products, to get something a bit of interest, and then after the interest, open a dialogue."</i></p>	<p>(R, PK)</p>

Apparently the formation of bonding that was based on common interests and mutual benefits was mainly determined by the cognitive aspect of new product development. However, a further examination of those interactions of Dealing with Technological Problems/Requests shows, although the cognitive aspect of new product development was the orientation of the interactions in some relationships in the Linking, yet this does not mean that cognitive trust was the only relational artefact yielded. Affective trust such as honesty also emerged through the interactions and played an important role in the boundary spanning individuals' decisions on setting further expectation. In some network relationships, the partners had had past face-to-face experiences with each other in the Antecedents prior to the occurrence of specific technological problems/requests:

"... There was telephone conversation first of all, then face-to-face meeting. So we had answered those questions, taking from there ... then we had the US came back 'can you deal with this particular problem' and that was on the email ..." (I, Alb)

"... you know who these people are because they have been around in various scientific meetings or business development meetings, what you do is you target ..." (G, CR)

Past face-to-face experience was shown to allow the entrepreneurs and customers to have inter-personal knowledge of each other. The inter-personal knowledge gained reduced relational uncertainties and facilitated the trustor to judge whether the trustee was a reliable person. Face-to-face meeting was the interaction mode highlighted for such a discovering process. In addition, the interactions in the Linking by face-to-face meetings also emerged to be closely connected with the need to exchange personal knowledge, as shown in Table 7.9 of Initial Interactions in the Linking.

The formation of bonding that was based on common interests and mutual benefits was, in fact, a result of both cognitive and affective trust building. Such bonding then served as a part of the trust which was developing and enabled further expectation and interactions towards the common goals. This was a crucial step to progress the collaboration for incremental innovation. Customers' and the respondents' common interests to further develop proposals for technological solutions to the problems/requests served as a cornerstone for the generation of incremental innovation. As the respondents expressed:

"Once scientists know the problem, we go on to handle it ... basically and think of solutions. That's a big innovative step, that's where innovation comes up ... the whole solution of the problem." (G, CR)

The identification of common interests was not only the interaction outcome of Dealing with Technological Problems/Requests network behaviour style, but also the other two styles of network behaviour, namely Creating Inter-personal Friendship and Exploring Business Interests, shown in section 6.2.1.6. Common interests would drive both partners engaged in future activities related to the revisions of the existing products and the development of new products. This was as a result of a process of networking over time.

This section has discussed the approach of cognitive trust building in the Linking stage. This approach was exercised through the entrepreneurs' intensive backward and forward daily or weekly interactions of focusing on technological issues, including the use of both emails and face-to-face meetings. In some cases, video-conferences were also used for discussing technological issues. Although the interactions were with a focus on the cognitive aspect of trust building, the affective trust in terms of the entrepreneurs' individual reliability also emerged which determined the progress of network relationships contributing to the formation of common interests. Without either, the relationships and interactions would not continue to develop.

Network behaviour style of Dealing with Technological Problems/Requests, discussed above in fact represents one of the entrepreneurs' networking approaches, as a strategy for collaboration in the generation of incremental innovation. The interactions began with technological issues and accordingly the entrepreneurs focused on dealing with these work-related issues in the early stage. It is considered that this networking approach can perhaps be labelled as Technical Approach. The characteristic of this approach was shown to mainly focus on the cognitive trust building. The success of the formation of common interests suggests that this networking approach in some network collaborations also generated the affective trust between boundary spanning individuals in the Antecedents. A question is therefore raised here, "which types of network relationships may be the ones which use a cognitive trust building approach in the early stage of the collaboration?" The answer to this is related to the interpersonal characteristics of boundary spanning individuals in the interactions. More details will be discussed in section 6.2.2.2.

Whilst this approach of networking is shown to be successful in enabling network partners' trust building and continuous interactions in some collaborative relationships for incremental innovation, however there were relationship situations within which a focus on cognitive trust building might be inappropriate and therefore there was a risk to sustaining and developing network relationships. In this sense, before examining the interactions within the Development stage,

this study takes a further look at the style of networking behaviour Creating Inter-personal Friendships, highlighted in section 6.2.2.1 and which demonstrates a different networking approach in the Linking.

6.2.2.1.1.2 Social Approach

Contrary to those interactions which continued to explore work-related issues based on presumptive trust, network interactions in the behaviour style of Creating Inter-personal Friendships in the Linking stage demonstrated that network partners focused on obtaining inter-personal knowledge of honesty and benevolence. There were four network relationship examples which bore the characteristics of this category, as Table 6.26 shows:

Table 6.26 Expectation of Establishing Inter-personal Friendships

<i>"... people like to see people, talk to people ... You may not talk about the work, but people buy from people ... you have got to get that relationship ... "</i>	(C, Biot)
<i>"... (the customers) they like to know about you. Before they discuss any work, they will talk about your family or everything else other than work ..."</i>	(I, CMBL)

These quotations show that there were expectations of knowing the individuals and establishing inter-personal friendships manifested in the interactions. The respondents emphasized that inter-personal friendship building was a crucial relationship challenge in some relationships before network partners could concentrate on technical discussion. The entrepreneurs were aware of these challenges and were aware of what was required to progress the relationships, as shown in Table 6.27.

Table 6.27 Awareness of Emotional/or physical Needs

<i>"...if they are really interested in, they will stand quite close to you, they may hold your hand ..."</i>	(I, Alb)
<i>"... people pick up the phone, someone they have never met or heard before trying to sell them something, no, no ..."</i>	(C, Biot)
<i>"... of course it was like going out for a meal, things like fish, and 'all the rest whichever weren't very important' (laughs) ... It is actually very difficult until you know what people think like."</i>	(I, CMBL)

Social activities jointly attended by the boundary spanning individuals provided opportunities for them to observe each other's behaviour in a social context. The joint social activity of having meals became shared experiences. The relaxed atmosphere made the interactions become informal and facilitated the information flow, and therefore generated increased inter-personal knowledge between the individuals involved. The entrepreneurs were aware of these physical and emotional needs of customers. The above quotations show that social interactions were conducted via face-to-face meetings instead of virtual modes. More detail of virtual mode, trust and interactions will be discussed in section 6.2.2.2.

In addition, reliability is shown to be an element that constitutes trust building in the interactions. The individuals evaluated network partners' reliability by obtaining and accumulating knowledge of the individuals, as Table 6.28 shows:

Table 6.28 Reliability of being Friends

<i>"in Arab countries, they are quite different, they are much happier about the person ..."</i>	(I, Alb)
<i>"...people buy from people, they don't buy from a faceless person ... it's about building good relationships."</i>	(C, Biot)
<i>"... they like to know about you. Before they discuss any work, they will talk about your family or everything else ..."</i>	(I, CMBL)

As distinct from network behaviour characteristics in Technical approach, the ways in which the entrepreneurs demonstrate individual reliability was through the exchanges of inter-personal information, the information that showed benevolence and honesty and how the entrepreneurs relate to other people, particularly those who are close to them. In addition, social activities shown in the above Table 6.28 also allowed individuals to observe each other's behaviour and responses in a social environment out of working settings. These interactions formed the network partners' understanding of the individual reliability in terms of being inter-personal friends and encouraged further interactions.

Furthermore, the entrepreneurs' awareness of physical and emotional needs in trust building and those responses which demonstrated their awareness during the interactions created customer satisfaction:

"... I would say in the Middle-East ... they won't be happy because they like to see you, they like to know about you." (I, CMBL)

Customer satisfaction in the entrepreneurs' capability of understanding and building interpersonal friendships increased customers' confidence in the entrepreneurs' future behaviour and as reliable persons, and thus enabled customers to set expectations on technological issues in the future. The way of building trust by making inter-personal friends represents a different networking approach - affective trust building. Such affective trust could be the base for cognitive trust building in some network relationships. The latter will be discussed in more detail in the next section of Development of Trust.

Moreover, it appears that inter-personal bonding was established over time in the networking process, as shown in Table 6.29.

Table 6.29 Bonding by Inter-personal Friendships

<i>"... you have got to get that relationship, the best friends ..."</i>	(C, Biot)
<i>"... we talk about their lives, their wives ... we know each other ... probably share something with them ..."</i>	(D, Biot)

The behaviour of sharing private information has built inter-personal intimacy and liking between the entrepreneurs and customers. Inter-personal friendships established over time through the interactions act as a bond between the individuals.

The elements discussed above emerged as the key components of affective trust; they were developed over time in the processes of network interaction. In some relationships where the entrepreneurs employed network behaviour of creating inter-personal friendships in the beginning of collaboration, the establishment of

affective trust was shown to determine cognitive trust building and the success of the relationships, as Table 6.30 shows:

Table 6.30 The Importance of establishing Affective Trust

<i>"... in Middle-East countries, they are quite different, they are much happier about the person, if they are really interested in (the specific projects) ..."</i>	(J, Alb)
<i>"... with business missions, again we just had the initial contact. Once we have that established we will do another ... we've given them proposals, and need to sit down and go through with them in more detail."</i>	(J, CMBL)
<i>"... where in Japan it's almost like a social thing first, then business talk ... discussion of work, going into technical aspects..."</i>	(I, CMBL)

We can see that the exchanges of technological information and the discussion of technological/or business topics was based upon the satisfactory outcomes of affective trust building. In other words, the building of cognitive trust such as identification of common business interests is dependent on the development of affective trust in these network relationships. Email did not appear to be the interaction mode in supporting the interactions and relationships building, rather face-to-face meetings in social settings such as the places of "house", "restaurants" were highlighted by the respondents; more detail of virtual mode will be discussed in section 6.2.2.2.

A further examination of the style of network behaviour of Creating Inter-personal Friendships in building affective trust indicates that individual characteristics of boundary spanning individuals may be the factors affecting the entrepreneurs' undertaking of this networking approach, in that customers' culture backgrounds, entrepreneurs' individual capabilities and life experiences could be the elements of individual characteristics, more detail will be discussed in section 6.2.2.2.

Network behavioural style of Creating Inter-personal Friendships, discussed above in fact reflects one of the entrepreneurs' networking approaches, as a strategy for collaboration for generating incremental innovation. The success of building inter-personal friendships was crucial in determining whether the discussion of specific technological issues could be brought into the networking processes, and it was the determinant of the formation of business interests.

Therefore, it is considered that this networking approach can be labelled as Social Approach. The strategy of this approach mainly focuses on affective trust building in the beginning of the relationships.

This section has discussed that in some network relationships the entrepreneurs took the approach of building affective trust in the Linking stage. An interesting question may be raised here, "is it possible to estimate how long it takes from the initial interaction to the identification of common interest?" It appears that the respondents did not explicitly describe the time scale in each relationship. Trust building could be different from one to another and there were many factors affecting the processes. However, reflective reading of the stories and narratives may offer some basic ideas on this concern to both networking approaches. The figure below shows the respondents' comments by comparing the cognitive and affective approaches to trust:

Table 6.31 Time Taken for the formation of Common Interests

Cognitive approach	Affective approach
<p><i>"... they had two particular problems ... we have come up with potential solutions, we then go back to them next week." (I, Alb)</i> <i>" ... then you'd follow that up with a phone call or email, dependent on what you hear back, maybe a week or 2 weeks later ... and then you just go to the next stage." (G, Cly)</i></p>	<p><i>"... in the Middle-East, unless you prepare to go there at least 4 times a year and 2 weeks each time and spend days with each of your clients ..." (P, CMBL)</i> <i>"Me and another senior consultant were in Libya in January and in Egypt in February ... another consultant is due there in May ..." (J, CMBL)</i></p>

It seems that there were differences in terms of time taken in reaching the formation of common interests between the two styles of network behaviour. For the cognitive approach the respondents appeared to describe the processes by the term "weeks", whereas for the affective approach they used "a year" and "months" to demonstrate the processes, and in particular the duration was emphasized as the critical factor in influencing the affective trust building. As discussed in section 6.2.1.6 Networking Process, there were lots of time and effort involved in those network relationships which focused on creating inter-personal friendships in the beginning, for example the emotional element – intimacy – took time to emerge in face-to-face meetings in social settings. Comparing the two styles of behaviour for building trust, it seems that it took

longer for the one of Creating Inter-personal Friendships to form common interests and common goals than that of Dealing with Technological Problems/Requests.

As highlighted in Chapters Three and Four, trust building in dyadic relationship processes varies from one case to another and one situation to another. However, there emerged some commonalities in terms of network behaviour in the process of building trust. Figure 6.2 summarizes different manifestations of the elements of trust building based on individual entrepreneurs' networking approaches.

Figure 6.2 Technical Approach and Social Approach for Trust Building

Technical Approach	Trust Building	Social Approach
Focusing on technological problems/requests	- Expectation -	Focusing on inter-personal friendships building
Engaging in technological issues in the early stage of network relationships	- Main behavioural theme of Interactions -	Engaging in emotional/physical aspects in the early stage of network relationships
Demonstrating individual and/or organizational competence, building credibility	- Reliability -	Demonstrating individual honesty & benevolence through joint social activities & personal information sharing
Getting closer through creating customer satisfaction on technological issues	- Bonding -	Getting closer through creating physical/emotional comfort, intimacy & forming friendships
Solutions to technological problems/requests	- Strategy to form common business interests -	Establishment of inter-personal friendships

The two networking approaches for building trust discussed above seem to be ideal types of categorization for viewing their differences. There were similarities though, for example both networking strategies worked, based on the primary business interests for establishing collaboration, and the presumptive trust has been presented as the base for trust building. This means that in the context of supplier-customer relationships, trust building is not blind. After all, common business interests were the outcomes of the interactions and the processes of trust building in the Linking.

As discussed in section 6.2.1.6, it appears that not all the network behaviour fits neatly into one or the other category. This is also echoed in the approach to trust building. The examination of the trust process was based upon network behaviour and process. It is shown that not all of network behaviour for trust building fits completely into Technical or Social Approach, rather many fell somewhere in between the two extremes. In practice, the approach to trust building categorized as such may not bear all of the characteristics of either the cognitive or the affective aspect. The categories of Technical and Social Approach are the two ends of extremes, the ideal illustrations of Hossain and Wingant's (2004) categorization of trust.

Nevertheless, the categorization serves as the exemplifications for capturing the characteristics of the trust process. There were 7 network relationships characterized as having the behaviour style of Exploring Business Interests in the Linking and the ways in which entrepreneurs build trust appear to exhibit neither all of the characteristics of Technical Approach nor those of Social Approach. A majority of the ways of trust building of Exploring Business Interests lay in the middle, in between, but possessing certain tendencies of Technical or Social Approach in terms of the cognitive and affective trust exhibited. These in between cases, nevertheless seem to possess certain characteristics of either approach to some extent, shown in Table 6.10 and Table 6.13. They were considered to be labelled as Combined Approach; more detail of the discussion of this approach and virtual interaction mode will be in section 6.2.2.4. To demonstrate the characteristics of trust process, this study will mainly focus on Technical and Social Approaches.

Before ending this section, this study shall discuss another form of trust presented in the interactions in the Linking, that is, contractual trust. Regardless of what networking approach was used, it seems that contractual agreements had been brought into the network relationships at some point in the Linking stage, as the respondents highlighted:

"... if we go and talk to a customer, he may want to tell us something just highly confidential, so we are free to prepare a non-disclosure agreement. He has a level of protection, and we have a level of obligation ... Virtually, ours is a two-way agreement ..." (I, Alb)

"Depends on who is our science partner (for new customers) ... clearly under the non-disclosure agreement ..." (R, PK)

In the case when network partners needed more technological information exchanges so as to identify common interests and move the collaboration forward, contractual agreements were introduced into the relationships with attempts to reduce the risks and uncertainties, since some technological information could be confidential.

In the Linking, in the early stage of network relationships, when the entrepreneurs and customers had limited inter-personal knowledge about each other, uncertainties existed since there were doubts about network partners' competences and honesty as to whether they would take the roles and follow the rules in the relationships. Trust generated by the contractual agreements seemed to have enabled further information exchanges and moved the collaboration forward. It appeared to function by providing confidence to one network partner that the other would take the role and follow the rules. The use of contractual trust highlighted by the respondents was closely related to three aspects of risk and uncertainties: (1) collaborative relationships were related to product innovation, and new product development was generally the lifeblood of the enterprises. Thus, the risk of technological information disclosure would not only impact on the collaboration itself but also the core competence of the enterprises in a broader sense particularly to SMEs; (2) in the relationship context of supplier-customer networks, the enterprises in the sample and customers were independent organizations. Both of them had independent business objectives and they were looking for benefits from the network relationships, and any potential jeopardizing behaviour that caused collaboration failure would become a threat to the core competence of their business; (3) in collaborative incremental innovations, the SMEs in the sample (the suppliers) were generally the investors, since new product development was based upon the revisions of

existing SME products; and there were higher risks for the entrepreneurs in network relationships. As the respondents expressed:

"... if you have taken the risk of inventing something, you wouldn't want to know something that give you ... you need to be careful, because downstream the other companies may come after you and say 'well, we invented first ...' You have to be careful on that, that's why we put confidentiality agreements, they are there to stop ... or define what these conversations are about ... so we can have free exchanges of information without worrying too much about one or other party going off and I don't want to start the negative points of this ... but it's very useful ..." (G, CR)

For different new network relationships contractual agreement might be introduced at different points in the Linking stage, depending on the needs of transferring specific technological information. Although contracts had been used to reduce perceived risk and uncertainties, yet they could not cover everything that had gone through the interactions, some respondents preferred not to rely on this form of trust:

"... and I don't want to start the negative points of this ... but it's very useful ..." (G, CR)

Although contractual trust helped to progress network relationships and interactions, however, contracts were only there to protect a trustor's legal rights in case of a trustee's jeopardizing behaviour. The contractual trust was not the one upon which network relationship development depends, because it did not motivate the individuals to enter into the collaborative relationships. It is impossible that customers or the entrepreneurs relied on checking each other's behaviour following the clauses in the agreements.

Common interests and increased knowledge, which are the outcomes of cognitive and affective trust building, enabled network partners to carry on the processes

of interactions towards the common goals. An investigation of how trust was developed will be discussed in the next section.

6.2.2.1.2 Development of Trust

Comparing the behavioural themes of networking approaches in developing trust, there appears to be great commonalities among the approaches at this stage. It is thus considered that the reporting and analysis will mainly focus on the commonalities of two extreme approaches, pointing out and demonstrating those differences where appropriate in the processes. As discussed in the last section, it is clear that the presence of the presumptive trust was essential in initiating the interactions. However, such presumptive trust which was cognitive based was insufficient to sustain the relationships. The evidence has shown that the active involvement of engaging in building the elements of trust through networking has enabled the entrepreneurs to interact based on the relationship outcomes, common interests and common goals, and to continue their entrepreneurial pursuit of product innovation into the Development stage.

An investigation of trust in the Development of network relationships suggests that the manifestation of trust elements emerged as being different from those exhibited in the Linking. Trust in the Development appears to have different “ingredients” in each element. The report and analysis of this section will go through each element: Expectation, Awareness, Reliability, Reciprocity, Bonding and Satisfaction.

6.2.2.1.2.1 Expectation

As the entrepreneurs brought their hopes into the interactions, expectation continuously emerged as an element of trust yet with the updated “ingredients”. As Table 6.32 shows, there were a few aspects of expectation identified in relation to the collaboration for incremental innovation:

Table 6.32 Expectation of the Cognitive Aspect

Expectation of Confirmation on the Proposals of Technological Solutions	
<i>"... we discussed how the collaboration would work ... more technically, what exactly they wanted to do and whether I could have them do this."</i>	(A, KinS)- Techn-A
<i>"...the whole solution of the problem. Then they would go back, normally it's an email document but it describes and defines what their problem is, to make sure that we have got it right ..."</i>	(G, CR)- Techn-A
<i>"... so we travelled to wherever they were, then came up with more concrete proposal, sent that by email with all the costs and the associated timings ..."</i>	(I, CMBL)- Exploring B
<i>"... we've got quite a few, we've given them proposals, and need to sit down ..."</i>	(J, CMBL)- Making F
Expectation of Customers' Understanding of Technologies	
<i>"... we do training, sometimes we send myself or Dr ... and we often go out to chemical companies, oil companies to give training courses to their staff on the aspects of microbiological analysis ... So again we have a direct face-to-face contact then with, ... sometimes going out visiting each of the different clients to give proper training as well."</i>	(I, CMBL)- Making F
<i>"...it isn't very simple to operate the system and innovation in terms of new software, new technology, control system and everything else ... It took us an hour and half to train the guys on how to use the system ..."</i>	(I, Alb)- Technical A

The discussion and explanation of technological solutions continued after the identifications of common interests. As shown in the first theme in Table 6.32, however, the expectations manifested by the entrepreneurs were different from those in the Linking, in that they tended to look for confirmation of those technological interpretations and proposals from customers. These expectations reflected their willingness to continue the satisfactory network relationships and they were fulfilled by customers' acceptance of the proposed technological solutions. The explanation of the solutions demonstrated the entrepreneurs' technological competence and in-depth understanding of the industry, which built up customers' confidence in the entrepreneurs' future innovative behaviour.

The focus of the interactions concerning the cognitive aspect of trust was different to that in the Linking. In Linking, the interactions regarding the cognitive aspect were mainly concerned with "how technological solutions worked" and related to the primary understanding of technological issues and identifying common interests. Network behaviour in the Linking was constrained by limited trust, and thus there was limited amount of information flow and knowledge shared. However in the Development stage, once common interests were formed network partners seemed to be more open. It is not surprising that there was more technological information flow in terms of the amount and a higher degree

of information significance and technological complexity. The issues covered such as “how the collaboration would work ... technically, what exactly they wanted to do ...”, “... come up with more concrete proposal ...” shown in Table 6.15. The knowledge exchanged was more tactical in the Development stage, in that customers were confronted by and were expected to make decisions on accepting those proposed technological solutions.

In addition, to create mutually satisfactory relationships the entrepreneurs expected customers’ understanding of the technologies involved in using the new products, shown in the second theme in Table 6.32. The delivery of tactical knowledge was conducted by technical training given to customers. The training fulfilled entrepreneurs’ as well as customers’ expectation of using new products. Customer satisfaction was gradually built up as the expectation of the cognitive aspect of new product was fulfilled. In general, those discussions, explanations and training in the Development stage were conducted through the arranged face-to-face meetings. More detail of virtual interaction mode and tacit knowledge exchanges will be discussed in section 6.2.2.2.

6.2.2.1.2.2 Awareness

The entrepreneurs not only brought the expectation into the Development stage, but also formed the awareness of customers’ business interests and needs in continuous network relationships, as Table 6.33 shows:

Table 6.33 Awareness in the Development Stage

Aware of customers’ business interests	
<i>“...they want us to develop the acid ...”</i>	(G, CR)- Techn-A
<i>“...you are serious now, let us go and sit down ... then came up with more concrete proposal ...”</i>	(J, CMBL)- Exploring B
<i>“... they were assessing potential partners in the UK to work with, there were delegations came over from 2 companies of Japan ...”</i>	(I, CMBL)- Making F
Aware of customers’ potential technological/service needs of using the potential new products	
<i>“The company has got good products, competitive prices and we have got good services as well, we tend to deliver on time, that’s we suppose... what customer wants, especially the industry we are in ...”</i>	(C, Biot)- Making F
<i>“... (a manager) will go down to assist them ...”</i>	(C, Biot)- Making F

As a result of the interactions in the Linking, the entrepreneurs established the awareness of what customers' business interests were and bore them in mind in the interactions in the Development. However in some cases these interests might need to be further clarified and confirmed due to the complexity of tacit knowledge involved for product development with incremental changes in the biotechnology, and this is highlighted in the last section of Expectation. In addition, the awareness of customers' technological needs and expectation of new products enabled the entrepreneurs to take actions and to fulfil those needs and expectation by providing tacit knowledge in terms of technological know-how.

6.2.2.1.2.3 Reliability

For Technical Approach/Exploring Approach, it appears that the entrepreneurs continued to demonstrate reliability of technical competence through the interactions in the Development. As shown in Table 6.32 and 6.33 in the previous sections of Expectation and Awareness, the interactions in terms of explanation and discussion of technical solutions and delivering of tacit knowledge demonstrated the entrepreneurs' technical competences, experiences and in-depth understanding of the industry, and these reinforced customers' confidence in the quality of potential new products.

The relational outcomes of cognitive trust building that were derived from the previous interactions were shown to have an impact on affective trust development. The entrepreneurs demonstrated individual honesty and morality to customers through those previous interactions of work-related issues, shown in the first theme in Table 6.34.

Table 6.34 Reliability in the Development Stage

Reliability of honesty and morality through the interactions on cognitive aspect	
<i>"... We got together because we both recognised this mutual benefit here ... You are honest with people, you tell people roughly where you are going ..."</i>	(I, Alb)- Tech-A
<i>"... then came up with more concrete proposal ... we built up a relationship between business development people but also the scientists, we got to know each other ..."</i>	(J, CMBL)- Tech&Explor
Reliability of honesty through the interactions on affective aspect	
<i>"... we have got customers visit, when you go out in the evening, you ask what life is like in the US this type of thing. You may have a meal in the restaurant or they may take you out to something, sporting events or ..."</i>	(M, Cyp)- Tech-B

Being honest on work-related issues reflects the trustworthiness of the entrepreneurs who could be relied on in long-term network relationships particularly at a time of crisis. We can see that the cognitive aspect of reliability is intertwined with the affective aspect of reliability. The emergence of both aspects together as the elements of trust demonstrates that the presence of both cognitive and affective trust was a necessary condition to progress the relationships. As such, reliability as an element of trust reduces the risk and uncertainties. It is true that the prerequisite of trustworthiness of an individual's information or competence is that s/he needs to be honest and reliable.

The affective aspect of reliability emerged also as a result of the interactions of getting to know more about each other, shown in the second theme in Table 6.34. A harmonious atmosphere was created as shared inter-personal knowledge increased and the individuals were getting familiar with each other. Uncertainties decreased as they started to disclose and share more social information. The more inter-personal information exchanged and stored, the more capable a trustor was to use it to predict a trustee's future behaviour. We can see that the development of cognitive trust can facilitate that of affective trust.

The individual's reliability in terms of honesty and competence was an important factor in creating innovative opportunities to the entrepreneurs:

"until we get the expert in front of the customer, some of them don't realise they have problems, once experts speak to them, until we ask

them 'do you do this, why do you do that?', we'd say 'if you don't do X, Y would happen', they realise they have problems, so from that perspective, they give us a small order to start with ... what happened with some of the bigger companies, we then become nearly microbiological experts to the company, they invite us to their monthly meetings." (J, CMBL)

Being competent and being honest enabled the entrepreneurs to practise a business philosophy - creating customer satisfaction beyond customers' needs, which created value. These two elements also allowed network partners to get closer and partly integrated in each other's businesses in some cases. Thus reliability became a part of trust, which grew to be a richer property and functioned to enable network partners to have confidence in and set further expectation of each other. The development of trust was also found to be reciprocal. The next section will take a further look at the reciprocal interactions in the development of affective trust and cognitive trust.

6.2.2.1.2.4 Reciprocal Interaction

Reciprocal interaction was shown to be one of the manifestations of trust in the Development stage. It was not only found to be an element of affective trust, but also cognitive trust development. The first theme in Table 6.35 shows the rapport that has been discussed in the last section through socializing was reciprocal:

Table 6.35 Reciprocal Rapport

<i>"... if you have got customers visit, when you go out in the evening ... You may have a meal in the restaurant ... I know the other directors go to Japan, they take them to lots of things, like sight seeing things ..."</i>	(M, Cyp)- Techn-A & Exploring B
<i>"... this is the way they operate, they expect face-to-face meetings, simply by email is not sufficient ... because they like to see you, to know about you."</i>	(I, CMBL)- Making F

Developing trust through developing the affective aspect of incremental innovation was found to be a specific characteristic of Technical Approach in the Development. Furthermore, obtaining more inter-personal knowledge through

social activities/events was also a theme of affective trust development in those relationships using Social Approach, shown in the second theme in Table 6.35. Although the friendships were perhaps established in this approach prior to the Development, yet the respondents highlighted that time and effort were needed in further developing intimacy and closeness. It appears that the affective trust development of the Social Approach might be related to the cultural impact on individual customer's behaviour. Intimacy and closeness required frequent and quality face-to-face meetings in social settings where there was a context for the flow of inter-personal information. As the respondents pointed out, email was not appropriate for such an element of affective trust development.

As expectation was fulfilled and re-fulfilled based on the formation and re-formation of the awareness of what was needed to develop trust, the interactions continued to move network relationships forward. Reciprocal interaction was also shown to be a component of cognitive trust development. The reciprocal feature was, in fact, evident in the beginning of relationships regardless of which networking approach was taken. The intention of addressing this element in the Development is mainly to highlight that its existence is related to the progressive processes of relationships and the accumulated effect of repeat interactions. The accumulated effect of reciprocal exchanges can also have impact on other elements of trust development such as familiarity and bonding which were also outcomes of networking processes. Table 6.36 shows different facets of reciprocal interaction:

Table 6.36 Reciprocal Interactions regarding Work-related Issue Exchanges

Reciprocal interactions and tacit knowledge exchanges	
"... <i>this was a close conference, we were asked as ice-breaker to describe what we did, I described what I did, and he described what he did.</i> "	(I, Alb)- Exploring A
"... <i>we then quite often have conference calls with our customers to talk through how we were resolving the problems, things like these ...</i> "	(P, Alb)
"... <i>at that meeting it will be technical experts either around the phone or around the table ... we get together basically to understand the problem, the technical detail of the problem. Once scientists know the problem ...</i> "	(J, CMBL)- Techn-A
"... <i>they may hold your hand, engage the conversation (of technical issues) ...</i> "	(I, Alb)- Making F
Reciprocal information exchanges	
"... <i>between me and their business development guys backwards and forwards with the email drafts ...</i> "	(G, Cly)-All three A
"... <i>(in face-to-face) then you go into discussion with them, in that discussion you just keep looking.</i> "	(I, Alb)- Techn-A
"... <i>then usually they get back or ... the manager commits to send them information, then you start to get that dialogue. Usually via email ... so you get that initial meeting and emails, then they are interested ...</i> "	(J, CMBL)- Exploring B

The reciprocal characteristic of the interactions indicated the confidence held by both network partners in continuing the relationships. Expectation was expressed and awareness was formed by reciprocal information exchanges, including technological, production and legal aspects. Reciprocal interactions were the essential enabler for trust building and development.

The exchanges of tacit knowledge exemplified above were conducted through the arranged face-to-face meetings and video-conferences in the Development. Collaboration for incremental innovation was moved forward as trust was developing over time. Expectation, awareness, reliability and reciprocal interaction discussed above were closely related to Bonding, an element of trust emerging in the Development.

6.2.2.1.2.5 Bonding

Following the identification of common business interests, both network partners were bound together towards the same goals - collaboration for incremental innovation. The formation of common goals appeared to be the turning point which signalled the occurrence of changes in the "ingredients" of trust and these

were reflected in the Development. The respondents commented that the common goals served as the motivation to their behaviour in continuing trust development, as the first theme in Table 6.37 shows.

Table 6.37 Bonding in the Development Stage

Bonding by common business goals	
<i>"... You don't just go and say 'well, what have you been doing?' you know people just don't have that time ... you really got to have a reasonable goal ..."</i>	(C, Biot)- All three A
<i>"...with our customers to talk through how we were resolving the problems ..."</i>	(P, Alb)-All three A
Bonding by shared experience and familiarity	
<i>"...so over about 3 months we built up a relationship between business development people but also the scientists ..."</i>	(G, Cly)- Techn-A
<i>"...as you become more familiar with the customer or anyone, you relax the tone, which is a process."</i>	(G, CR)- Techn-A
<i>"... and set up a meeting, there is gradation of getting to know somebody, you know it makes a lot easier when you meet someone once you speak to them."</i>	(M, Cyp)- Techn- & Exploring
<i>"... It is actually very difficult until you know what people think like ..."</i>	(I, CMBL)- Making F

The common goals in supplier-customer relationships for incremental innovation would also mean mutual benefits to be shared by two network partners; thus it serves as the motivation that enabled the individuals to devote time and effort engaging in those interactions. The interactions included expressing expectation, establishing awareness, fulfilling partners' expectation, negotiating those issues representing conflicting interests, adapting where it was appropriate to increase the possibility of success in the collaboration, as shown in Table 6.15. Working towards the same goals, the entrepreneurs' network behaviour of adaptation also indicated their honesty towards the collaboration, empathy to customers' situations/or pursuit of benefits and their competence in being able to adapt to customers' technical needs. The adaptation was reciprocal and from a long-term perspective. In such processes adaptation would not take place without the presence of trust developed along the way.

Whilst the entrepreneurs were developing trust from customers, their trust in customers also evolved over time. This was manifested by the entrepreneurs' increasing confidence in customers' business interests and awareness of the

technologies, and customers' competences' of using technological new products with incremental changes, all of which contributed to the confidence on their decisions on purchasing new products. Bonding by common goals enabled network behaviour of adaptation, this in turn, enhanced customers' confidence in entering into the collaboration. We can see that trust was augmented as its elements were updated in the Development stage. Shared experience and familiarity were two main ingredients of bonding, as shown in the second theme in Table 6.37.

Shared experiences and familiarity, emerged in the Development stage bound network partners together through empathy and intimacy, and moved the relationships towards the success of collaboration. Bonding by cognitive and affective aspects, trust was developed in networking processes over time and across the stages of the relationships. More detail of the two approaches to the trust development will be discussed at the end of this section 6.2.2.1. It appears that satisfaction emerged as an element of trust in the Development.

6.2.2.1.2.6 Satisfaction

There is no doubt that customer satisfaction that was gradually established was an element of trust in the Development, as the respondents commented in the first theme in Table 6.38.

Table 6.38 Satisfaction in the Development Stage

Creating Satisfaction on Work-related Issues	
<i>"... there are formal elements of it. That's probably the way it was handled ... fine, everybody is happy; then ... threw that formal style away ... you start to talk about something much more informal."</i>	(I, Alb)
<i>"... the stage where we produced a legal agreement ... then we got the agreement we were happy with ..."</i>	(J, CMBL)
Creating customer satisfaction on honesty and benevolence	
<i>"... Because you are honest with people, you tell people roughly where you are going ... that's the key really..."</i>	(I, Alb)
Creating customer satisfaction of physical/or emotional comfort	
<i>"... we go for dinners in the evenings stuff like that, for a drink or something ... that's very good."</i>	(A, Hptg)

These narratives were generally applied to all three networking approaches to trust in the Development. The respondents used "happy" to describe customer satisfaction before both network partners approached to make decisions for the collaboration. Satisfaction that was reached included work-related issues such as customers' business interests in "how the solutions would work", understanding of the technologies, the entrepreneurs' competence in accomplishing new products production; and these have been discussed throughout the sections of Expectation, Awareness, Reliability, Reciprocal Interaction and Bonding in the Development.

We can see that in those network relationships of Social Approach, the emergence of elements of cognitive trust was noticeable in the Development; this seems to be complementary to those elements of affective trust emerged in the Linking. It appears that successful network relationships for incremental innovation require both cognitive and affective trust in the processes for those relationships of Social Approach. Similarly the respondents highlighted the importance of creating an affective aspect of satisfaction in customers' decision making on continuing the collaboration, as the second and third themes in Table 6.39 show, creating customer satisfaction in the affective aspect seemed to be closely integrated with the cognitive aspect of trust in the relationship processes. We can see that cognitive and affective trust development are intertwined in the interactions and drive those relationships that used Technical Approach forward in the Development.

The previous satisfactory experience determined customers' decisions on moving the relationships forward. The analysis of the narratives relating to the Technical and Social approaches shows, satisfaction provided customers' confidence and enabled them to have further expectation in the future. Customer satisfaction appears to be an element that constitutes the manifestation of trust in the Development. Without the satisfactory experience established over time customers would not be able to make decisions on bonding together and to proceed to commitment to the relationships. As highlighted in 6.2.1.4.1, commitment was signalled by the network partners' actions of signing contracts and working together towards the production and purchase of new products.

The action of signing a contract demonstrates that there have been significant changes to the nature of the relationship. It implies that the partners would commit to each other not only in terms of agreed commercial but also legal responsibilities. The differences made now means that the network behaviour expected by the other partner would be governed by legal forces. It is not surprising that both sides were cautious about what was included in the contracts, as shown in the interaction themes of Clarification and Revision in Table 6.16. We can see that email was used for transferring and revising the content of contracts in such processes.

The form of collaboration meant that on the one hand, both network partners remained autonomous in terms of properties, enterprise management, human resources and finance. The enterprises in the sample were generally the investors in incremental innovation, as demonstrated in section 6.2.1.6. On the other hand, network partners entered into a collaborative network by sharing resources, for example, the SMEs committed to produce and customers committed to purchase the new products.

Signing of a contract was found in all of the collaborations. It appears that the presence of contractual trust was essential to progress the relationships. Using legal force to protect a trustor's rights in case of a trustee's jeopardizing behaviour to some extent seemed to provide certain confidence and reduced the perceived risk while either network partner pursued their own benefits.

"We have a lot of innovative new products generated within the contractual collaboration; because that's in the diagnosis area ... and we have quite focused R&D programmes because that takes so much money, quite a long time and so much effort." (A, Hptg)

We can see that the reason that the presence of contractual trust was necessary was due to the nature of the collaborative relationships - incremental biotech product innovation - the issues involved in the outcomes of networking such as

intellectual property rights, sales of new products and markets were of high concern to both partners because of the potential economic impact, particularly for the SMEs. Quite often the success of incremental innovation and its impact defined the enterprises' core competence and entrepreneurship. Thus the presence of contractual trust was needed to progress the collaboration into the production and implementation of the new products. In fact, network partners did not rely on contractual trust as the governance for the relationships in general. Contractual trust was there to guard against the worst case scenario. Hence, it was viewed as being part of the concept, "augmented trust", which will be discussed in the following paragraphs.

6.2.2.1.3 Augmented Trust

It was trust that had been developed that contained the elements with enriched "ingredients" which was more influential in customers' decision making for entering into the relationship state of commitment. As the outcomes of voluntary behaviour, knowing the competence and knowing the honesty of the persons, as discussed in the previous sections were the main aspects of trust against the future jeopardizing behaviour and led to the success of collaborative relationships. As the respondent commented:

"... We got to know each other, then we went on to the stage where we produced a legal agreement ..." (J, CMBL)

Based on the development of trust, customers were confident and comfortable in bringing a contractual agreement into the network relationships. The consequence of contract signing would mean, both network partners not only acquired the benefits from the collaboration, but also shared the risk and uncertainties which might be associated with the changed relationship situations in the challenging environment in the future. In the contracts, not every potential relationship situation was stated. Thus we can see that the trust with updated elements had been augmented over time, comprised of affective and cognitive aspects and characterized by strong ties. This study thus defines such a

relational artefact at this stage as “Augmented Trust”, to imply the complexity and dynamic nature of trust in the relationship processes in the biotech incremental innovation context. In addition, such trust also possessed inter-personal, inter-organizational and relational characteristics, and had impact on the virtual mode used in network interactions. More detail will be discussed in section 6.2.2.2 to 6.2.2.5. As the key determinant, augmented trust was stronger and led to the collaboration necessary for incremental innovation. This argument demonstrated by the data applies to network relationships of all three networking approaches.

6.2.2.1.3.1 Relationship Condition of Augmented Trust

The entrepreneurs have invested substantial resources in developing new technological products in the collaboration. Customers’ purchases have enabled new value to be added to their existing business. The networking processes allowed them to combine available resources and match customers’ demands/requests and discover more potential demands/requests in further interactions. As shown in Table 6.17, the entrepreneurs continued various interactions after new product sales. As the interactions carried on, the entrepreneurs were shown to have been actively engaged in seeking more opportunities from the collaboration. Augmented trust appears to be maintained and have its potential in such processes; a further exploration is conducted attempting to reveal the richness of the network interactions, thus the later section 6.2.2.1.4 will focus on these two issues of the trust process.

Before going into the detail, this study will go on to examine the relationship conditions of augmented trust, in other words, the answer to the question “in what relational conditions could trust develop to be augmented trust?” may help to gain a deep understanding of the potential of the trust. As the respondent commented:

“... it’s a bit more long term ... partners are, I think they like our products sent out previously, obviously feels there is a market there ...” (C, Biot)

"When the project finishes, he is on to the next project ... there are lots of projects by projects ... we have regular customers ..." (J, Rmd)

Indeed, a long-term relationship orientation at the start and which was borne in mind through the relationship processes was essential for developing trust from a form of presumptive to augmented trust. A long-term relationship orientation enabled network partners' reciprocal exchanges and willingness to engage in the identification of common interests proactively, as they viewed the relationships not only from a long-term perspective. In turn, the building and development of trust ensured the sustainability of a long-term relationship orientation in the processes.

An examination of augmented trust in the Maintaining the Contacts shows clearly that the entrepreneurs continued to make efforts to maintain cognitive and affective aspects of trust by networking with new content, shown in Table 6.17.

6.2.2.1.3.2 Maintenance of Cognitive Trust

Cognitive trust was maintained by the entrepreneurs' ongoing trusting behaviour in relation to technical competence to accomplish the job. Table 6.41 summarizes the themes of interactions in the Maintaining the Contacts. The entrepreneurs' initial involvement of gathering feedback allowed them to understand customers' expectations and to update the awareness of customers' problems/requests, related to the use of new products. Hence, high quality after-sale services were able to be provided accordingly. In the Table 6.17, the citation in the categories Gathering Feedback and Providing Advice on Using New Products shows that high quality after-services that were delivered through video-conferences and face-to-face meetings, demonstrated continuously the entrepreneurs' reliability of technical competence and commitment to the relationships, and enabled the maintenance of customer satisfaction. In some cases, customers' feedback was used as valuable information to further revise those new products to satisfy customers' demands.

Updating information, related to new products, markets or other business information through emails or face-to-face meetings maintained customers' familiarity with the enterprises from the cognitive aspect. We can see that Maintaining the Links to the bioscience community emerged as a theme, as Table 6.17 shows. Being a member of the bioscience community enabled the network partners to have updated information and knowledge of each other, which served as a base for knowledge sharing and learning. The connection also allowed the entrepreneurs to maintain reputations and identities through the presentation and demonstration of their research in the industry. Information sharing with customers stabilized the bond established in the past. The updated information was used by a trustor to predict a trustee's future behaviour and reduce the perceived uncertainties in the relationships.

Other than using the direct interactions, some entrepreneurs of the small enterprises maintained trust with existing customers by third party referrals; for example some distributors and Scottish Enterprises have been acted as the third party referrals in the industry, as shown in Table 6.17. The maintenance of trust was enabled by keeping in contact, for example updating information on various aspects of the enterprises; so cognitive trust was maintained. We can see that the entrepreneurs used various ways, including direct and indirect interactions to maintain cognitive trust. However, reflective reading of the stories and narratives reveals that the understanding of cognitive trust maintenance cannot be separated from that of affective trust.

6.2.2.1.3.3 Maintenance of Affective Trust

As shown in Table 6.17, to some extent the maintaining of cognitive trust was mixed with various social interactions in a sort of relaxed atmosphere and this generally occurred in face-to-face meetings. Additionally in some cases it also occurred in the emails exchanged. The latter will be discussed in more detail in section 6.2.2.2.

The behaviour theme of "Socializing" in Table 6.19 shows that socializing appears to be a routine/or a habit when there were face-to-face meetings. As both sides had known each other, social interactions were naturally combined with work-related interactions. The interactions were more informal compared to those in the Linking; the individuals had more social information to exchange and share, which was as a result of increased knowledge and reduced relationship and innovation uncertainties. We can see that the affective aspect was intertwined with the cognitive aspect of trust and united as one unit - augmented trust.

Augmented trust in the Maintaining the Contacts emerged as a characteristic in all of the relationship stories or narratives. The differences in augmented trust in various network relationships seem to lie in the differences in the degree of affective trust between the individuals. In some relationships, an individual entrepreneur and customer might remain as loosely socially connected friends and respective interactions consist of general social information exchanges, whereas in other relationships, individuals might have become close inter-personal friends and the interactions might include certain private inter-personal information exchanges.

6.2.2.1.4 Potential of Trust

As time moved on augmented trust evolved as the entrepreneur went through the networking process. It became stronger and more effective in terms of its capability to provide valuable resources to customers. Augmented trust was strong enough to be used as a "first aid" by customers, as shown in the first theme in Table 6.39.

Table 6.39 Potential of trust

"First aid" effect	
"So the existing customers have already known what we can do, and known we are very innovative and flexible ... if they have got a problem and not sure what to do, or maybe they don't even know if they have got a problem, they contact us, phone us and say 'I'm not sure about this ...', we talk to them on the phone and help them basically."	(G, CR)
Coping with uncertainties due to changed situations	
"Sometimes we are turning down, they come and say 'we want you to do this, and this ...' we question 'why?', 'because we have got this problem ...', we say 'no, you don't want to do this, don't do that, it's a waste of time. What you need to ... because this paper has already been published ... so, don't spend your money' ... we'd say 'then you don't need to do that work because ...' that's why we have got so much repeat business with people, because they get an honest appraisal."	(G, CR)
"... when we go and visit, if we are in the area for example, we'll try to go and see them, because you pick up new ideas and business just because of having conversation ..."	(R, PK)
Source for third party referral and word-of-mouth	
"If they have got someone else with the problem, can't resolve, then they think 'oh, (the company name) ... can help you' and they direct them to us ..."	(G, CR)
"... you know someone ... you always deal with them, you meet a colleague of his ... the word has gone through the system ...it's so much easier."	(I, Alb)
Source for other entrepreneurial opportunities	
"We are expanding our services all the time, that's mainly driven by customers ... these new products, services, techniques and practices, they were looking to develop ..."	(C, CMBL)

Customers' increased knowledge of the entrepreneurs made them confident enough to use augmented trust as the "first aid" to access available resources and in a timely manner. We can see that augmented trust functioned to provide a stronger tie that bound the network partners together to cope with uncertainties, as indicated in the second theme in Table 6.39. The quotation shows that the entrepreneur has the high quality of being competent, honest and benevolent, which enabled the generation of potential innovation opportunities in the changed relationship situations.

In addition, customers' positive user-experiences could be a valuable source of third party referral and word-of-mouth that would bring more potential new customers, and thus enable them to have a greater source of innovative ideas by expanding the existing networks, as the third theme in Table 6.39 shows. Thus augmented trust is more powerful in generating resources not only for incremental innovation but also a broader scope of business in general for

entrepreneurship, for example market expansions, shown in the fourth theme in Table 6.39. Those potentials would not be realized and utilized as the opportunities without the entrepreneurs being capable of making sense of the networking experience in trust development. As highlighted earlier the approaches to trust are closely related to the individual characteristics, and these links to the use of virtual mode, the next section will discuss in detail.

6.2.2.2 Inter-personal Trust and Virtual Interactions

A clear theme which has emerged throughout the data on the process of trust, is that in the context of the SMEs' supplier-customer innovation relationships, the individual was the main platform by which the elements of the trust process were operationalized. Building, development and maintenance of trust served as an engine that functioned to move the network relationships forward. Inter-personal characteristics clearly have impact on the operationalization of the elements of trust, as do virtual modes. This section attempts to demonstrate individual characteristics, virtual interactions, the trust process and the impact of their interplay on the networking process. Then it moves on to discuss the role of social capital as defined by this study so that we may be able to have a deep understanding of the complex and dynamic nature of trust in the study context. As email was found to be the virtual mode which has been by far the most commonly used in each network relationship process, the analysis of virtual interactions will focus on the use of email.

The individual characteristics include technical competence in accomplishing the tasks, honesty and benevolence. An analogy would be that the use of superior grade products in a construction project can determine the quality of the building. In this study, the high quality of the individual entrepreneur was the foundation that enabled the formation of reliability, reciprocal interaction, satisfaction and bonding, and it allowed the entrepreneurs to be able to build trust with and be able to trust their customers. As such, trust as a relational artefact could possibly grow over time.

The sharing of technological knowledge between those scientist-entrepreneurs in the enterprises and the buying firms served as the bonding social capital, which facilitated tacit knowledge exchanges and thus enabled the formation of common interests. The scientists were more capable of understanding their counterparts who spoke similar technical language. In some relationship situations, the scientists were the ones being the boundary spanning individuals and taking the role of conducting technological discussion:

"... (customers) they are all general scientists anyway, so they come up and ask about the products ..." (M, Cyp)

Those interactions of tacit knowledge exchange are shown in the category of the behavioural theme of Dealing with Specific Technological Problems/Requests in Table 6.9 the Linking, Table 6.12 Development and Table 6.15 Maintaining the Contacts. The exchanges of tacit knowledge in terms of technological details of problems/requests and explanation of proposed solutions facilitated the generation of innovative ideas. The entrepreneurs' solutions acted as the base for the formation of common interests and identification of complementary resources. Emerging from the data, social capital, defined by this study in Chapter Three, seems to be the key element of individual characteristics influencing the processes of trust.

6.2.2.2.1 Development of Social Capital, Trust Process and Virtual Interactions

As discussed in section 6.2.2.1 Trust as a Process, it appears that the two main networking approaches, Technical and Social, have been used by the entrepreneurs in the building, development and maintenance of trust. A closer look at the interaction modes indicates that all of the respondents commented that face-to-face meeting was the critical mode in the beginning of the relationships:

"I prefer to meet somebody firstly ... face-to-face, and once I have met them, anything else works ... what you do is you know who they are ... everybody is out there; so we would then send an introductory message usually by email with an attachment ..." (G, Cly)

The above quotation shows that the face-to-face meeting was recognized as the appropriate mode to obtain inter-personal knowledge and to establish affective trust so that a trustor was able to judge the individual honesty of the trustee and make the decision to trust. The respondents used "meeting somebody first, once I have met them, anything else works ... you know who they are ..." These also show that firstly, the presence of affective trust is the prerequisite to cognitive trust building; secondly, the affective bonding social capital of individual similarities in terms of honesty could be identified through face-to-face meetings instead of emails. These findings are evident not only in the entrepreneurs' attitudes but also in the networking behaviour of both networking approaches.

The examination of the cognitive approach reveals that face-to-face experiences in the Antecedents provided opportunities for both sides to obtain inter-personal knowledge such as individual identities, honesty and benevolence in some relationships, shown in the category Previous Face-to-face Meeting Experiences in Table 6.1, and through bioscience conferences or business meetings with the presence of other professionals in the community. It appears that certain tacit knowledge exchanges via emails occurred between the scientists after previous face-to-face experiences in some Technical Approach relationships, as the first theme in Table 6.40 shows:

Table 6.40 Virtual Interactions by email in Trust Building – Technical Approach

Virtual interactions with prior face-to-face meeting experiences	
<i>"There was telephone conversation first of all, then face-to-face meeting ... but you related it back to the conference ... So we had answered those questions, taking from there ... the US came back 'can you deal with this particular problem' and that was on the email ..."</i>	(I, Alb)
Virtual interactions without prior face-to-face meeting experiences	
<i>"... (After the emails) we very quickly try to have a meeting, so we can understand the people ... quickly we will travel at least to have a long meeting, to sit and look eye-to-eye with people, and to understand who they are ..."</i>	(P, Alb)
<i>"... (in the email) they said 'can you develop an acid that shows this compound is ...?' we may phone to arrange a meeting ... in that meeting it will be technical experts around the table ..."</i>	(G, CR)

The quotation in the first theme infers that (1) the exchanges of tacit knowledge by emails occurred in the form of customers' (bio-scientists) explanation of their technological problems, resulting from the individuals' understanding of technological issues; (2) the entrepreneurs' explanation of a particular technological know-how was based on their knowledge and experiences, "this is what is going to happen ... how it is going to break down ... what is going to come out of it ...". However, these exchanges happened under the condition that there was a previous face-to-face meeting/or meetings, as a way by which boundary spanning individuals knew each other's identities as well as certain technological issues. Similar professional backgrounds, serving as bonding social capital, played an important role in the tacit knowledge exchanges in the initial interactions by emails, since both sides knew that their counterparts would understand the technical language. As the respondent indicated:

"... so they were feeling very confident if they (the customers) talked to someone who knew what they were talking about." (A, KinS)

Linking the above and the previous quotations, we can see that the previous face-to-face experiences not only enabled the formation of affective but also cognitive social capital, and therefore cognitive trust building via emails in the early stage. This may be explained by the fact that the identification of bonding social capital in terms of inter-personal honesty and benevolence enabled the customers to be willing to discuss technological problems/requests with the entrepreneurs, which was the main drive of the interactions. In addition, during the face-to-face meetings such shared experiences enabled the identification of bonding social capital in terms of similar professional backgrounds. Under such circumstance, certain tacit knowledge exchanges occurred via emails in some network relationships in the Linking.

The investigation was also carried out into those relationship situations that were without prior face-to-face interactions using Technical Approach; it appears that the scientists of two firms generally arranged face-to-face meetings quickly to know more details, shown in the second theme in Table 6.39. The quotations show that in a situation where there was no previous face-to-face meeting

experience, the entrepreneurs and customers generally preferred to meet in order to obtain inter-personal knowledge such as honesty and individual identities.

Secondly, the examination of those relationships of Social approach shows similar findings in terms of the importance of face-to-face meetings in trust building, and this has been discussed in section 6.2.2.1.2. Therefore, face-to-face meeting seems to be the appropriate mode that facilitates the generation of affective as well as cognitive bonding social capital in the beginning of the network relationships, and thus enabled trust building.

This may be explained by the characteristics of face-to-face meetings in that social presence and a high level of interactivity were the essential elements for the generation of human affection/emotion and information flow, as the respondent described:

"When you try to be involved in relationship building, it's always important to see how the other person reacts to something, and you can change your approach accordingly ... and it's impossible by email ... email tends to be more to the point, more depersonalised than face-to-face ..." (G, Cly)

The above quotation shows that the characteristics of email were in contrast to those of face-to-face meetings, in that email was impersonal and lacked social presence and interactivity. Email was unlikely to allow for the formation of bonding social capital, both affective and cognitive aspects through the interactions without face-to-face meetings as pre-requisite; therefore, it was unlikely to allow for effective trust building in the early stage when uncertainties were high.

Trust grew as intensive interactions were carried out. After the identification of common interests, there was more information flow and tacit knowledge exchanges and the level of knowledge tacitness increased. As the interaction

themes of Presentation, Discussion and Negotiation in Table 6.15 and the section Trust Development indicate, the tacit knowledge exchanges were more related to the discussion of how those technological solutions worked. There were increased technological and relationship complexities as the network relationships developed. In such circumstances, instead of using emails the entrepreneurs and customers generally used face-to-face meetings/or video-conferences for these exchanges in the Development in order to progress cognitive trust and therefore the collaboration.

As discussed in the analysis of Development of Trust in section 6.2.2.1.2, the development of affective trust emerged in some relationships of Technical Approach. An examination of interaction mode shows that frequent face-to-face meetings tended to be related to the judgement of inter-personal honesty, generation of intimacy, familiarity and the exchanges of social information which were an affective aspect of trust development. This is shown for example in the analysis of Reliability of affective trust in section 6.2.2.1.2.3 and behavioural theme in Table 6.15 in the Development. Email was not the mode used for the development of affective trust. The association between affective trust and face-to-face meeting was not only manifested by the entrepreneurs' behaviour but also by their views:

"Trust, you can pick up the wrong feeling about an email, if you see somebody you can look in their eyes, you know whether they are making a joke or not, because sometimes you could transfer a joke in email, but it can completely backfire, they think seriously about something when you are being funny." (A, Hptg)

Social presence in face-to-face interactions appeared to be the key to generating emotion. This finding was congruent with the way in which affective trust was formed in the Linking. The respondents highlighted the importance of this aspect by making a comparison with how the interactions went in the emails.

In Maintaining the Contacts stage, in some situations when knowledge exchanged was even more tactical in those interactions such as technical training, trouble shooting of new products, case demonstration, the bonding social capital appeared to be less able to facilitate the tacit knowledge exchanges via email even though trust had developed to be a stronger form - augmented trust, as the respondent reported:

"... there can be a large number of reasons (for face-to-face meetings), it may be ... they have problems in understanding the report we sent, when they received a report and were not sure what it meant. So I have to go and explain to them what they relate to; sometimes it's about what they asked, they didn't get what they asked for and I had to go and explain why it was done in that way ... other information includes asking for certain testing to be done, so they can be problem meetings, there are also meetings with technical staff when they have a problem and don't know how to address it, they want me to go through the data ..." (I, Alb)

Face-to-face meetings were employed due to a high level of interactivity, richness and immediate responses required so that proper expectation and awareness were formed between boundary spanning individuals. The rest of the elements, such as reliability, bonding and satisfaction, of the cognitive trust were also maintained through the quality of interactions provided by arranged face-to-face meetings or meetings in conferences or exhibitions, shown in the interaction categories of Technical Training, Gathering Feedback, and Providing Advice on Using New Products in Table 6.17. Email appeared to be an inappropriate mode in such interactions because of its characteristic of lack of interactivity and richness. This was not only shown in the entrepreneurs' behaviour but also in their comments:

"Because if you try to do it in email ... a kind of getting it very long winded, because you don't know how much you have to explain (the technical details)..." (T, Biot)

In Maintaining the Contacts stage, in those cases when there was a high level of tacit knowledge exchanged, knowledge tacitness was the key factor which determined the choice of interaction mode rather than the bonding social capital and affective trust. Face-to-face meeting was the most appropriate mode. The impact of virtual interaction on the maintenance of cognitive trust is dependent on the interplay between bonding social capital (such as sharing professional background, individual honesty and benevolence), stage of trust process, the level of knowledge tacitness and the characteristics of a virtual mode in the networking process.

In general, when the level of knowledge tacitness was not so critical as to need face-to-face meetings, the entrepreneurs reported that email was generally used in the Maintaining the Contacts:

"... When the relationship is there, it avoids the need to spend 10 or 15 minutes chatting about non-essential things, you just send a quick message and get feedback. Most of those messages are only 2 or 3 lines rather than 150." (W, PK)

Email being used as the main interaction mode in this stage may be explained by two aspects. Firstly, as discussed in Trust as a Process the form of trust in network relationship maintenance was augmented trust. Augmented trust was stronger, as it consisted of both cognitive and affective aspects of trust that were developed over time. Compared to the relationship situations in the early stages, the uncertainties were dramatically reduced at this stage. In general either network party was able to predict another's future behaviour. Secondly, uncertainties related to the new product development were also reduced as the collaboration had resulted in new product implementations. The relationships generally can afford to be maintained by a lean mode. As the respondent expressed:

"We have got this new database, and then once every two months, we will email them about our new development or price change or references or

something good or bad happened whatever, so we are now able to put all of our customers into groups by applications ...” (D, Biot)

The above quotation shows that the updated information, related to new products, prices and enterprises was generally transferred by emails and this partly contributed to the re-identification of inter-personal similarities by creating the opportunities for potential common interests. We can see that cognitive trust at organizational level is closely linked to inter-personal trust. Indeed, reduced uncertainty was one of the key factors enabling the use of email to be the interaction mode for updating business information in general. Moreover, the relationship situations might change as a result of the changes occurring in the environment which affect the maintenance of trust, and then face-to-face meeting was the preferred mode in such situations:

“... have to meet when they have problems, product problems, bad debts, attitudes change or something like these ...” (D, Biot)

The quotation shows that when uncertainty was perceived as high, email was not chosen during the processes of maintaining trust. Since the boundary spanning individuals already had inter-personal knowledge at this stage, the maintenance of bonding social capital was generally conducted by updating the inter-personal knowledge stored previously and as such it was kept “fresh” over time and functioned to facilitate the maintenance of trust. As revealed in the preceding sections, although face-to-face meetings were less frequent in the Maintaining the Contacts, for example 2-3 or a few times a year, yet the respondent highlighted their importance:

“... so face-to-face meeting is completely important to me. Even within the maintaining ...” (R, CMBL)

A part of the content in face-to-face meetings was to “refresh” bonding social capital, and this is manifested in those quotations shown in Table 6.17, for

example in the behaviour categories Maintaining Links to Science Community and Socializing. We can see that augmented trust had its impact on the interactions. It made the interactions informal and thus there was more interpersonal information flow and sharing. As the richest interaction mode, face-to-face meeting was regarded as an important mode in maintaining bonding social capital and trust. It provided the context, an individual's social presence, the interaction richness and interactivity required for the exchanges of "sticky" information; it also enabled individual observations. The re-gained inter-personal knowledge and familiarity allowed the individuals to strengthen the perceptions of individual honesty and benevolence and thus make the decision to trust continuously. Therefore, the reinforced bonding social capital functioned to maintain augmented trust and to clear doubts and uncertainties caused by the individuals being apart from each other. Face-to-face meetings were needed not only in the situations when tacit knowledge exchange was high and relationship uncertainties increased, but also in the maintenance of bonding social capital and augmented trust.

If face-to-face remains an important mode in maintaining affective bonding social capital and trust, what about the use of email? In some network relationships email has also been used for the exchanges of social and inter-personal information:

"... once you know people, there would be more personal things going (in emails), how are your kids, what's the weather like ... (laughs) just become more personalised as you know people better. It's the same as it would be if you knew them face-to-face. Initially if you meet somebody you would be more formal, and then gradually once you know the person you would tend to relax more, it's exactly the same in electronic system (email) ... you do include some social chat." (G, Cly)

The above quotation indicates that the manifestation of maintaining the social domain of bonding social capital via email was not only shown in the entrepreneurs' behaviour, but also in their attitudes. The entrepreneurs and customers appeared to be very familiar with each other and they had many

facets of bonding social capital to share at this stage. There were 7 respondents who reported this similar networking behaviour and attitudes. We can see that once trust is established, email can be used to maintain the social domain of bonding social capital. The inter-personal similarities were updated and were re-identified in such processes; intimacy and inter-personal closeness were re-formed. In such a way bonding social capital and thus augmented trust remained robust. Hence, this study infers that to some extent virtual interactions by email may facilitate the maintenance of affective bonding social capital in the circumstance in which the individuals have established augmented trust and already shared several facets of affective bonding social capital in the past.

However, this does not mean that email has itself increased information transfer capability; rather it was the augmented trust which enabled the individuals to be capable of using it as if it were a rich mode. As the respondents' attitudes towards email shows:

"... but (generally) email tends to be short, sharp, more to the point, more depersonalised than face-to-face and telephone call ... Email, you tend to keep to a minimum, you don't write a big rambling note, because that's just ... not to fit the purpose" (G, Cly)

In general, the respondents still perceived it as a lean mode. However, affective and cognitive social capital established before enabled them to be more capable of using it as a rich mode:

"I think everybody imagines the face ... I think if you have face-to-face, you would certainly miss less ..." (F, CBL)

The above quotation shows that the respondents imagined the social presence of the individuals they were interacting with through emails because of familiarity, inter-personal knowledge and intimacy generated in the past. Therefore, based on these facts, this study argues that there is not a straightforward answer to

the debate about whether email is a lean or rich interaction mode - the examination needs to be in context and within a holistic picture. A deep insight may not be obtained if one purely focuses on the characteristics of email in isolation.

As far as cultural differences are concerned, an examination of the four network relationships which were with customers coming from Middle-East cultures indicates that they were in the category of the Social Approach. It seems that more face-to-face meetings were needed in the beginning and maintenance stage of the trust processes in these relationships, as shown in Table 6.11 as well as the comments below:

"... they will demand a certain amount of meetings each year, and if you don't do that, it's very much like out of sight, out of mind, the relationship will decrease very rapidly if you try to do it only by email ... in the Middle-East ... because they like to see you, they like to know about you." (I, CMBL)

In dealing with the Middle-East, it seems that more face-to-face meetings are required by the customers. The reason may be related to their ways of forming and maintaining affective bonding social capital and thus building and maintaining affective trust. In essence, both affective and cognitive trust emerged in the trust process, and affective trust appears to be determinant in the beginning of the relationship process (see section 6.2.2.1). These results seem to suggest that there was not much impact caused by culture differences on the critical role that trust played, nor the forms of trust needed in the relationship process; rather it was the ways of entrepreneurial networking in building and maintaining trust which varied.

6.2.2.2.2 Summary of Inter-personal Trust and Virtual Interactions

Given the two main networking approaches, which emerged to represent the entrepreneurs' ways to trust (section 6.2.2.1 Trust Process) and the importance of individual characteristics in the trust process, a further examination of the development of bonding social capital, trust process and virtual interactions shows that some patterns and trends may be identified.

Firstly, face-to-face meeting appears to be an interaction mode critical to individual trust building. It enabled the identification and formation of affective bonding social capital in terms of individual similarities such as honesty and benevolence and therefore affective trust building. In addition, the formation of cognitive bonding social capital was another outcome of the face-to-face meetings. The identification of individual professional backgrounds allowed the entrepreneurs to build cognitive trust. Email did not appear to be the appropriate mode for building trust in the beginning of the relationships. Secondly, in the network relationships of Technical Approach within which trust building had occurred in the previous face-to-face meetings, certain tacit knowledge exchanges via emails had taken place when the bio-scientists formed cognitive bonding social capital in terms of professional backgrounds and which constitutes a part of the process of identifying common interests.

Thirdly, the development of trust was based upon the identification of common interests and mutual benefits, which in turn facilitated the development of bonding social capital. The sharing of common interests and goals for collaboration served as bonding social capital. Through the demonstration of technological competences and capabilities, the entrepreneurs got closer through creating customer satisfaction on technological issues and by sharing bonding social capital of science-domain individual characteristics. Again face-to-face meeting emerged as the appropriate mode in the development of the bonding social capital and the trust process due to the richness, social presences and interactivity provided, the knowledge exchanged being more tactical at this stage.

Fourthly, as trust developed to be augmented trust, in general email can be used in maintaining cognitive bonding social capital by enabling the feedback on new products and updates of business information. Inter-personal trust cannot be

separated from inter-organizational trust. However, face-to-face meetings were needed when the level of knowledge tacitness was high; likewise for changed relationship situations that yielded uncertainties. In some relationships email can be used to maintain affective bonding social capital, and therefore, the maintenance of affective trust.

Finally, as a part of individual characteristics, culture differences did not seem to have much impact on the importance of trust and the forms of trust needed in the relationship process between those with customers from UK and Middle-east cultures, but rather the means of entrepreneurial networking, to build and maintain trust in the process, varied. Indeed, the entrepreneurs do not exist in isolation from the environment; some factors related to organizational characteristics appear to have impact on the process of trust, the interactions and interaction mode in the collaboration. The next section will explore this aspect, inter-organizational trust.

6.2.2.3 Inter-organizational Trust and Virtual Interactions

Although all of the enterprises in the sample had been established for over 3 years at the time of the interviews, yet apart from one they were small sized. It is understandable that in general the entrepreneurs generally took multiple roles. Their organizational structures and functions were in the process of being developed. This is manifested by several facets, corporate websites, flexibility and the use of video-conferences in their networking processes, which will be discussed in this section.

The use of corporate websites is one of the manifestations of the impact of organizational characteristics on the network interactions and trust, and the following two aspects will be addressed and discussed: the recognition of the importance of and the continuous investment in enhancing the websites. In the Antecedents, Corporate Website Visit was one of the means by which customers became network partners. As shown in section 6.2.1.1.1, the respondents viewed their corporate websites as important to the initiation of the relationships.

The presence of the websites represented the trust from an organizational perspective; inter-personal trust between the individual entrepreneurs was closely related to their organizations' characteristics, as expressed by the respondents:

"New customers ... so everything we have got ... all of our intellectual property is on the website, so we are sharing it with our customers, so you want to know what are global warming and coal efficiencies? It's there. Do you want to know ... when you dilute it with water? It's there by the end of this month we will have got this product ready, and launch it in our website, that's our new product." (D, Biot)

We can see that the corporate websites were not merely a media for advertising, but also acted as platforms for sharing. Such sharing included general as well as specific information and knowledge. The information and explicit knowledge held by an enterprise were resources which formed the characteristics of the entrepreneurs; therefore, the customers' requirements could help identify and form cognitive bonding social capital and facilitate cognitive trust building and maintenance, as the respondent commented:

"We are putting dialogue with a customer which everybody can see. We spoke to ... everyone can see it in the company, discuss certain issues." (C, Biot)

Taking advantage of the website being in the public domain, the enterprises had built their corporate identities and credibility by means of the manner of delivering relevant information and knowledge that built up the portfolios of the enterprises. Recognizing the importance of the websites, some small enterprises endeavoured to make continuous improvement:

"... We are going to a website approach; we are modifying our website at the moment ... we have got new launch of a different profile for the company." (P, Alb)

The entrepreneurs' networking experiences relating to the websites in the trust process benefitted the SMEs' innovation practices. Corporate websites became an instrument which enhanced their ways of using the existing resources and capabilities in their approach to the trust process in the future.

Another organizational characteristic is the flexibility of SMEs due to their size, and this can be brought to the entrepreneurial networking. The SMEs were able to adapt and make changes. This point can be referred to the behavioural theme of Dealing with Specific Technological Problem/Request in Table 6.9 Initial Interactions in the Linking. In addition, the respondents also held the views on the flexibility:

"... In big organisations making a change is difficult and expensive. SMEs you can change overnight almost, because the cost impact is very small, you can train people very quickly and effectively." (P, Alb)

Small and medium sized enterprises were shown to respond quickly to market demands and thus were more likely to form common interests with customers in innovation collaboration. This organizational characteristic appears to have a positive impact on the incremental innovation in terms of providing the flexibility to be responsive to the environmental changes.

The last organizational characteristic that appears to have impact on the networking process is the use of the video-conference. As the detail will be discussed in section 6.2.2.5 Relational Trust and Virtual Interactions, this section will address the impact on the use of video-conference and audio-conference. The entrepreneurs of the only one medium-sized enterprise in the sample which had the facilities used video-conferencing regularly with those international

customers. The subject of networking was the discussion and explanation of technological problems/requests, propositions, solutions and other technological issues. These interactions took place under the condition that both network partners had previous face-to-face meetings and had obtained primary interpersonal knowledge, shown in the behavioural theme of Dealing with Specific Technological Problems/Requests in Table 6.10 Follow-up in the Linking. Furthermore, the respondents ranked face-to-face meeting as the best mode for tacit knowledge exchanges:

"I'd rank face-to-face probably the best in terms of how you feel about other persons' thinking and for general negotiations ... then video-conference, then tele-conference, because tele-conference you can't see everybody, you can't see the reaction; on the video-conference you can see the body language, and that shows the way as much as what people say, so we find it very useful, especially if you have already known the people ... as you know their reactions and what it means." (G, Cly)

In general, the respondents ranked face-to-face meeting, video-conference and audio-conference and email in a decreasing order in terms of their capacity to deal with relationships uncertainty and interaction ambiguity. Previous interpersonal knowledge was critical in triggering the virtual interactions, which were conducted when there were clear communication objectives and were for cognitive trust development. It helps the trustor to predict a trustee's future behaviour and form awareness of the trustee's behaviour. Having discussed inter-organizational trust in the process, this study will locate the interactions and trust process in a broader context in the next section, indicating that individual entrepreneurs and the enterprises did not exist in separation from their industry.

6.2.2.4 Contextual Trust and Virtual Interactions

The biotechnology industry within which the collaborations were located clearly had an impact on the ways of networking and the trust process. As shown in the behavioural theme of Exploring Business Interests in section Initial Interactions

in Table 7.10, bioscience conferences, business trade meetings and exhibitions in bioscience communities acted as science forums with a relaxed atmosphere and made the emergence of the elements of both cognitive and affective trust become possible. The second network approach that is defined as Combined Approach and discussed in section 6.2.1.3.3 reflects the entrepreneurs' networking approach to trust building. The face-to-face meetings in these industrial events provided social presence, a trusting atmosphere and venue for the individuals to observe each other's behaviour in both formal and informal social settings, and hence facilitated the building of both cognitive and affective social capital through such aspects as reputation, credibility and identification of primary business interests, and thus trust building.

These events also served as a networking venue that allowed the individuals to maintain cognitive and affective trust, shown in the behavioural theme of Gathering Feedback and Providing Advice on Using New Products in Table 6.17 and 6.18. Through information flow and tacit knowledge exchanges in face-to-face interactions in both academic and social contexts, the individuals were able to re-identify inter-personal similarities in the Maintaining the Contacts stage. As the technologies advanced, the intermediaries' websites became the platforms linking the members and enabling them to establish contacts prior to the community events. They (discussed in the section 6.2.2.2.2) served as platforms for identifying primary business interests which mainly assisted the arranged face-to-face interactions. Hence, they can be viewed as a tool for linking the members in the bioscience community networks. The tacit knowledge exchanges were actually taking place in the community events. Following the discussion of industrial context, the next section shall consider geographical factors.

6.2.2.5 Relational Trust and Virtual Interactions

The preceding sections of this chapter have focused on the details of the networking process in terms of interactions, the essence and factors of interactions. What is remaining and considered in this section is the impact of geographical distance, as a factor in the interactions and trust process.

Firstly, although all of the enterprises in the sample had international customers, yet none of the entrepreneurs reported that geographical distances were barriers to their networking. Face-to-face meetings were utilized in each network relationship, in other words, they were viewed as an imperative mode in the processes. The role may be related to several characteristics of the collaboration. These may include a high level of knowledge tacitness, affective trust, network relationships of customer-network which were critical to incremental innovation and entrepreneurship, and these aspects have been discussed in the preceding sections.

Secondly, the major reason for virtual interactions was related to the expectation of saving time in some circumstance, in that there was a conflict between the time needed and the available time the entrepreneurs could manage for international travel.

"... sometimes you have a chance to see them or somewhere else, in Dundee for instance and you can talk to them face-to-face, 'hi, how are you doing' (laughs) the point is that the amount of customers I have is not so difficult to do this ..." (A, KinS)

Nevertheless, some respondents highlighted that video- or audio-conferences facilitated tacit knowledge exchanges when the scientists of two firms had built trust (refer to section 6.2.2.3). They expressed the expectation of possessing the facilities in such circumstances in the future:

"... Because we have customers in Dubai, Africa, Middle East and Europe ... I found it ... It's not dynamic, you can't reach over and shake hands with somebody, but I think it works if you know the people, so if you are discussing a project and everybody knows each other, it works, and things work if you know people. But as a small company, I'd very much like to have video conferencing." (D, Biot)

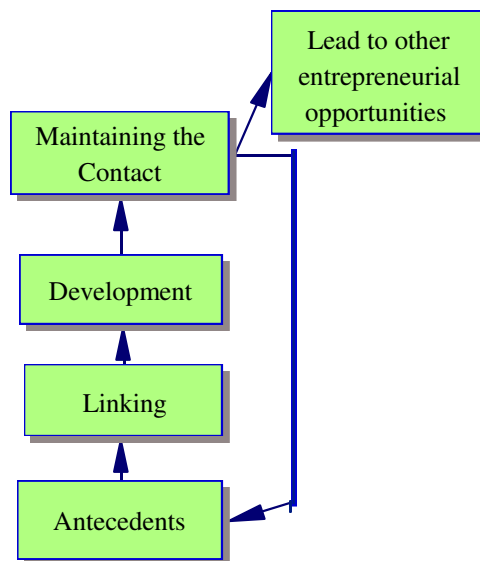
We can see that it is likely that to some extent, the video-conference may become an interaction mode for some entrepreneurs for maintaining cognitive trust with customers located internationally in the future.

6.3 Conclusion

The study is derived from research questions set to investigate what the respondents' networking processes are in the collaboration in customer-networks for incremental innovation, what their experiences were and how such experiences have impacted on their future innovation practices. Based on the analysis, it has been clear that the networking processes are comprised of a series of stages, each of which consists of dynamic interactions which reflect a relationship state. The mechanism that moves the relationships from one stage to another is a process of trust building, development and maintenance. Within the trust process, the formation, development and maintenance of bonding social capital played an important role.

It appears that entrepreneurial pursuit of generating innovation, discussed in the beginning of section 6.2, serves as the motivation for network interactions and the trust process. The entrepreneurs' dispositional trust, expectations and a series of interaction that yield trust building, development and maintenance constitute a dynamic and circular process. The outcomes of these processes have led to increased information and tacit knowledge exchanges, therefore incremental innovations; in addition, they can have an impact on generating other entrepreneurial opportunities such as market expansion and network expansion. As a part of the networking process, virtual interactions played a limited yet irreplaceable role in facilitating the trust process. Moreover, the experiences of networking also allow entrepreneurs to make sense of those experiences and contribute towards antecedents and expectations in their next collaborations. The dynamic and circular networking process is shown in Figure 6.3.

Figure 6.3 Key components of the Networking Process in the Collaboration for Incremental Innovation



The categorizations of different types of networking approach, namely the Technical, Combined and Social Approaches are not intended to be a definite typology, yet they emerge from the data and have been explained and identified to be helpful in forming our deep understanding of the strategies entrepreneurs employ. No matter where an entrepreneur's approach is located in the continuum between the Technical and Social Approach, it is recognized that the entrepreneur's trust process is the key relationship factor governing the developmental process of networking and will have an impact on the future collaboration.

Whilst other types of trust are participative in shaping the process of trust, interpersonal trust is recognized as the most influential in the SME context. It appears that the formation, development and maintenance of both affective and cognitive bonding social capital play an important role in the trust process and such bonding social capital requires of face-to-face meetings as an appropriate mode. Nevertheless, virtual interactions can be used to maintain trust in some relationships when the individuals have formed augmented trust and shared several facets of affective bonding social capital. The essence of the networking

process and its implications in the collaboration will be discussed thoroughly in the next chapter.

Chapter Seven

Discussion

7.1 Introduction

The last chapter analyzed the research findings collected through in-depth interviews with bio-science entrepreneurs located in Aberdeen and Dundee. Based on the primary categorization of data, this study gained an understanding that the collaboration for incremental innovation in supplier-customer networks was a networking and trust development process. It consists of several components which construct the entrepreneurs' networking experience. This chapter focuses on tackling the second half of the fourth research question, "... what can we learn from entrepreneur's narratives". The research findings will therefore be discussed in a broader context of the existing studies into biotechnology product innovation, supplier-customer network relationships and virtual interactions highlighted in the literature review. To do so, this chapter will present the networking and trust process, bonding social capital and virtual interactions model which represent different layers of data. It will also demonstrate how the networking process contributes to incremental innovation generation and re-generation. In addition, it will address where the study links to/or builds upon the existing literature, where it identifies the recognized gaps, and therefore its contribution to our knowledge of innovation through entrepreneurial networking. Furthermore, it will discuss the advantages of the phenomenological approach into the entrepreneurs' lived experiences. Finally, the discussion of the implications will be in the next chapter, Conclusion.

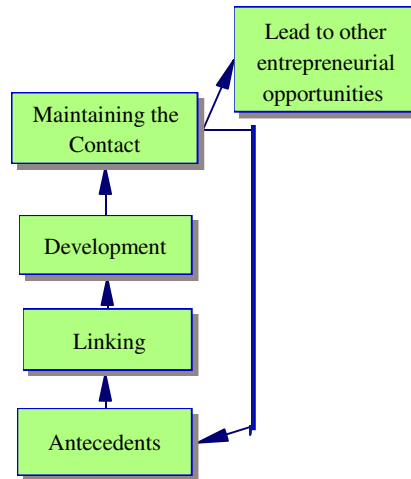
7.2 Collaborative Innovation and Entrepreneurial Networking

A part of the contribution of this study is the indication of the dynamic nature of networking in incremental innovation in the biotechnology SMEs and the way the

processes are intertwined by trust, entrepreneurs' inter-personal characteristics and virtual interactions. An intention was to use induction as a way of reasoning to arrive at a model indicating the impact of virtual interactions on entrepreneurial networking process and incremental innovation. The model shown at the end of the last chapter is formed based on the themes and categories which emerged from the entrepreneurs' narratives. It shows a dynamic and complex process of networking that entrepreneurs have gone through. The model has been constructed by undertaking a phenomenological methodology to reach an understanding of the entrepreneurs' lived experiences. By re-counting those experiences, the entrepreneurs contribute to the stock of our knowledge which constitutes what Axelsson (1995) and Johannisson (1995) refer to as network approaches utilized by entrepreneurs in pursuing entrepreneurship by generating innovation.

In addition, the entrepreneurs' experiences contribute to their own future collaboration for innovation. They themselves become "a resource" to engage in the next round of collaboration. This is driven by the ongoing entrepreneurial pursuit and is equipped with the competences and skills learnt from the previous interaction experiences, which facilitate their current collaboration. This indicates that an entrepreneurial networking process is built upon a series of episodes, including the antecedents, interactions with customers to identify common interests and form shared goals, collaboration, maintaining the contacts and a reflection on the current upon past networking experience. In this way we can understand entrepreneurial networking as built from past networking to reach out to future networks. In other words, the network partners' mixture of interactions, network relationship, trust, social capital and interaction mode shaped the current experience of collaboration. Past experience in the antecedents shapes the actual experience. To show what it means by this statement, the following section will attempt to demonstrate the process graphically, and which will be segmented into its basic components, and then developed layer by layer. Figure 7.1 indicates the basic components of the process.

Figure 7.1



As indicated in the last chapter, it is clear that the findings support the viewpoint that product innovation is important to the biotech SMEs (Calabrese et al., 2005). New product development was highlighted to be crucial to the entrepreneurs, and this was what they had been engaged in doing since the enterprises were established. At the time of interview, all of the entrepreneurs were actively involved in the development of several new products.

This study confirms what the literature (Cooper, 1994; Olsen, 2006) suggested, that there are more incremental than radical innovations; and customers are the most important external stakeholders contributing to the generation of incremental innovation (Kaufmann and Todtling, 2000, 2001; Pittaway et al., 2004). They contribute by means of generating innovative ideas (Jack et al., 2004; Kristensson et al., 2004). However, this study recognized that apart from the innovative ideas in the early stage, customers also contribute to the implementation in terms of facilitating entrepreneurial learning of technical know-how (e.g. by giving feedback about using the new products) and generating more potential innovation opportunities by acting as potential customers, third-party referrals and the sources of word-of-mouth. In addition, the experiences have enabled the entrepreneurs to be more knowledgeable in networking (e.g. understanding people, cultures) and the innovation practices (e.g. problem solving, the ways of providing solutions).

Existing studies have identified that collaborative product innovation is a process of people interactions (Hellstrom, 2004; Madhavan and Grover, 1998) and this is reflected and discussed in the research findings. Indeed, an entrepreneurial networking process has social and economic outcomes (Anderson and Jack, 2002; Anderson et al., 2007; Larson, 1992), which are in effect related to affective and cognitive aspects of product innovation reviewed in Chapter Two. Theories of product innovation generation suggest that different elements constitute the people interactions (Albrecht and Ropp, 1984; Knight, 1967; Pittaway et al., 2004; Roy et al., 2004), this study demonstrates that it is comparatively straightforward to recognize and distinguish cognitive aspects of the interactions, e.g. reputation, technological or business information exchanges, tacit knowledge exchanges. However, the links between affective and conative aspects of innovation and the use of virtual modes as factors in the relationship process are more complicated, for example, as shown in the discussion in section 6.2.2.2.

The network literature suggested that network relationships are social outcomes of the interactions, they in turn shape the interactions and the process of networking, and consequently the economic outcomes, these notions have been pointed out by the literature in supplier-customer relationships (Huang and Chang, 2008; Powell et al., 1996; Roy et al., 2004; Szarka, 1990; Turnbull et al., 1996). This study adds to the literature by focusing on incremental innovation in the biotechnology industry.

Some scholars focus on highlighting network interaction and its importance to the generation of innovation (Albrecht and Ropp, 1984; Madhavan and Grover, 1998; Pittaway et al., 2004; Roy et al., 2004). This study goes further to demonstrate that actual interactions and the experience become part of a circular networking process and integrate with antecedent factors of network interactions in the future. The influence of time and geographical distances are shown to relate to the interaction modes by several scholars (Ala-Rami, 2007; Albrecht and Ropp, 1984; Fontes, 2005), but how interaction modes, relationship process, trust and bonding social capital shape network relationships and the progress of the collaboration has not been explored until this study. Part of the contribution therefore is that it shows a dynamic networking process with the

interactions mediated by inter-personal characteristics, network relationships, trust, bonding social capital and interaction modes.

The network interactions with customers are identified as including several components, which reflect the development of the relationships, namely Antecedents, Linking, Development and Maintaining the Contacts. The network relationship literature shows different views on the processes, which are represented by Stage (Dwyer et al., 1987; Ford, 1980; Heide, 1994; Kanter, 1994; Larson, 1992) or State theories (Batonda and Perry, 2003; Ford and Rosson, 1982). The findings of this study indicate that the process of a network relationship, in fact, involves both stages and states. On the one hand, the collaboration is a gradual process within which changes and technical aspects take place at different stages. The collaboration takes time to evolve (Anderson and Jack, 2002). The model (Figure 8.1) produced by this study appears to be congruent with Larson's (1992) stage theory. However, what this study demonstrates is an insight into the relationship process in the context of collaborative incremental innovation which is connected to the trust process and the interplay of virtual interactions and bonding social capital. On the other hand, the interactions within each stage reflect a dynamic and complex relational status, each of which contains rich interactions, changes in the relationships and cognitive aspects of incremental innovation (refer to section 6.2.1.6). The scope of "state" in this study differs from that of Ford and Rosson (1982) and Batonda and Perry (2003), in that these authors attempt to include every relationship situation. However, this study focuses on reflecting the entrepreneurs' experiences of successful collaboration and examines key behaviour themes and the determinant of the process. To demonstrate the contribution, the following section will discuss the networking process, trust as a process and the ways in which virtual interactions operate in comparison with the literature.

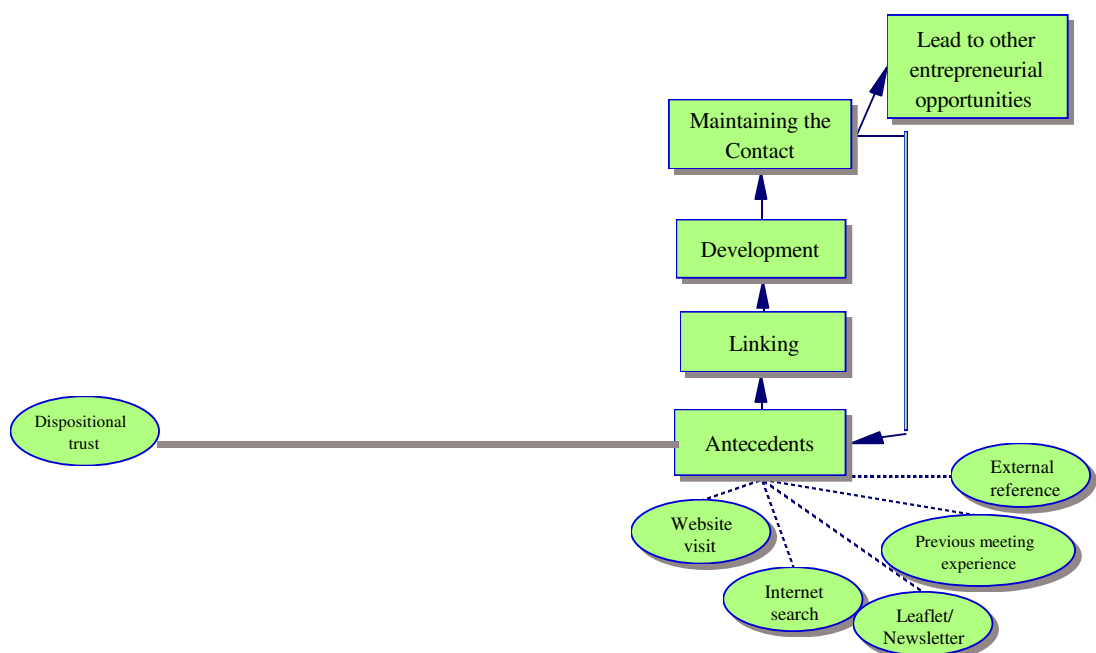
7.3 Linking and Development, Trust and Virtual Interactions

Taking a phenomenological approach to examining the process, this study has recognized that the knowledge gained and dispositional trust formed prior to the

collaboration serve as the antecedents for the network relationships. These consist of the entrepreneurs' experiences, competences, skills and ways of networking, which form the basis upon which they go through the networking processes.

These antecedents (Figure 7.2) affect the way the entrepreneur conducts the interactions before entering into the collaboration. If the entrepreneur has met the customer and had certain inter-personal knowledge from general conversations, they may go into technical details relatively quickly in the initial interactions; whereas if they just have had some prior knowledge regarding the reputation and general business information obtained from the websites or word-of-mouth, they may request to meet to know more about each other. Different interaction modes can shape the antecedents, bonding social capital and the ways of pre-disposed trust, and therefore the modes used in the initial interactions. As discussed in section 6.2.2.2, some bioscientists who had obtained certain prior inter-personal knowledge used emails to transfer tacit knowledge to some extent, as they perceived that the individuals of the other firm were honest and would understand their technical language through email. Consequently, the context of the interactions and interaction mode used shape how the interactions are conducted and trust is built. Trust building varies depending on different situations.

Figure 7.2



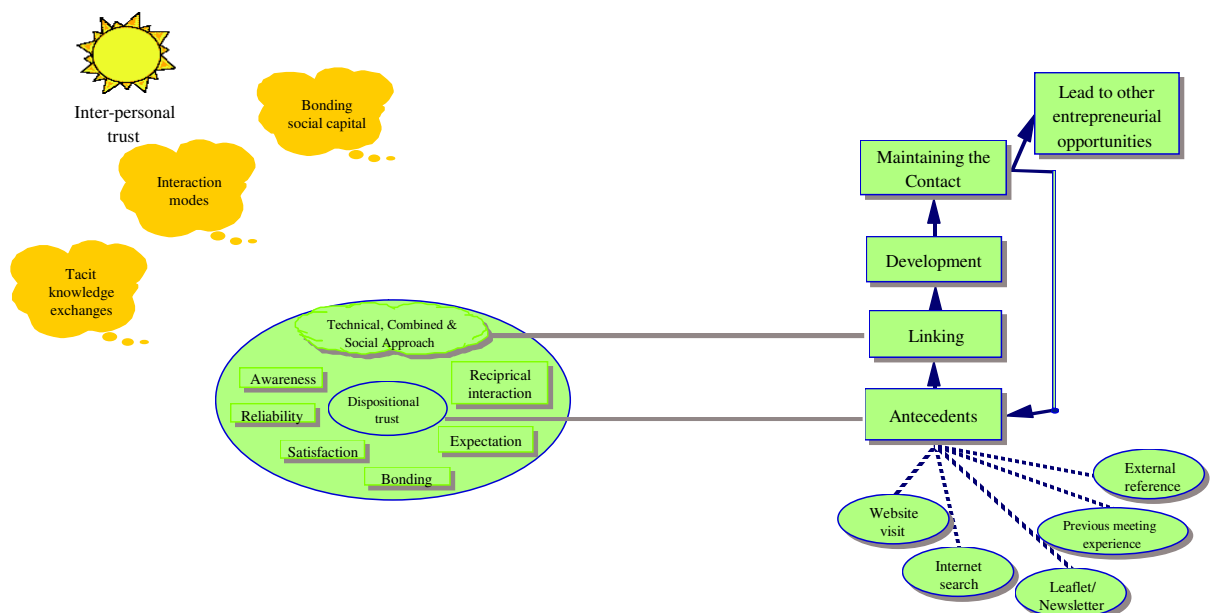
The literature (e.g. Ganesan and Hess, 1997; Hung et al., 2004; Kramer, 1999) identified these antecedents as the factors and contributed to our stock of knowledge by addressing the role of each factor in the trust formation. However, by looking into the process this study reveals that the entrepreneur actually uses a combination of these methods to seek for information proactively. Indeed, Larson (1992) suggested that network partners formed the primary trust before the relationships, but this study goes further to explain the trust process and the nature of trust.

Anderson and Steinart (2005) pointed out that presumptive trust is shallow and fragile. This is confirmed in that this study has uncovered that the presumptive trust is unable to move the relationship forward, and that critical information and high level of tacit knowledge were not exchanged in the early stage. Moreover, this study recognizes that the presumptive trust is different from swift trust, defined by Meyerson et al. (1996) in a different relationship context. While swift trust is formed within temporary teams to achieve the same ultimate goal of a task, it formed deliberately and quickly at the outset; presumptive trust is formed to serve a relationship from a long-term perspective. Relationship uncertainty is greater in a new relationship in supplier-customer network than a teamwork context whereby both network partners need to identify common interests in the process. Hence, swift trust did not present in this study due to a different context.

The interactions are demonstrated by three types of behaviour, namely Dealing with Technological Problems/Requests, Creating Inter-personal Friendships or Exploring Business Interests. This study contributes to our understanding of collaboration in the study context by describing the behaviour patterns. These key themes which emerged from the data were linked to the categories of trust. The ways of building trust in a relationship differ from one to another, and relate to these behaviour tendencies. The behaviour categorisation of Dealing with Technical Problems/Requests, Creating Inter-personal Knowledge or Exploring Business Interests shows that the connection between network relationships and interactions is more complicated than the literature indicates. Scholars (Dwyer et

al., 1987; Ford, 1980; Kanter, 1994; Larson, 1992) acknowledged that network relationships in supplier-customer networks consist of several elements, including trust. This study demonstrates, however, that the entrepreneurs' network behaviour differs from one to another and is driven by their different ways of building, developing and maintaining trust. Those various relationship elements addressed in the literature such as identity, credibility and motivation in a new relationship can actually be viewed as part of the trust process and relating to the formation of expectation and awareness in the technical or social approach, shown in Figure 7.3. For example, as indicated in section 6.2.2.1.1.1, in some relationships, entrepreneurs (I, Alb; G, CR; D, Biot) focused on understanding the customers' technological problems and on showing their technical competences in the initial interactions. In other relationship situations entrepreneurs engaged in social conversations and activities to build interpersonal friendships, or when entrepreneurs met the customers in a bio-science community conference, they interacted to build trust by a mix of the two approaches, technical conversations were integrated in social interactions.

Figure 7.3



Trust building and development are derived from the understanding of common interests, individual identity, reputation and mutual goals. This study supports

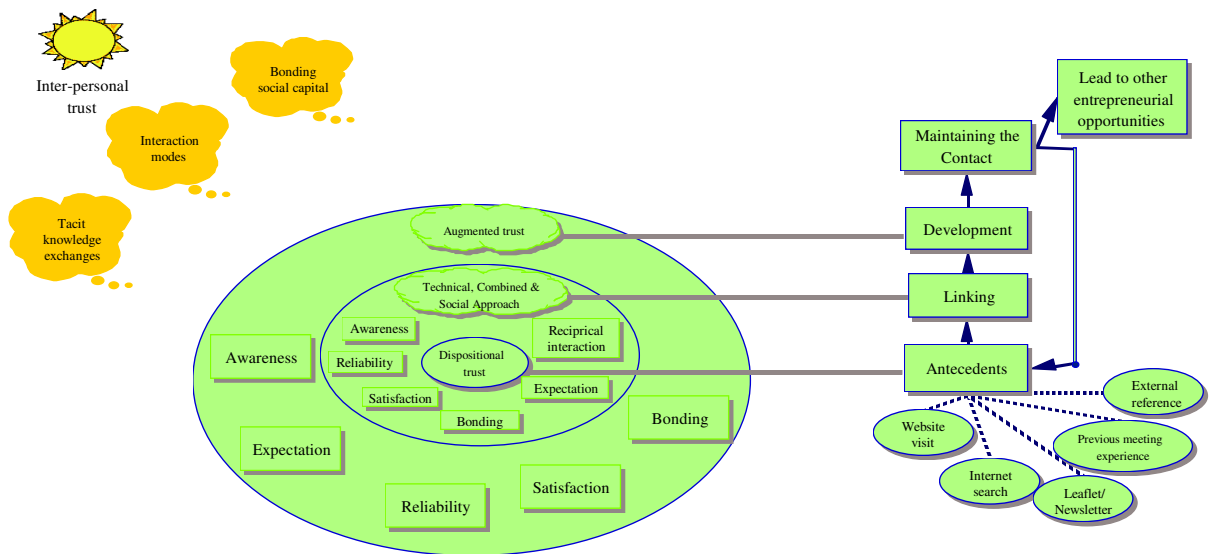
the notion that trust formation is based on repeat interactions where face-to-face contacts take place (Axelrod, 1987; Kanter, 1994; Tushman, 1977; Tushman and Scanlan, 1981). As Gilmore et al. (2001) pointed out; face-to-face interaction is the best mode to initiate a new relationship. This study finds that face-to-face interaction is the best mode to build trust in all three approaches; it facilitates the identification and formation of both affective and cognitive bonding social capital, indicated in section 6.2.2.1.1 and 6.2.2.2.

Within the trust building process, the establishment of affective trust determines cognitive trust development, and it is conducted through face-to-face interactions. This finding is congruent with Anderson et al.'s (2007) viewpoint that in trusting a person's honesty, the information and knowledge exchanged would be, in effect, trusted. This study contributes more by investigating the role of virtual modes in the process of trust building in the collaboration in incremental innovation. Based on the formation of affective and cognitive bonding social capital and the dispositional trust in the previous face-to-face meetings, virtual modes can be used for cognitive trust building between bio-scientists of two firms (refer to section 6.2.2.2.1.1).

Through the interactions, boundary spanning individuals' inter-personal knowledge is increased, which facilitates trust development. Expectation, awareness, reliability, satisfaction and bonding are several elements which emerged in the trust building process. As a result there are tacit knowledge exchanges and information flow which enable the formation of common interests and mutual goals at both individual and inter-organizational levels. Common interests and mutual goal formation become the new elements emerging and they serve as the bonding social capital, and enable the individuals to set up more expectations and awareness due to the changed relationships. The literature (Huang and Chang, 2008; Larson and Starr, 1993) about trust holds that relationship investment, building ties, risk taking and reciprocity contribute to the process; the first three elements are found in this study, for example, the individuals invested in the training and discussion of the proposals. Reciprocity is manifested in the form of reciprocal interactions, where the SMEs are producing and the customer is purchasing the new products. What this study reveals, but is

not included in the literature, is the development of trust in terms of the changes in the several elements. The “ingredients” of trust have been changed in the development stage and each element is enriched with the updated “ingredients”, shown in Figure 7.4.

Figure 7.4



Bound by shared goals and common interests, the individuals continue to invest their time and effort in the interactions. The growth of trust is associated with the growth of familiarity. Expectation, for example, is manifested by the customers’ desire to understand the technologies and services. The “ingredients” of Awareness is updated which include the discussion of detailed proposals (section 6.2.2.1.2.1 and 6.2.2.1.2.2). Whilst demonstrating technical competence, entrepreneurs also showed individual honesty by engaging in social activities in those relationships using a technical approach. This study agrees with the notion in the literature, in that the development of affective bonding social capital by creating shared experiences and common perspectives (Uzzi and Dunlap, 2005) in the social milieu facilitates trust development. This is congruent with Stolle (2001) and Lewicki and Bunker’s (1996) views on the identity-based trust, in that trust that has been developed and based on individual identity enables network partners to have a full-empathy with each other’s needs and desires. Therefore, at this stage entrepreneurs had formed both affective and

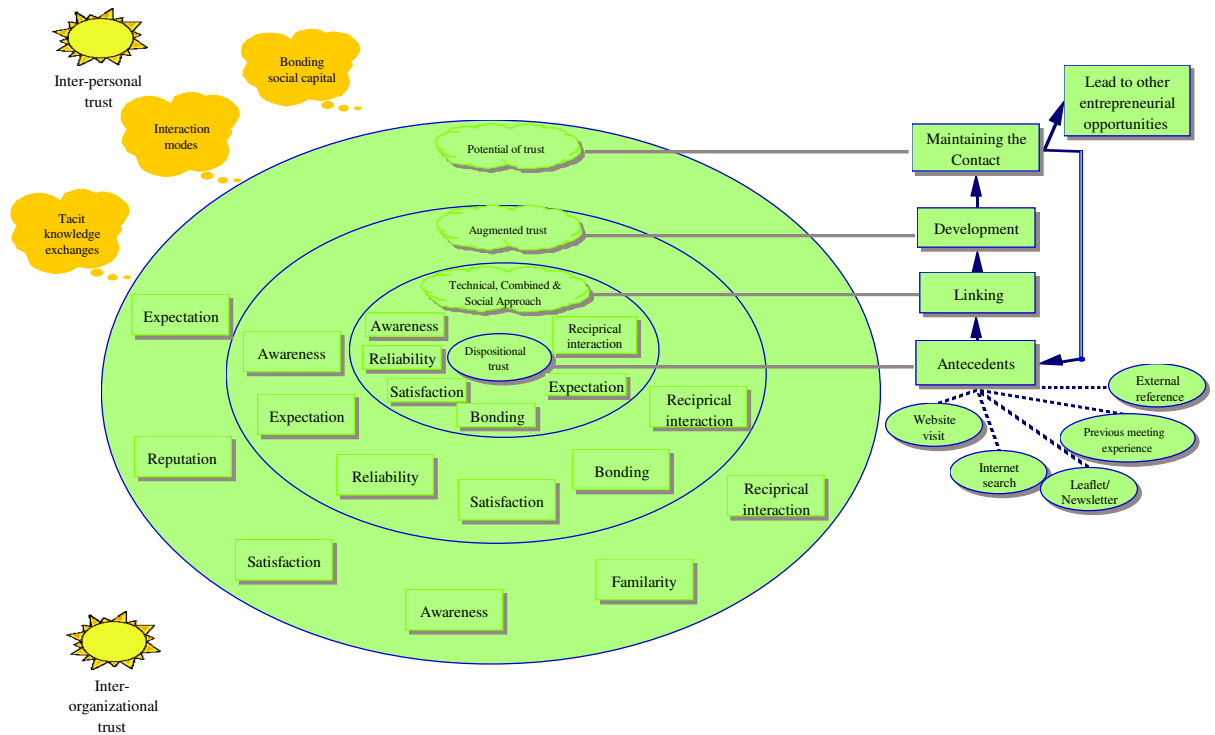
cognitive bonding social capital over time; customer satisfaction was developed based upon the issues relating to technical and affective aspects of the potential new products. Trust that had been developed provided the confidence to customers and entrepreneurs to go forward to commit to each other.

What this study contributes further is pointing out that trust as a changed property was enriched with new ingredients over time in the networking processes; it was stronger and developed to become a new form, augmented trust. In general, face-to-face meeting is the most effective mode for developing affective bonding social capital and exchanging technical knowledge with increased level of tacitness in the Development.

7.4 Maintaining the Contacts, Trust and Virtual Interactions

As discussed in sections 6.2.1.5 and 6.2.2.1.3, entrepreneurs and customers engaged in the interactions which were related to after-sales of new products; and maintaining the contacts involved the maintenance of trust, both the cognitive and affective aspects. The frequency of interaction is less in the maintaining stage since augmented trust is durable, the partner has established the awareness of the other's needs and desires in general, and therefore, has the confidence in the network partner's future behaviour. As a relational artefact, trust is not merely a psychological belief, but rather grows through the interactions. Augmented trust is characterized by strong ties between network partners, shown in Figure 7.5. This is congruent with Granovetter's (1973) view in which the relationships are bound by loyalty and close friendships, and a high level of trust allows for good quality information at the time required.

Figure 7.5



This study confirms Williams (1988)'s view on the generation of deep trust, which is based on the individuals' sharing of bonding social capital. In other words, those individuals who are socially homogeneous in terms of similar occupation/professions, social status, can generate augmented trust. For example, in some relationships bio-science entrepreneurs have developed close inter-personal friendships with customers who share the bonding social capital of professional backgrounds, family ties, individual interests and hobbies (refer to section 6.2.2.2). Kanter (1994) suggested that network relationship orientation shifts gradually from tending towards personal/or emotional in the beginning to depersonalized/or institutional in the maintenance stage. However, this study challenges this notion, and argues, based on the empirical evidence, that network relationships differ from one case to another. As discussed in section 6.2.2, in general the cognitive aspect of new relationships can be the focus of interactions at the maintenance stage; however, the relationships are not shown as being depersonalized/or institutional in all situations. The affective augmented trust is maintained through the maintenance of affective social bonding capital, and this is achieved through networking in the biotech community conferences, business meetings, and social events and in some cases through emails.

Referring to the use of interaction mode in maintaining trust, although Roy et al. (2004) proposed that deep trust may facilitate the individuals' understanding of communication objectives regarding technical discussion via emails, however, it is not until this study that "how" and "why" questions are explored. This study has provided the insight into how trust is maintained by email and explained the role of bonding social capital in the process; it has further demonstrated how bonding social capital is maintained, in that in general email can be the interaction mode used to maintain trust. As shown in section 6.2.2.2, the maintenance of cognitive trust is achieved through the interactions relating to updating the information on products, markets and general business. As such cognitive bonding social capital is maintained by keeping the knowledge up to date about the enterprises; the interactions also create the potential opportunities for the identification and formation of common interests in the future. These interactions generally can be conducted through emails when the level of knowledge tacitness exchanged is not critical.

In addition, in some relationships within which bio-science entrepreneurs of two firms have already formed several aspects of affective bonding social capital, email can be an interaction mode to maintain affective bonding social capital through the updated inter-personal information. Therefore, although the literature (Culnan and Markus, 1987; Walther et al., 1994) shows that email is a lean interaction mode with a lack of social presence, email can be used as a rich mode for maintaining trust. The reason being, both cognitive and affective bonding social capital established previously allows the social presence to become visualized during the virtual interactions. In addition, this study points out that in some circumstances when the level of tacit knowledge is critical, and the relationship uncertainty and message ambiguity are perceived high due to the changed business situations, these factors and their interplay become the determinants of using face-to-face interaction. Hence, this study challenges the literature (Daft and Lengel, 1984; Daft et al., 1987; Sproull and Kiesler, 1986) which views email as a lean media, defined only by its characteristics of being in electronic text format, without taking the relationship process into account. It also challenges those who view email as being unable to convey social presence

(Walther, 1992, 1995; Walther et al., 2005b) without clarifying what trust means and without considering bonding social capital, trust as a process, relationship process and the context of collaborative incremental innovation.

Finally, it is recognized that face-to-face meeting is needed to maintain affective bonding social capital, as it enables network partners to re-gain familiarity and shared inter-personal knowledge, and this has been discussed in detail in section 6.2.2.2.1.1. Nevertheless, the affective bonding social capital is affordable with less face-to-face interactions (for example once to three times a year).

As far as the factors of trust are concerned, this finding shows that the individual is the main platform upon which trust and network interactions are built. This is congruent with the literature in terms of the characteristics of entrepreneurial networking of the SMEs (Johannisson, 1987, 1995; Larson, 1992; Larson and Starr, 1993). This study demonstrates that it is the individual knowledge, competences, skills and ways of networking attached to an entrepreneur that enable the trust process and the relationships between two firms.

Referring to one of the individual characteristics - cultural embeddedness - the insights gained indicate that there are characteristics in terms of the ways of networking with the customers embedded in oriental cultures. For example, for the customers embedded in the UK cultures the entrepreneurs blended the activities for building affective trust with those for building cognitive trust together. Whereas, in other relationships they focused on social topics and engaged in social activities in order to build affective trust due to the relationship demand. This finding is partly congruent with Batonda and Perry's (2003) finding, in that owner-managers of Chinese culture tend to build and rely on inter-personal relationships for their inter-organizational network. This study extends the literature by further investigating the trust process within the relationships; the findings show that there appears to be no cultural difference in terms of the aspects of trust, namely the affective and cognitive trust needed and the determinant role of affective trust in enabling the development of cognitive trust.

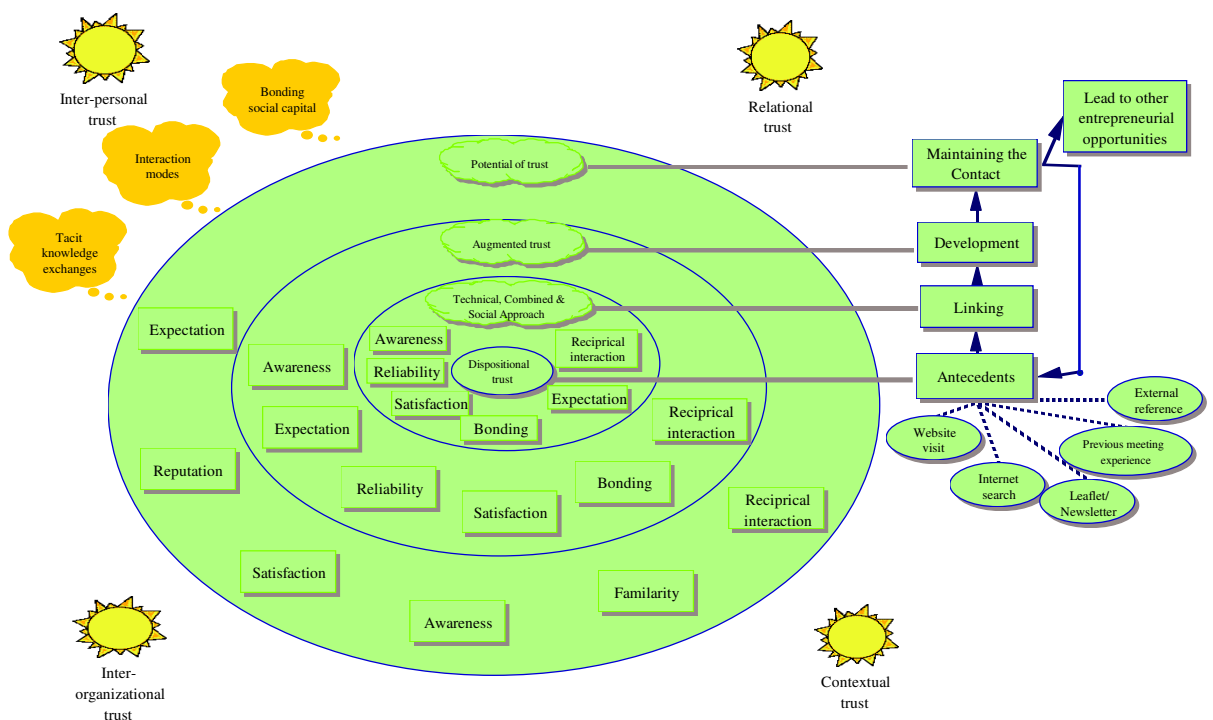
As indicated in the literature, apart from individual characteristics as the main factor, organizational attributes also play certain roles in the trust processes between developed SMEs and the partners (Larson and Starr, 1993), shown in Figure 7.5. The finding confirms the literature that the formation of common interests, mutual goals and reciprocal exchanges are at inter-personal as well as inter-organizational level (Larson, 1992; Powell, 1990; Powell and Brantley, 1992) in the networking processes. In examining the trust process at inter-organizational level this study mainly focuses on the organizational attributes and virtual interactions, in that the entrepreneurs recognized that their corporate websites were not just tools for advertising, but also platforms for sharing organizational information which contributed to creating and maintaining cognitive social bonding capital and cognitive trust. Corporate websites were used for enabling network connectivity with new and existing customers, but not as instruments for storytelling, proposed by Sinclair (2005). In other words, they were not used as an approach for building, developing and maintaining affective trust. This may be related to the entrepreneurs' purposes in using and interpreting the role of websites – publishing general business information instead of building emotional ties. Instead, face-to-face interaction is viewed as the best mode to build affective trust.

The frequent use of video-conferencing was found in one medium-sized enterprise which possessed the facility. The interactions were conducted based on the affective trust and under the condition that both network partners had clear communication objectives - discussing and explaining technological issues. The interactions facilitated cognitive trust development and maintenance to some extent. The last aspect relating to inter-organizational trust is the size of the SMEs. The size provided flexibility and enabled responsive changes to customize customers' demands (Birley, 1985; Ostgaard and Birley, 1996; Szarka, 1990). This made it likely that they would form common interests and shared goals, and therefore cognitive social capital. In this way it facilitated cognitive trust building.

Although the literature has identified the importance of the context in terms of community events for establishing weak ties, sources of information and advice (Powell and Brantley, 1992; Weick, 1976) and informal networks (Orr, 1990),

however this study reveals the impact of context on the trust process, shown in Figure 8.6. The events within the biotechnology community provided an academic and social setting for the identification, formation and maintenance of both cognitive and affective bonding social capital as well as trust. The context also links the entrepreneurs to a pool of connections, which creates customer referrals, and sources of information which generate the opportunities for potential trust for future collaboration.

Figure 7.6



The discussion of relational trust mainly focuses on the impact on geographical distance and the use of video-conferencing in the trust process. This study reveals that face-to-face interactions are imperative in each network relationship regardless of customers' geographical location. Such need for face-to-face interaction is considered to relate to the characteristics of the network relationships in this study (refer to section 6.2.2.5). The use of video-conferencing is generally in the circumstance when there is a conflict between the time required for international travel and whether the entrepreneurs are available at the time; this finding is congruent with that of Fontes (2005) and

Powell et al. (1996). This study goes further to point out the relationship condition needed for using video-conferencing - the entrepreneurs have built affective trust. A video conference provided the speed for certain tacit knowledge exchanges in the trust development. However, since only one sampled firm had video-conferencing facilities, it must be acknowledged that this finding is provisional.

Referring to the concept of trust, some scholars (e.g. Thorelli, 1986) suggested that trust is a psychological belief, while others (Anderson and Jack, 2002; Anderson and Steinart, 2005) argued that trust is a relational artefact. It is produced through the interactions and it takes time to emerge. This study has empirically confirmed the latter view by showing the manifestation of the elements and the growth of trust through the networking processes. The aspects of psychological belief, for example, the elements of expectation and confidence are part of the concept (refer to section 6.2.2). Moreover, this study supports Anderson and Steinart's (2005) viewpoint that trust is a multi-dimensional concept by providing empirical evidence in the study context. Inter-personal trust is the focus among the various dimensions. Nevertheless, this study further explores the process of bonding social capital, its role, and the impact of its inter-play with the use of email at different stages in the trust process and how these shape the processes of network relationships and incremental innovation. This study contributes to our knowledge by examining and explaining the construction of trust processes, network relationships, interactions and interaction modes in the networking processes.

7.5 Reflections on the Phenomenological Approach

As highlighted in the previous chapters, there is increasing recognition by entrepreneurship scholars that entrepreneurial networking experience involves emotion, feelings, individual characteristics and a socially constructed environment as the elements. Moreover, each entrepreneur's experience is different from another's, depending on a mix of dispositional trust, past networking experience, networking style, approach to trust and the use of

interaction modes by an individual entrepreneur. Due to these complexities scholars have called for more qualitative research to obtain richer insights than may be gained by standard questionnaires, pre-defined by a researcher, as discussed in Chapter Five. Hence, this study tried to catch the entrepreneurs' lived experience of networking in collaborative incremental innovation via in-depth interviews, to collect their narratives and analyze the stories and reveal the ways in which they made sense of the experience. This section discusses the advantage of the phenomenological approach and the ways to interpret the usefulness of the theoretical model of networking process.

The analysis and discussion of the findings indicated the complexity and dynamic nature of entrepreneurial networking and the inter-connection between the components. The undertaking of in-depth interviews enabled the respondents to recount and tell their networking stories through open conversations, while a standard questionnaire would not allow for the data collection to be rich, in-depth or disclose complex relationships, trust process, bonding social capital and virtual interactions. As Anderson and Jack (2002) argued, the respondents cannot interpret their own social capital (*ibid.* p.199). Therefore, it devolves to the researcher to interpret social capital with empathy. Furthermore, the interpretation of the narratives enables the construction of a theoretical model such as the networking process through the entrepreneurs' sense-making of their lived experience (Patton, 2002, p.11).

It is the interpretation that enables the development of Technical, Combined and Social Approaches to trust (refer to the last chapter). These categories are descriptive; they explain the differences in the way by which trust is built, developed and maintained, and how the collaborative relationships are developed and affected by virtual interactions. The categories are produced by identifying the themes which emerged from the text/or lived experience, describing and explaining the structural aspects of networking experience, which are congruent with Van Manen's (1990) analytical approach, hermeneutic phenomenological reflecting. These categories are not suggested as universal stereotypes, rather as the ways to understand the networking process by which entrepreneurs experience the collaboration.

The groups categorized as Technical, Combined and Social Approaches are points located in a continuum. Entrepreneurs will network with an inclination to one end or the other, yet this is affected by the characteristics of boundary spanning individuals and relationship situations. Nevertheless, the categories may be useful for explaining some entrepreneurial networking behaviour; e.g. a bio-science entrepreneur embedded in an oriental culture confronts the same situation of establishing affective bonding social capital as the entrepreneur in the UK culture in the early stage of the collaboration.

As Moustakas (1994) noted, the way to understand the characteristics of a phenomenon is through gathering the lived experience as material to obtain a description and explanation. The reflection upon the lived experience, identification of the themes and disclosure of the structure help us to understand the meaning attached to that experience (Van Manen, 1990, p.29). A phenomenological approach leads the researcher to capture the experience of the individuals who experienced the phenomena, examine the richness and illustrate the structure, nature and significance of them, and therefore, gain deep understanding of the phenomena (Van Manen, 1990, p.38). This approach has been a useful tool to the researcher for investigating the entrepreneurs' networking experience. The theoretical model (Figure 7.6) produced by this study is not a universal model, but rather a way to illustrate the components, the key determinant and the connection of the components that make up the entrepreneurial networking process.

7.6 Conclusion

The discussion in this chapter has located the findings of this study into the broader context of existing literature, namely entrepreneurial networking and generation of product innovation, network relationships and virtual interactions. It has constructed and explained the networking process model, layer by layer, indicating that the networking approach is clearly a strategy used by the bio-science entrepreneurs to generate product innovation. The customer network is

probably the most important external stakeholder for incremental innovation. The discussion suggests that collaboration in incremental innovation is actually a networking process, comprised of affective, cognitive and conative aspects of people interactions shown in the literature (Albrecht and Ropp, 1984; Knight, 1967; Pittaway et al., 2004; Roy et al., 2004). This study recognizes that these aspects are separate but intertwined, and integrated in an entrepreneur's activities in the antecedents, actual network interactions, and updated and brought into the antecedents of the future networking process.

It has been demonstrated that network relationships shape the interactions and the progress of collaboration, and therefore the economic outcome – the generation of incremental innovation. The whole process is mediated by the inter-play of bonding social capital, trust, interaction mode, the level of knowledge tacitness and the relationship process. As proposed by Anderson and Steinart (2005) that being a relational artefact, trust takes time to develop. The categories of Technical, Combined and Social Approaches are identified as the ways to understand how the different mix of dispositional trust, bonding social capital, interaction modes and relationship stage influence the network interactions and trust process. Inter-personal trust is the operative factor in the process. The formation of affective bonding social capital which leads to affective trust building is critical for cognitive trust to develop. It is argued that the investigation of the role of virtual interactions needs to take other factors into account.

Chapter Eight

Conclusions

8.1 Introduction

The research questions, set out primarily in Chapter One, were derived from the researcher's personal interest in understanding entrepreneurial networking in relation to whether and how network interactions, in particular virtual interactions influence the collaboration process in incremental innovation.

A review of the existing studies concerning biotechnology product innovation generation and entrepreneurial networking, network relationships and virtual interactions pointed out several areas for investigation. It was learnt that a majority of the studies related to product innovation had focused on radical innovation, there was little research that had been carried out in incremental innovation although this form was far more frequent than radical. The literature showed that networking with customers, as an approach to generating product innovation, had been beneficial to SMEs. However, while the existing studies examined what contributes to innovation generation, there was little research which had investigated dyadic interactions in supplier-customer networks in the process of generating incremental innovation in the SMEs in the biotechnology industry. This gap signalled that not only the influence of the actual networking process, but also understanding the role of network interactions in collaboration needed investigation. In the literature, a network relationship was shown as the main entity of the interactions, and the use of interaction modes was also an influential factor. Trust itself as the key determinant in the relationship is in fact viewed as a process, shaped by the development of bonding social capital. The findings of this study indicated that these interaction factors did not participate in the process separately and that there could be more than one factor operating on any boundary spanning individual in any specific relationship. The findings also showed that these interaction factors influence the progress of collaboration.

Relating to the ways in which entrepreneurs might conduct and perceive network interactions, the literature showed that in recent years scholars had explored and increasingly recognized the personal nature of virtual interactions. The interactions have been conceptualized as transaction (Beije and Groenewegen, 1992; Williamson, 1975), communication (Albrecht and Ropp, 1984; Olkkonen et al., 2000) and networking (Nonaka and Takeuchi, 1994; Roy et al., 2004). Based on the stock of our knowledge, this study proposed that an entrepreneur's virtual interactions joined into a process of network interactions. Since network relationships and trust influence the interactions of information and tacit knowledge exchanges, they might also influence the use of virtual interactions, and vice versa, in the networking processes. The existing studies of entrepreneurial networking had mostly focused on its relation to marketing or its impact on firm competitiveness and growth in general rather than the process and its impact on collaborative incremental innovation, and there were none in the biotechnology industry. Analysis of the entrepreneurs' narratives uncovered the processes by which the interactions are experienced and perceived, becoming integrated into the antecedents and network relationships in the potential collaborative innovation or other entrepreneurial opportunities.

The literature has shown several areas where there is little or no existing research: (1) the impact of entrepreneurial networking process on collaborative incremental innovation; the interplay between the antecedents, dispositional trust and the use of the interaction mode which an entrepreneur carries into network relationships and the interactions in the processes; (2) the interplay between the elements of trust as a process, bonding social capital, the level of knowledge tacitness, virtual interactions in the networking processes and their impact on the collaboration; (3) the ways in which the previous collaborative innovation is integrated and becomes part of the circular process of networking in the future. Furthermore, many of the product innovation and networking studies have been conducted by quantitative research. This study undertook a phenomenological approach as an interpretative study to explore and understand entrepreneurial networking process through the narratives. The analysis yielded the development of a new framework which depicts and elucidates the processes

through which entrepreneurs make sense of their experience in incremental innovation.

8.2 Major Findings

This section summarizes the key findings by re-visiting the research questions. The first research question pertained to the identification of the components of entrepreneurial network interactions. The first layer of the data analysis in Chapter Six provided the descriptive categories of the components of networking, which the entrepreneurs carried with them (antecedents) and which they went through during the collaboration (Linking, Development, Collaboration, Maintaining the Contacts and Virtual Modes). Furthermore, the entrepreneurs' narratives clearly showed that the networking processes and virtual interactions had influenced the innovation practices.

This study also indicated that there were commonalities of entrepreneurial experience, which explained the patterns of networking. An examination of network behaviour showed the differences between the entrepreneurs in terms of the ways they entered into the relationships in customer networks, which suggested that network relationship was part of the process of networking. Analysis demonstrated that some respondents focused on discussing customers' technological problems/requests, in that they interacted to identify common interests; and others engaged in social topics and activities, and might start to talk about technological issues when inter-personal friendships were established.

Three behaviour styles were therefore recognized and described, namely Dealing with Specific Technological Problems/Requests, Exploring Business Interests and Creating Inter-personal Friendships. Differences in networking strategy were identified, showing that these three types of network behaviour were associated with the ways of building, developing and maintaining trust in the networking process. These three styles reflected strategies towards trust building respectively: Technical, Combined and Social approaches. Trust, per se, was also shown to be a process in the networking behaviour.

Networking practices of trust building and the behaviour styles were related to the entrepreneurs' use of virtual modes and bonding social capital. The categories of Technical, Combined and Social Approaches are ideal exemplifications, constructed upon the characteristics of network behaviour and relationships exhibited in the entrepreneurs' interactions. They assist the interpretation of the ways by which networking experience is affected by the factors entrepreneurs carried with them into the relationships (dispositional trust, interaction modes used in the antecedents), networking strategies chosen for the trust process (dealing with technical problems/requests, exploring business interests, creating inter-personal friendships), the ways they use interaction modes and how they then progress the collaboration. Therefore, based on sorting several characteristics of the network behaviour and relationships into distinct groups, we may be able to make predictions about entrepreneurial network behaviour.

The entrepreneurs at any point in the spectrum between Technical and Social Approaches might experience the same process of building bonding social capital, yet these were manifested in different ways of networking. Those of Technical Approach who have already gained certain information about inter-personal identities in face-to-face meetings in the antecedents, can go into technical discussion relatively straightforwardly by emails since some amount of affective trust has been in place, during those virtual interactions by email certain tacit knowledge exchanges occur in the form of understanding technical problems/requests and offering initial ideas related to the solutions. The technical approach appears to focus more on the cognitive aspects of new product development at the outset. Nevertheless, social activities are integrated into the interactions for developing the affective trust in Development stage.

Those entrepreneurs using Social Approach, on the other hand, mainly concentrate on establishing inter-personal friendships and intimacy, identifying individual honesty and benevolence through social activities in face-to-face meetings at the outset. Their ways of building affective bonding social capital and trust are based on the individuals' personal closeness and liking so that affective

trust is ensured. This networking approach to trust is used due to the relationships' needs from the customers embedded in oriental cultures. Once affective trust is built, the focus of this approach becomes the development of cognitive trust in Development stage.

Although entrepreneurs of the two approaches interact in different ways for building trust, the commonality is that the formation of affective bonding social capital arose in face-to-face interactions at the outset, when email is not the appropriate mode. Affective trust is determinant in developing cognitive trust in both approaches.

For the development of cognitive trust, email is insufficient to support the technical discussion due to the increased level of knowledge tacitness, such as explanation and demonstration regarding more concrete proposals, technical training on how to use the potential new products. Thus in these situations, face-to-face meeting is the best mode. The examination of the trust process in both approaches shows that the affective and cognitive aspects of trust are imperative, they work together to enable the relationships to progress and function to allow for a higher level of tacit knowledge exchanges, leading to the collaboration.

Trust is not merely a psychological belief, rather a relational artefact, this is manifested by the changes in the "ingredients" in several elements, consisting of expectation, awareness, reliability, satisfaction and bonding. Each element is developed from both affective and cognitive aspects over time. Thus, augmented trust is stronger and more capable of functioning in the changed situations such as providing aid in a timely manner.

In Maintaining the Contacts stage, due to the presence of augmented trust, email can be used to maintain affective bonding social capital under the condition when bio-science entrepreneurs have shared the several facets of affective bonding social capital in the past. In some situations when the knowledge tacitness is critical, relationship uncertainty exists and message ambiguity arises, then these become the factors in determining the use of face-to-face interaction due to

changed business situations. Bonding social capital then becomes less relevant factor in making the choice on the interaction mode.

This study advocated the use of a qualitative approach in helping us gain an understanding of the social phenomena through capturing the entrepreneurs' lived experience. To develop the argument, Chapters Five has discussed the importance, and the ways, of enabling a phenomenological openness during the fieldwork and analysis, and shifting backwards and forwards. The Chapter also brought about the issues of judging trustworthiness in qualitative studies (consistency, transferability and credibility) and suggested a research technique of being empathic in order to generate true and open conversations in the interviews, providing a multi-layered and richer data package. It also expressed that data should be treated as unfinished resources and explored the benefits of computer aided qualitative data analysis as a tool to manage the process.

This research has shown the usefulness of the phenomenological approach to interpretative study: understanding the phenomena through the entrepreneurs' stories, it has armed the researcher to go into the lived experience and gain deep insights into the ways in which the key components of networking are interconnected, and as such to uncover the networking processes in-depth. In this way it has fulfilled the need to use qualitative methodologies rather than pre-defined hypotheses and standard questionnaire survey. This study exemplifies that entrepreneurs' narratives concerning their networking in collaborative incremental innovation can, indeed, be a means to obtain an understanding of the links between the components, trust, bonding social capital and virtual interactions. The re-collection and re-telling of the stories that enabled the entrepreneurs to reflect the ways by which they make sense of the experiences and bring them into the antecedents of their future collaboration for innovation.

8.3 Research Contribution and Implications

This research contributes to our understanding of the collaboration process in incremental innovation by offering an account and explanation of the

entrepreneurial networking processes and the impact of virtual interactions upon the processes experienced by the bio-science entrepreneurs, a field of study where there seems to have been gaps in the literature. The findings show that the connection between the two basic, cognitive and affective, aspects of product innovation is complex and dynamic. The antecedents of relationships, including website visits, Internet search, previous meeting experiences and external references, combined with dispositional trust, expectations and awareness of the network partners, all involve in different ways in each collaborative relationship circumstance. Consequently, the networking process that is experienced by an entrepreneur is shaped by their dispositional trust, interaction mode used in the antecedents, expectations and individual characteristics he/she carries with him/her as well as by his/her interactions and the ways of going through the trust process.

As addressed in the literature review, there is no universal, one-fits-all theory of supplier-customer relationship process. This study demonstrates that what may be useful to the understanding is to reveal the structure, bearing in mind the context and inter-connections between the elements. In this way, the impact of the networking process and virtual interactions can be disclosed.

This study has revealed the richness and dynamic nature of network relationship processes in the context of incremental innovation in supplier-customer networks in the biotechnology SMEs by providing empirical evidence. The findings show that the networking process mediates the relationships context - incremental innovation in the biotechnology industry. This particular context shapes the entrepreneurial networking behaviour. Trust is found to be critically important in new relationships since the goals of collaboration are to develop new biotechnology products within which the technologies can be the core competence of an enterprise. As a context, product innovation in the biotechnology industry determines that the network interactions involve a high level of message ambiguity and tacit knowledge exchanges.

In addition, the type of product innovation, namely incremental, confirms the fact that the ways of networking and the use of interaction modes determine the

success of collaboration. Since the interactions are the basis of how the innovative ideas are generated, the proposals for technological solutions are explained and discussed, training is conducted and technical problems are resolved. The process of collaborative incremental innovation is a networking process with gradual changes in the cognitive aspects of trust which signal an evolving process of generating new products. However, such cognitive aspects of new product development should not be viewed in isolation. The cognitive trust would not be able to grow without affective trust building and development. Without trusting the individuals' honesty and benevolence, the information flow and the tacit knowledge exchanged would not in effect be trusted. Affective trust is determinant for the development of cognitive trust.

In the literature, the discussion of bonding social capital is largely related to its elements and its role in the trust building and innovation. This work extends the literature by disclosing the development and maintenance of bonding social capital and its links to the ways of using virtual modes, and the interplay of these factors with the trust process in the collaboration.

This research has contributed to our stock of knowledge in several ways:

- ❖ It has identified the gaps in the literature, in that there is a lack of research investigating the processes of entrepreneurial networking in supplier-customer networks in an entrepreneur's collaboration for generating incremental innovation and the impact of actual processes on the innovation practices.
- ❖ It has constructed a conceptual model, which shows the process of entrepreneurial networking and explains the links between the entrepreneur's antecedents, dispositional trust, the use of interaction modes, and how the combination of these carried by an entrepreneur influences not only the actual networking process in incremental innovation, but also future innovation practices.
- ❖ It has explained that the progress of collaboration is determined by the process of trust development, and provided a framework for capturing the characteristics of entrepreneurial networking behaviour. This is reflected in

their ways of experiencing the trust processes and explained by the theoretical exemplifications of Technical, Combined and Social Approaches.

- ❖ It has revealed the process of bonding social capital development, its links to virtual interactions and how the interplay of bonding social capital, trust process, virtual interactions, level of knowledge tacitness and the relationship process shape the development of collaboration in incremental innovation.
- ❖ It has deepened our understanding of the concept of trust in the entrepreneurial networking context and suggested that trust is a relational artefact rather than merely a psychological belief. The concept has been shown to contain several elements; expectation, awareness, reliability, reciprocal interaction, satisfaction and bonding, which evolve and update through the interactions and enable trust to become different forms of relational property over time. Augmented trust, as a result of the networking is characterized by strong ties. It is a stronger form of relational artefact that functions to provide more potential innovation or other forms of entrepreneurial opportunities.
- ❖ It has empirically confirmed that trust is a multi-dimensional concept with a number of facets involved, namely inter-personal, inter-organizational, contextual and relational trust. They are involved in the trust process to various extents. Among all, inter-personal trust is the central aspect.
- ❖ It has enriched our understanding of virtual interactions, in particular of email; whether it is a lean or rich mode is dependent on several operational factors in the relationship process. The examination of virtual interactions has demonstrated that theories and explanations should link various aspects within the networking process holistically rather than simply focusing on the electronic system itself or the message conveyed, which those theories, namely "Cues-filtered-out", MRT, SPT and SIPT do.
- ❖ Finally it has demonstrated the usefulness of the phenomenological approach to interpretive research in the investigation of social phenomena concerning entrepreneurial networking and in enabling the understanding of entrepreneurs' lived experience.

The implication of the research, including theoretical and practical aspects will be in the next section.

8.3.1 Theoretical Implications

From the theoretical perspective, the model developed by this study (refer to Figure 7.6) shows a broad picture which researchers can use as a general reference in the investigation of any collaboration in innovation: what the structure, components and key determinant are and how they relate to each other. In addition, it helps to explain how the links between them yield the impact on actual collaboration and future innovation. For example, the model can be used as a reference for understanding the ways by which science entrepreneurs experience network interactions with customers in the collaborative service innovation. This may suggest a process of the interactions with customers and uncover the critical role of trust and its development in moving the relationship forward to achieve the outcomes in a new service. The collaboration can be derived from customers' antecedents of corporate website visits, their expectation of having a better service/or service more tailored to their needs. Their relationships with the entrepreneurs during the networking are a relevant and important factor. By paying attention to the trust process and identifying which approach suits this customer or a group of customers, the trust building may be approached in an appropriate way. In some relationships, customers may view network behaviour and ways to trust against their own benchmarks, whether technical issues are appropriate to discuss together with the social topics in the beginning of the relationships (Technical Approach) or set the building of inter-personal friendships as the priority (Social Approach). In addition, an examination of the interplay of the factors, including bonding social capital and interaction modes should not be ignored in the analytical process.

Moreover, trust as a multi-layered concept reminds the researchers to look into the dimensions and their impact on the progress of the trust process in various relationship situations. For example, if the entrepreneurs and customers have met in the science conferences prior to the collaboration and have certain information of individual identities, they may use emails to interact and discuss technical or management detail of a service development at the outset. Therefore, the model provides some clues from where a researcher may examine and analyse a relationship process and the ways of linking various participating

aspects. The logic of enriching the impact of the existing networking process in actual collaboration to future innovation practices should also be borne in mind.

This study demonstrates that regardless how fast or how lacking in social presence virtual interactions may be, the use of virtual modes is one of the factors in the networking processes. Science entrepreneurs carry a combination of various elements going into and interacting with customers in the processes. As discussed in Chapter Five and Chapter Six, the examination of the impact of virtual interactions should integrate other factors and the interplay of these factors which shape the progress of collaboration in innovation. In these ways, a contribution to conceptualizing networking processes and practices has been achieved.

8.3.2 Practical Implications

The findings of this research are useful to science entrepreneurs and government/or other policy makers in relation to networking strategies and networking practices in the innovation process. It should not only assist bio-science entrepreneurs but also those in other industries in their understanding of collaboration processes and the impact of the processes on the generation of innovation. Science entrepreneurs can use the model developed from this research in the relationship management in collaboration with customer- or supplier-networks. The model shows that although relationship management can be complex and difficult to cope with, due to the diversity of individuals, relationship situations and the impact brought by technology advancement in terms of using virtual interactions, yet there are patterns and trends that we can capture from the behaviour and relationships and use them as references for managing collaboration processes in order to achieve the success of innovation generation.

The model would assist them to identify and clarify customers who may share certain bonding social capital into a number of groups, for example, those with different cultural backgrounds and to bear in mind that the inter-personal

characteristics may affect the ways of building, developing and maintaining bonding social capital and therefore the ways of networking in the trust processes. The model shows that a networking process takes time and effort, and needs interactions to nourish a trusting relationship. The antecedents in the model provide a source of information for entrepreneurs to explain how innovation opportunities can be cultivated; they may engage in certain activities or take actions according to their own situations.

This study indicates that technical competences for accomplishing the tasks as well as individual qualities of honesty are imperative and equally important for the collaboration in innovation. In particular the demonstration of individual honesty is a pre-requisite for establishing trust in technical competence. Trust is not only a psychological belief; it grows through the interactions over time to allow several elements (e.g. expectation, awareness, reliability, etc.) to develop and become augmented. Then the trust established can be convincing and used to predict an individual's future behaviour. The power of trusting relationships in generating innovation and other potential entrepreneurial opportunities revealed by this study shows that entrepreneurs realize the value of the relationships and take actions to maintain that trust. The networking behaviour in the Maintaining the Contacts stage and trust process discussed offer entrepreneurs guidance for the maintenance of trusting relationships.

This research has explained why entrepreneurs need to take other factors into account when they think of using a particular interaction mode in the collaboration. Simply regarding email as a speedy tool or a lean mode for network interactions without considering whether it suits the individuals, the trust process, and the level of tacit knowledge exchanged may lead to collaboration failure or misuse of the resources in the practices of innovation generation.

For government or other policy makers, this study provides the richness of the entrepreneurial networking process, the insight gained may help relevant government bodies understand the process and therefore provide assistance to science entrepreneurs to cope with the complex and dynamic relationship

situations, and therefore, fulfil their pursuit of innovation and entrepreneurship. They may refer to the model developed from this research to provide some training related to networking skills, the ways of interacting with people (e.g. understanding behaviour and customs in other cultures). They may set policies to encourage bio-science community events (e.g. conferences, exhibitions) where there is the context of antecedents which may generate innovation opportunities. Certain training programmes can be provided to entrepreneurs for enhancing their capabilities in virtual interactions (e.g. training programmes of IT skills and presentation skills in virtual conferences). Certain financial aid may be established to help some SMEs to be equipped with video-conferencing facilities where possible so that the virtual interactions can be conducted.

8.4 Limitations and Future Research Recommendations

8.4.1 Entrepreneurial Networking in the Chosen Regions/Countries

The in-depth interviews of this study were conducted in Aberdeen and Dundee, UK, the two cities where there was a culture of promoting bioscience and where there was an aggregation of biotech firms. While the interpretative research undertaken does not intend to generalize the findings to a broader population, it is noted that the bio-science entrepreneurs who participated the interviews were located in the UK. They all networked internationally. In addition, all of the SMEs which participated in this study were actively engaged in several product innovations at the time of the interviews. Therefore, it may be interesting to repeat this study through in-depth interviews with science entrepreneurs in the bioscience SMEs in other countries (e.g. Middle-East countries, Asian countries) to find out the patterns of networking and virtual interactions where there are different technological infrastructures. Anecdotal evidence emerging during the in-depth interviews suggested there are possibilities that the future findings may reveal different patterns of virtual interactions in certain countries, in this way our understanding of the networking process may be enriched by taking different influential factors into account.

8.4.2 Entrepreneurial Networking of Different Individual and Organizational Characteristics

Given the fact that a majority of bioscience entrepreneurs who participated in this study were male (only one female respondent) and all of them aged between 35 and 54 and all were UK nationals, this means that the work contributes to the understanding of networking behaviour within a group of entrepreneurs possessing these characteristics. It would be interesting, however, to carry out a further set of interviews with science entrepreneurs having other characteristics (e.g. under 35, female) and in non-high-tech industry, or to recruit more of those entrepreneurs of medium-sized enterprises which possess video-conferencing facilities and to constitute them in the sample, as such future examination may find some differences in terms of the use of virtual interactions and network behaviour patterns. Whilst the model developed from this study is informative, its application is open to be assessed and revised, depending on different innovation circumstances. Further studies discussed in the above two sections may allow us to compare the models and help entrepreneurs to amend the references of networking behaviour in the collaboration experiences in innovation practices.

8.4.3 Exploration in Research Methods

This research has generated a model which shows and demonstrates the process, key determinant and factors of network interactions through which entrepreneurs experience their collaborative innovation. Further studies may be conducted to obtain a deeper insight into the ways in which networking experience in incremental innovation contributes to the generation of radical innovation. Moreover, the interviews in future studies can include customers or bioscience network intermediaries which may expand the sub-categories in the model with more elements in the networking process. As technologies advance, such future investigation may exceed the bounds of virtual interactions in this research and contain different virtual mode categories, which may possibly relate to the contribution of virtual interactions to tacit knowledge exchanges and therefore cognitive trust development. The further research would assist in deepening our insights into the networking process and virtual interactions as experienced by different groups of respondents. Additionally, a research method of employing a

longitudinal study of those SMEs involved in this study can be set in a schedule to see what, and if, differences exist in their ways of using virtual interactions as time goes by.

8.5 Concluding Remarks

This research has investigated the process of entrepreneurial networking and the impact of the process in collaboration for incremental innovation in the biotech SMEs. It has shown the undertaking of the phenomenological approach in obtaining an insight into the entrepreneurs' lived experience and it has developed a model to reveal the complexity and dynamics in the network interactions by presenting three layers of data, the components, key determinant and factors in the process. It has explored several theoretical and practical implications based on the findings. The researcher wishes that the model developed from this research can be useful to our understanding of entrepreneurs' experiences of networking and virtual interactions in collaborative innovation.

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Appendix One

Participant Observation and Interview Arrangement (Chapter 5)

(1) Introduction Letter

Dear

We are conducting a study in respect of networking and product innovation in small and medium sized companies in Scotland. This is also part of my doctoral work. We are very interested in you and your company and would be grateful if you would agree to be interviewed. The interview should last about an hour, but your participation and cooperation are very important to us and will be greatly appreciated. All answers are completely confidential. Following this letter, I will telephone you with a view to arranging an appointment for participant observations and an interview at a time suitable for you. If you are not willing to participate in this study, please email me.

Thank you

(2) Follow-up Letter

Dear

Further to our recent conversation, I write to confirm that I am conducting a research project into interaction modes and entrepreneurial networking amongst entrepreneurs in Small and Medium Sized companies in the Biotech industry. My particular interest is virtual interactions in the collaboration for product innovation generation.

As such, I am grateful to you for affording me an interview facilitating my data collection. To this end, I enclose a note of the areas which I hope to discuss with you, in order that I can develop an understanding of the extent of your organisation's external networking behaviour and process. In addition, I would be obliged if you would take the time and complete the enclosed questionnaire for collection by me at our meeting.

Your participation in this research project is greatly appreciated, and I confirm that all information gained will be treated in utmost confidence.

I look forward to meeting you at interview.

(3) A Two-section Questionnaire

Interviewee surname:

Section One: General Information

1. Please tick the appropriate categories within which your organization falls in terms of the number of employee, and turnover in the last financial year.

Enterprise category	Number of employee
Medium-sized	< 250 <input type="checkbox"/>
Small-sized	< 50 <input type="checkbox"/>
Other, please specify	

2. When was the firm established? _____

3. Your gender

Male female

4. Your age

Under 24 25-34 35-44 45-54 55-59 60-69

70+

5. Education level:

Secondary school

Degree (First degree)

Higher Degree

Other, please specify _____

6. Country of origin _____

Cont'd, A Two-section Questionnaire

7. Section Two: Topics for Conversation

- Product innovation of your firm since establishment
- Networking in product innovation
- The use of face-to-face and non face-to-face electronic interactions

Appendix Two

The Value and Problems of Participant Observation

Participant observation, as a qualitative research method, enables a researcher to immerse him/herself into a natural setting of the phenomenon. This is achieved by the researcher being there to participate and experience the phenomenon (Patton, 2002, p.4). Van Manen (1990) argued that participant observation can be a useful approach for collecting lived experience, which is determined by the ontological perspective of research. He suggested that "the researcher enters the life-world of the persons whose experiences are relevant studying material for his/or her research" (*ibid.* p.68). Participating implies being subjective and empathic, and observing means to be objective and with a scientific attitude. In this way, participant observation serves as a tool allowing the researcher to access the phenomena, so that the people experiencing the phenomena are familiar with him/her and then get used to his/her presence, therefore enabling a "natural occurring" for the observation.

From an ontological perspective, participant observation is suited to those studies where the researcher intends to understand interactions, actions and attitudes, and to generate data with richness and detail in the social world. The observation can include events, daily routines, conversations and style of behaviour (Mason, 2002, p.85). These occurrences of social phenomena may take place in a setting that is conceptualized as a context of natural occurring of the phenomena and in which the researcher immerses himself/herself and learns about the phenomena.

From an epistemological perspective, for social phenomena the knowledge of the social world can be collected through observation in "natural settings". As such, the data gathered in those settings containing interactions and actions can reveal the phenomena in multiple ways. Participant observation enables moving from social facts to lived meaning since it allows the researcher to develop a sense of

being in the respondents' life world and therefore to understand their behaviour as the respondents perceive them through participation and interaction.

For the purpose of this study participant observation was used as a method for carrying out the preliminary study. It was intended to enable the researcher to become familiar with the natural networking settings, related to product innovation practice in the biotechnology SMEs and to explore the network behaviour, actions and attitudes of the entrepreneurs. In addition, participant observation in various network activities, events and meetings, and the access to the relevant documents (e.g. emails exchanged) would allow the researcher to observe what was going on in the networking processes, such as the ways of network interactions and social settings. The information collected would assist the researcher to carry out the interviews, for instance, the themes to explore and questions to pose in order to gain the richness of the interactions. Furthermore, participant observation would aid the interview process by enabling the researcher to become familiar with the networking processes engaged in by those entrepreneurs who were in the biotechnology sector and in small firms and thereby to "tailor" the interview processes in order to collect the relevant lived experiences, which might be characteristic of the science entrepreneurs.

Having discussed the usefulness of participant observation and its relevance to this study, however, participant observation is time-consuming and resource-consuming (Hussey and Hussey, 1997, p.68). In addition, for those phenomena that involve organizations, the access needs to be negotiated and permitted. The research object of this study involved networking processes and the use of virtual interactions in entrepreneurs' innovation practices, so it was understandable that some of these areas were regarded as confidential by the enterprises and so made the access difficult. These limitations could create barriers for obtaining the source of sample for the study.

Appendix Three

The collection and explanation of technical terms in this section are related to the accounts as well as the functions of Nvivo that have been utilized by this research. It is not designed to be a list of terminology as that included in Nvivo software books.

Nodes in Nvivo

Nvivo system provides three types of nodes for data categorization: free, tree and case nodes.

Free nodes

Free nodes are the holders for data that are not organized into a structure; they were used for coding as a result of emerging ideas and in the early stage of coding, prior to establishing the links between the codes.

Tree nodes

These provide a system enabling the categorization of ideas in the data. There are nodes and sub-nodes which can be created to show the links between different concepts and those of sub-concepts. They are also used to access and track the ideas for organizing the data. They are helpful for seeking associations and differences between categories and for creative thinking by moving the categories around within the data set.

Case nodes

These are used to keep the documents, memos together concerning an individual or other particular categories for tracking different materials designed by the researcher. For example, a case node can be created to hold redundant nodes.

Creating nodes

Creating nodes constitutes part of the coding and reflecting process of data analysis. Child or Sibling nodes can be added to an existing node. For example, in this study Networking Process is a parent node and four child nodes are created as sub-categories, which include Antecedents, Linking, Development and Maintaining the Contacts.

Managing Document in Nvivo

Documents can be stored and created into different types for different purpose of use in Nvivo.

Document Sets

These can be used to hold different groups of documents and to access these documents whenever there are needed. A set can be created to contain several documents related to a firm or which share similar natures (e.g. the interview transcripts).

Document

Documents can be created within the Nvivo system or imported from an existing word file. After creating a document, the text can be organized by highlighting the headlines or coding into different categories held by nodes.

Memo

They are created to record ideas or any thoughts during the analysis, they can be related to an individual, a node or any emerging issues to be considered or re-accessed.

DocLinks

Document links are used to establish the links between documents (or memos), or between documents and nodes for thinking and analysis, for example, analysis of a particular individual or a stage in the relationship process.

Attributes

They are properties attached to nodes or documents. Each interview transcript is given several attributes and used to record a respondent or firm's characteristics, such as age, number of innovations of the firm.

Show Tool

It helps to have an overview of the project. For example, this study uses Documents Coded at A Certain Node option to see how many relationships are coded for using Technical Approach. This is done by accessing and retrieving the narratives coded in Technical Approach.