Testing for the Effects of Organisational and Individual Cognitive-distance in Small Business and Creative Industries Innovation Partnerships

Lorraine Morley MBA

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University of Warwick
Warwick Business School
Entrepreneurship and Innovation Group

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Summary

This thesis is concerned with understanding how the similarities, or differences, between small businesses working on transactional open-innovation projects might affect the dyadic performance. Specifically it explores whether varying degrees of difference, both at the organisational-level and at the individual personal-level, affects innovation performance and whether there is a 'trade-off' in innovation outcomes somewhere between high levels of similarity and difference.

Empirical studies of similarity and difference have conflicting findings and most research into the particular condition of similarity and difference have taken place between multi-national businesses or in industries that have more formal innovation agendas, such as bio-technology or ICT. Additionally prior research has tended to evaluate a potential linear relationship between similarity variables and innovation performance. The study here draws on the Cognitive Theory of the Firm (Nooteboom, 2003) and its conceptual model of 'cognitive-distance' which proposes that there is an inverted U-shaped relationship between the degree of difference in an innovation partnership and the innovation performance. It suggests a tipping point where performance improves up to a threshold and then begins to decline.

The sample group is drawn from a cohort of small businesses based in the North-West of England taking part in an innovation voucher scheme designed to encourage linkages between small businesses and creative services suppliers. An analytical framework based on different measures and types of similarity is developed by reviewing a broad range of literature on innovation, open-innovation and small business innovation and these measures are used to assess innovation success against a range of six performance indicators.

A major contribution of the research is the extension of the empirical domain for cognitive-distance to the small and micro-business sector and further, the creation of a methodology which allows cognitive-distance to be directly measured, and performance assessed, at the level of the individuals within the innovation partnership. The relativity small sample group and the quite specific context requires the findings to be further corroborated but if results found here prove valid with other sample groups and within other contexts too, there may be implications in the future for how small firms might go about selecting their innovation partners.

Abbreviations

AVL **Allport-Vernon-Lindsey**

B2B **Business-to-business**

ESRC **European and Social Research Council**

NESTA **National Endowment for Science, Technology and the Arts**

OECD **Organisation for Economic Cooperation and Development**

SOV **Study of Values**

UK **United Kingdom**

1. INTRODUCTION

1.1 Introduction

Our appreciation of the nature of the innovation process has evolved from simple linear 'first generation' models to increasingly complex, integrated, networked and 'open' models (Chesbrough, 2003) conceptualised as 'fifth-generation innovation' (Rothwell, 1994). This most recent contribution to our understanding of innovation management calls for high levels of integration at both intra- and inter-firm levels, a requirement to spread the net wide in trying to pick up and make use of a wide set of knowledge signals and the need to learn to manage innovation at the network level. This increased inter-activity, first across the firm with cross-functional teams and other boundary-spanning activities and then outside the firm to links with other organisations has been found to require particular skills to navigate the highly uncertain and distributed environment which opening up a firms boundaries to outside organisations can bring. The differences between firms can enhance the difficulties and problems associated with open-innovation such as parity in motivation, cooperation and communication (Knudsen, 2007).

Whilst the research literature on the benefits and determinants of open-innovation has grown rapidly (Dahlander and Gann, 2010), particularly in investigations of open-innovation using case studies of multi-nationals such as Procter and Gamble (Dodgson *et al*, 2006) few studies consider the potential benefits of open-innovation to small or micro-firms, despite there being persuasive reasons to expect the effects and role of open-innovation to be different for smaller firms (Vahter, Love and Roper, 2012). The scope and focus of innovation strategy within small firms has often been found to be widely different to the approaches of larger firms (Acs and Audretsch, 1990). And particularly when using an open-innovation mode, Chesbrough (2010) argues that small firms are faced with a particular set of challenges due to their relative lack of capacity to both seek and absorb external knowledge. But despite the various difficulties and constraints, recent empirical

evidence suggests that SMEs are increasingly and purposely engaging in open-innovation (Brunswicker and Vanhaverbeke, 2011) and that the propensity for open- innovation amongst SMEs has increased in recent years (van de Vrande *et al*. 2009).

Relationships developed to draw in wider, superior or valuable external resources from partners such as suppliers, customers, firms in related markets and even competitors improves the probability of success of innovation projects (Belderbos *et al*., 2006; Becker and Dietz, 2004; Sampson, 2007; Abramovsky *et al.*, 2008) and offers better results in terms of the innovative output (Ahuja, 2000; Dyer and Singh, 1998). Collaboration extends resources, creates bonds and yields more variety and flexibility than integration of activities in a single organisation, and on average, the benefits of collaboration and cooperation in more formal innovation partnerships outweigh the costs of sharing returns (Vahter, Love and Roper, 2012). But if tapping into the world of knowledge outside of an organisation's boundaries is becoming increasingly the norm, as firms strive to address the large scale challenges inherent in an increasingly uncertain and complex commercial landscape, embracing the opportunity to increase the scope of knowledge creates its own problems (Willis *et al*., 2007). Firms differ in their innovation successes even using leading-practice models, particularly small or very small firms which tend to lack resources in many areas such as technical skills, financial access or restricted organisational structures (Vossen, 1998; Hewitt-Dundas, 2006). Small firms also find it more difficult to overcome the barriers to innovation they encounter along the way such as inertia which can cause difficulties in forming appropriate and effective connections to other businesses (Dixon, 2000), and risk and loss aversion where losses and gains that are in reality equivalent are experienced asymmetrically with losses systematically overvalued (Earl, 1986; Paquet, 1998).

Small businesses are increasingly seen as an important focus of policymakers as they form

a large part of any developed economic structure, most employment is concentrated in

this group and they play an increasingly important role in economic growth and job

creation (Hoffman *et al.*, 1998). SMEs and micro-businesses account for approximately 1.2

million of the total firms that are currently trading in the UK (BIS Small Business Survey,

2012). And a small number of high-growth SMEs, typically technology-led firms, spin-offs

or high-growth start-ups, are disproportionately innovative. These firms are sometimes

labelled the 'Vital 6%' (NESTA, 2009) and are persistently successful in their innovation

efforts and in job creation (Anyadike-Danes *et al*. 2009). But for most small firms

innovation is less successful. They demonstrate some innovation at the start-up of the

business and some degree of innovation in order to survive over time (Potts and Morrison,

2009) but, for the majority, innovation is not central to their business model.   And for

small firms where innovation is often an *ad hoc* activity driven by opportunity or interest

rather than strategy, and undertaken informally alongside the firms other activities

(Hewitt-Dundas, 2006) appropriate innovation partner choice is seen as a particularly

important issue (Vahter, Love and Roper, 2012).   Appropriate partner selection can

provide a degree of relational harmony between partners that will be sufficient to

overcome the persistent conflicts and opportunistic behaviours potentially inherent in

inter-organisational collaborations (Gulati, 1995; Cummings and Holmberg, 2012). In a

contemporary economic climate where business performance for most SMEs and micro-

businesses is difficult or stagnant with sixty-eight percent of those SMEs surveyed for the

2012 small business survey stating their turnover was similar or less than twelve months

before and eighty-two percent of the same firms employing similar or fewer employees

than twelve months before, identifying ways to enhance or mobilise innovation

competency and output may reduce the differential growth (Metcalfe, 1998, 2003)

between small businesses and their larger counterparts.

The contribution of this research is to explore whether, and how, the degree of similarity or difference in the characteristics of small firms working on transactional open-innovation partnerships impacts innovation performance. The characteristics are considered at two levels, firstly at the organisational level using measures reflecting the scale and scope of the business, and then at the individual level exploring similarities at the deeper, psychological level of the key boundary-spanning individuals,   The study uses measurements of similarity devised here and tests their effects on a range of innovation performance indicators. For example, the research explores whether more similar partners have better innovation outcomes, and if so, against all or only some of the performance measures. Or is diversity between partners better and if so, in which performance area(s) does it have the most beneficial impact?

Similarity and difference is operationalised through the concept of cognitive-distance (Nooteboom, 1996) which proposes that firms need to determine their boundaries in order to create some 'cognitive-focus'. This means that internal resources and strategy can be effectively co-ordinated in order to pursue some advantage in the market. But, the organisational myopia that this can generate needs to be mitigated by a degree of complementary cognition from outside of the organisation and at a greater cognitive-distance through external collaboration.   That is, firms, particularly for innovation, need to tap into the 'external economy of cognitive-scope' (Nooteboom, 1992). Within cognitive-distance there is a hypothesised 'optimal cognitive-distance' which is a trade-off between the advantage of increased cognitive-distance for a higher novelty-value of a partner's knowledge, and the disadvantages of less mutual understanding. If cognitive-distance is too narrow, then there is not much to learn from each other. If cognitive-distance is too large, then Nooteboom (1996) suggests there will be poor understanding, more chance of conflict and relationship breakdown.   This research tests for the existence of an inverted

U-shaped relationship between degrees of similarity and difference in the innovation partners (the cognitive-distance) and their innovation performance. In doing so it extends the current research paradigm for cognitive-distance from technology-led formal and quasi-formal innovation alliances between large and small firms to informal transactional relationships between very small firms applying incremental innovations.

The Cognitive Theory of the Firm (Nooteboom, 2006) and the literature review explain the psychological, economic and social dynamics which justify the selection of factors and which provide the rationale which constitutes the research assumptions. These 'how', 'what' and 'why' elements explored here fulfil the requirements needed to constitute a theoretical contribution (Whetten, 1989).   Additionally the conditions which place limitations on the results generated by the research – those temporal and contextual factors of 'who', 'where' and 'when' set the boundaries of generalizability and as such constitute the range of the contribution (Whetten, 1989).

By applying an empirical test of cognitive-distance to a variety of similarity measures at the organisational and individual-levels of analysis, the research makes a contribution to knowledge in that it isolates one similarity dimension at the organisational level - search-similarity and one similarity measure at the individual level – aesthetic-similarity which appear to have consistent positive links to a number of innovation performance measures. Further, search-similarity demonstrates the inverted U-shaped relationship between variables predicted by cognitive-distance, whilst aesthetic similarity appears to offer some early-stage empirical evidence for the existence and benefits of cognitive-proximity.   As such this is a step further to refining the extent of contexts within which the impact of partnered cognition appears to have a role.

Finally, it makes a contribution to practice, in that it provides a new, straight forward and easily-applied analytical framework for testing the concept of similarity at both the

organisational and individual-level where similarity can be investigated across a range of organisational and individual constructs. The results require further testing, particularly at the individual level where the sample group is smaller than ideal, but, it may have some future implications for open innovation partnerships, particularly in small and micro-firms in transactional partnerships for incremental innovation.

1.2   Research aim, Questions and Objectives

Drawing on the Cognitive Theory of the Firm (Nooteboom, 2006), this research seeks to better understand how the degree of similarity and difference between the focal firm and the innovation partner it selects influences innovation performance by applying a model of 'cognitive-distance' (Nooteboom, 1996).   Independent variables for organisational-level similarity, and the innovation performance output measures, are constructed from a dataset built from the NESTA *Creative Credits* surveys, part of an innovation voucher scheme administered in the North-West of England between 2009 and 2012. Individual-level similarity measures are constructed using data from the Allport-Vernon-Lindzey *Study of Values* 4th edition (2003). The data is organised and then analysed using a quantitative methodology to explore the following research questions:

1. How does the relationship between similarity and difference impact innovation performance of small business innovation partnerships using measurement constructs at the *organisational* level?

2. How does the relationship between similarity and difference impact innovation performance of small business innovation partnerships using measurement constructs at the *individual level*?

3. Does the relationship between similarity and difference and innovation performance follow the model of an inverted U-shaped curve as proposed by cognitive-distance?

Objectives of the research thesis are to:

A. Review research literature in the area of innovation, small-business innovation, and cognitive-distance in order to establish what is presently known about the benefits or drawbacks of similarity between organisations and individuals working on innovation projects.

B. Develop an analytical framework grounded in the literature that is capable of guiding and supporting the empirical research presented here.

C. Identify an appropriate research methodology that reflections the notion of similarity as adopted by this research.

D. Describe and analyse, specifically in relation to innovation, the role of similarity and difference by using the analytical framework.

E. Refine the analytical framework based on this empirical study and reflect and comment on its analytical value for our understanding of innovation in small businesses.

1.3 Scope

This research focuses on the role of similarity and its relationship to innovation performance. The objective of the research is to identify rather than prescribe how similarity works in innovation partnerships between very small businesses. It is not within the scope of this research to address in depth all the ongoing issues concerning innovation in small business but rather, the research draws on a wide range of existing studies in order to understand the innovation process on a more integrative and analytical level.

This research focuses on the notion of similarity within the context of two small businesses involved in an innovation project that draws on the expertise of a supplier in the creative industries. This means that the findings are related particularly to innovation partnerships

of this type. No attempt is made to analyse the specific innovation project type, i.e.

whether it is a product, process or other type of innovation that is taking place.

The unit of analysis operates at two levels. In part one, organisational-level similarity is

measured in terms of the strategic, knowledge search, and knowledge application profiles

of the businesses. In part two, individual-level similarity is measured in terms of personal

attitudes using six dominant attitudes identified by Eduard Spranger (1928) in his work on

'Types of Men'. These six Spranger 'attitudes', driven by underlying values - theoretic,

economic, aesthetic, social, political and religious – are believed to provide the underlying

conditions for personal behaviours.

 The three types of organisational-similarity, and six types of individual-similarity, are

tested against six innovation performance measures related to the project: met objectives;

completed on time; increased sales to existing clients; increased sales to new clients in

existing markets; increased sales to new clients in new markets; and increased profitability.

Similarity can differ between organisations and people in many different ways. This

research focuses on similarity at the organisational and individual-level because they are

deemed to be the most widely used aspects of similarity in other studies. It is not within

the scope of this research to study any other areas of similarity such as network similarity

or technological similarity, except where they are relevant to understanding organisations

or individual-similarity.

This research analyses the structural and social aspects of similarity. No attempt is made

to detail the project typology or content, the specific technologies used or developed, or

the volume or regularity of contact between the parties.

The analysis focuses on similarity between the parties within the cases which are part of

the defined sample group only, to ensure that the research concentrates on the effects of

similarity between a small business and its creative supplier. It is not within the scope of this research to consider or detail the role of similarity between any other types of innovation dyad.

To explore the role of similarity between an SME and its creative supplier in an innovation project it is necessary first to understand what is meant by 'innovation' and 'similarity'. The definition of innovation and similarity is a complex topic and it is not within the scope of this research to attempt to develop new definitions. After critically reviewing relevant fields and research, assumptions are made and definitions declared, upon which this research is based.

Being part of a research team involved in the NESTA *Creative Credits* Scheme (2009-2012) led to the selection of the sample group and provided formally agreed access to the business data. No attempt has been made to make the sample group representative of SMEs in the region or nationally. Instead they have been selected solely due to their inclusion in the *Creative Credits* scheme. It is unusual and fortuitous to be able to gather data concurrently from both parties involved on opposite sides of an ongoing innovation project.

1.4   Structure

The next chapter reviews relevant literature in the areas of innovation, small business innovation, and cognitive-distance within the framework of the Cognitive Theory of the Firm, in order to develop an understanding of how similarity can be conceptualised and managed in the context of innovation partnerships. An analytical framework based on constructs of similarity is proposed and will guide and support the empirical research.

Chapter 3 presents the methodological approaches adopted in the two levels of empirical research. An argument is made for using a positivist approach to explore the

phenomenon. The selection of the sample group is justified and data collection and analysis is outlined in detail.

Chapters 4 and 5 provide a detailed set of results. At the organisational-level similarity data is analysed using a specialised regression model for binomial response variables. At the individual-level similarity data is analysed using a theoretically-grounded directional correlation analysis.

Chapter 6 provides a discussion of the findings, comparing the empirical results to the focal theory, and reviewing the evidence, for this sample group, to either substantiate or refute the existence of the inverted U-shaped relationship proposed by cognitive-distance. An informed speculative discussion of the deeper linkages between the measures and outcomes is made which considers emerging themes and commonalities and considers how the conjectures might be tested.

Chapter 7 draws conclusions in the light of existing literature and presents the contributions of the research together with a review of the implications of the research for small-business innovation partnerships. The limitations of the research are exposed and propositions made for future research to further extend this work.

2.   LITERATURE AND THEORY

2.1   Introduction

The objective of the literature review is to establish the theoretical and empirical landscape related to the research objectives and to situate and contextualise the problem that is to be explored.

It begins by establishing definitions of small business and of innovation, as these are the basic building blocks associated with this work. Next, a review of the literature on small business and open-innovation begins to establish what barriers or constraints emerge as a consequence of partnering within the innovation processes. A further exploration of the literature is made for accounts of the benefits or drawbacks of similarity and difference between innovation partners and how these different dynamics might influence behaviours, especially with regard to cooperation or collaboration. And the review identifies work that link similarity and differences to innovation performance.

Finally, there is an attempt to explicate the potential relationship between degrees of similarity and innovation performance in the form of a conceptual and analytical framework which provides the basis for addressing the research questions.

2.2   Definition of an SME and Key Characteristics

SMEs and micro-businesses account for approximately 1.2 million of the total firms that are currently trading in the UK (BIS Small Business Survey, 2012). The European Commission organises SMEs into three levels based on scale:

- Medium-sized businesses are those that employ fewer than 250 full-time equivalent persons. Their annual turnover does not exceed 50 million euro or annual balance sheet does not exceed 43 million euro.

- Small businesses are those that employ fewer than 50 full-time equivalent employees. Their financial turnover or balance sheet have a value of less than or equal to 10 million euro.

- Micro-firms have fewer than ten full-time equivalent employees and a turnover or balance sheet value less than or equal to 2 million euro.

Small businesses are increasingly seen as an important focus of policymakers as they form a large part of any developed economic structure, most employment is concentrated in this group and they play an increasingly important role in economic growth and job creation (Hoffman *et al*., 1998). A small number of high-growth SMEs, typically technology-based firms, spin-offs or high-growth start-ups, are disproportionately innovative. Some labelled the 'Vital 6%' (NESTA 2009) are persistently successful in their innovation efforts and in job creation (Anyadike-Danes *et al*, 2009).

But for most small and medium-sized firms, innovation is less successful and as a trend, researchers have focused less on studies of innovation and innovation management in small businesses perhaps due to their lower financial resources and technical assets (Acs and Audretsch, 1987) which on the surface appears to make them less interesting or relevant. The heterogeneity of small firms has also made it more difficult for research

studies to generalise on aspects of small business innovation (Rosenbusch, Brinckmann and

Bausch, 2011) with the effects of innovation on SME performance more dependent often

on aspects such as the cultural context, the size and age of the firm.

But, in a contemporary economic climate where business performance for most SMEs and

micro-firms is difficult or stagnant - sixty-seven per cent of those SMEs surveyed for the

2012 Small Business Survey stated their turnover was the same or less than 12 months

before, and eighty-two percent of the same firms were employing a similar number or

fewer employees than twelve months before - it would be useful to understand how this

business type could better mobilise their innovation potential and improve their

innovation prospects.

2.3   Definitions and Concepts of Innovation

Formal definitions of innovation are numerous. The Oslo Manual (OECD, 2005; 47) uses for

its definition insights derived from theories of business innovation, together with those

that view innovation from a complex systems perspective, to produce a statement that

'the immediate drivers of innovation are 'all scientific, technological, organisational,

financial and commercial steps which actually, or are intended, to lead to the

implementation of innovations'.   Alternative views include:

> "recognising opportunities that can be turned into ideas which can be put into
>
> practice" (Tidd and Bessant, 2005).

> "a process that uses R&D resources and existing ideas as inputs" (Bottazzi and
>
> Peri, 2007).

"the development and implementation of new ideas by people who over time

engage in transactions with others in an institutional context" (Van de Ven, 1986,

p.591).

Von Stamm (2003) highlights the important role of creativity and the process of

commercialisation. And the important role of external actors is highlighted by

Van de Ven (1986).

The typologies of innovation are also not always clear; boundaries are blurred and can

overlap between categories. Innovation can occur in products such as new computers or

pharmaceuticals. Service innovations may include new types of bank accounts, or the new

self-service tills in supermarkets.   Confusingly, many service firms describe their new value

propositions as products such as new financial products. Innovation can occur in

operational processes, in the way new products and services are delivered and may take

the form of new types of equipment or machinery which are, at source, the supplier's

products.

There are similar definitional difficulties when considering levels of innovation.   A minor

innovation for one organisation may be substantial for another, so this can make it difficult

in practice to develop anything but a nominal scale of the differences between levels of

innovation, and categorization is best thought of as ideal types along a continuum

(Dodgson and Gann, 2010).   Most innovations are incremental improvements - ideas used

in new models of existing products and services, or adjustments to organisational

processes. This may include the latest versions of particular software packages, or

increasing the number of ways that products can be ordered for the customer. Radical

innovation, in contrast, changes the basic nature of products, services and processes.

Examples might be the production of new materials (nylon, for example) or the emergence

of open-source software which encourages a community of developers who interact with

the process, rather than maintaining the development in-house in conventional proprietary style. At the highest level, there are the transformational innovations which by their very nature are revolutionary and impact the whole economy. Examples of this might be the development of nuclear power as an energy source or the development of the personal computer or the Internet.

Innovation is inherently dynamic and complex. Its nature is difficult to encapsulate and define into one neat and over-arching set of rules. Its outcomes can be viewed conceptually as enhanced knowledge and judgement, or as a process that supports the capacity of organisations to learn. But at its centre are the creation, transfer and application of knowledge to produce outcomes which make a difference. It is about individuals and organisations attempting to go beyond the ordinary.

The fact that innovation has shifting definitions is both helpful in as much as it means innovation usefully covers a wide range of activities, Yet this is confusing for the same reason and has led to the word being used indiscriminately. Even a relatively simple definition of innovation such as 'ideas, successfully applied (Schumpeter, 1934; Dodgson and Gann, 2010) raises questions both conceptually and practically. What does 'success' mean? Does the concept of time play a role, because innovations may be successful at first but eventually fail or the reverse. How do we explain 'applied?' Does it mean applied within the boundaries of one department of one organisation or the wider diffusion amongst a much larger group of users or consumers? Does diffusion mean locally, nationally or globally? What are 'ideas' and who or where do they come from? Does anyone own them? Especially if they come from a combination of new and existing knowledge and thinking. Added to that is the 'perception' of what innovation means. A new recombination of established ideas; a programme that challenges the present order; a formula or an approach which is perceived as unique or new by the individuals involved

may be seen by them as 'innovation', even if to others it may appear merely to be an imitation of something that exists elsewhere (Zaltman *et al*. 1973; Rogers, 1982).

If the outcomes of innovation, then, are new products and services created by the application of new ideas that stretch and challenge in the context of organisational outcomes and processes, it suggests that there is a practical and functional nature to it. The research literature has tended to emphasise scientific, technical research and development (R&D) activities as the principal component of innovation activity and the key driver of product and process innovation. Within this tradition, research has focused on large manufacturing firms. For the most part, it has applied a narrow technological concept of innovation which emphasises the role of formal R&D and the generation of new technological artefacts and patents (Tether *et al*., 2001). It suggests that new ideas over time are produced by those who work in traditional R&D, i.e. engineers and scientists, who use a combination of knowledge and creativity to develop new ideas which in turn become new products and/or technologies. But the model of innovation is evolving as the world is changing, particularly in the advanced economies, where service activities increasingly have come to dominate business and economic life (Oliner and Sichel, 2000; Jorgenson and Stiroh, 2000, Miles, 2005). Boundaries are becoming increasingly porous as the benefits of exploring external knowledge and ideas are recognised and innovation processes move towards becoming more 'open' (Chesbrough, 2003).

2.4   **Models of Innovation and Entrepreneurship**

Our understanding of innovation has changed significantly over time. Early models viewed innovation as a linear sequence of functional activities. Either new opportunities arising out of research gave rise to new applications and improvements which eventually found their way to the marketplace (first generation 'technology push'), and which still remain popular today with many in the scientific research community, or else the market signalled

the need for something new which then created the impetus to find a solution to the

problem in what Jacob Schmookler (1966) called 'demand-pull' – where necessity

becomes the mother of invention. The limitations of both these approaches has led to the

evolution of more realistic dynamic models of innovation where in practice innovation is a

coupling-and-matching process and where interaction plays a crucial role (Kline and

Rosenberg, 1986). Sometimes the 'push' will dominate and sometimes the 'pull' (Tidd,

2006).

A key problem in managing innovation is for organisations to make sense of a complex,

uncertain and risky set of activities, and most recent work recognises the limits of linear

models. Innovation can be messy, there can be false starts and dead-ends. A wide study

of innovation types by van de Ven *et al.* (2000) explored the limitations of simple models of

the innovation process, and has drawn

attention to the complex ways in which

innovation has evolved over time.   Roy

Rothwell, a key researcher in the field of

innovation management, working at

SPRU at the University of Sussex,

produced an historical perspective on

innovation management, suggesting that

our perception of the nature of the

innovation process has evolved from

simple linear models to increasingly

Table X: Progress in conceptualising innovation: Rothwell's five generations of innovation models

Generation	Key features
First and Second	The linear models – need pull and technology push
Third	Interaction between different elements and feedback loops between them – the coupling model
Fourth	The parallel lines model, integration within the firm, upstream with key suppliers and downstream with demanding and active customers, emphasis on linkages and alliances
Fifth	Systems integration and extensive networking, flexible and customized response, continuous innovation

Source: Adapted from Tidd, Bessant and Pavitt, 2005.

Figure 2.1: Rothwell's five generations of innovation models

complicated interactive models. Rothwell's 'five generations' of innovation models is

shown in Figure 2.1. Rothwell's 'fifth-generation' innovation model sees innovation as a

multi-actor process, which requires high levels of integration at both the intra-and inter-

firm levels and which is increasingly facilitated by IT-based networking. For most firms,

innovation takes place within a set of rules which are clearly understood and involve

organisations who try

 to innovate by doing what they do, which might be product or process innovation, or

maintaining their positions, but better. But occasionally something happens which places

so much pressure on the established framework that the rules of the game are forced to

change. These events have the capacity to redefine the space and conditions in which

innovative activity takes place and this opening up of new opportunities challenges existing

players to look differently at what they are doing in the context of the new situation. This

is a manifestation of 'creative destruction', a central theme in Schumpeter's original theory

of innovation. Schumpeter's Mark I model of innovation (1912) saw the drive for

innovation through the individualistic entrepreneur at the head of a small firm striving for

technological progress which gained temporary market leadership through knowledge

spillovers (Audretsch, 2005). This small firm, continued on their trajectory until they

themselves were out-innovated by someone else.

Schumpeter's Mark II model (1942) expanded the innovation system to formalised R&D

environments in large organisations. But both were concerned fundamentally with the

process of 'creative destruction' mentioned earlier, where the innovation system is

punctuated by something that causes it to shift dramatically. These sources of

discontinuity may be the emergence of new markets, or the creation of new technologies,

or a market that has become saturated, or an exogenous force such as new political rules

or legislation (Tidd, Bessant and Pavitt, 2005). Typically, much of the basis of innovation

lies at a system level involving a network of supplier and partners who configure

knowledge and other resources to create a new offering.

Innovation involves attempts to deal with an extended and rapidly advancing scientific border, fragmented markets which can extend across the globe, political uncertainties, changing regulations, and competitors which come from unexpected directions (Tidd, 2006). Casting a wide net in order to pick up and utilise a broad set of new knowledge is what is needed for innovation. This is what Roy Rothwell saw in his work on innovation models – that firms needed to learn to manage innovation at the network level. Innovation has seen a move away from thinking about, and organising a linear science/technology-push or demand-pull process to one which has seen increasing interactivity – first across the firm with cross–functional teams and other boundary-spanning activities and then outside the firm to extending the links to working on innovation with others.

This move towards external linkages is an example of what Henry Chesbrough (2003) calls 'open innovation'. The importance of such networking is not simply firm-to-firm; it's also about building a web of linkages within the national system of innovation too. Government policy to support innovation is increasingly moving towards enabling better connections between elements in the innovation system, for example, between small firms

with technological needs and research and technology institutes or universities, or the example in this study where the small firms are part of a government initiative to encourage innovation in small businesses through a business-to-business innovation voucher

scheme. There is an increasing trend towards trying to build innovation networks in a purposeful fashion in what some researchers call "engineered networks" (Conway and
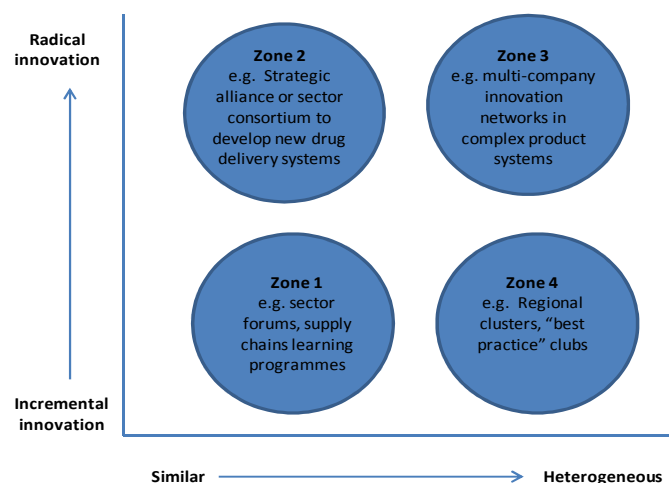
Figure 2.2: Different types of innovation networks

Stewart, 2005).   The purpose of these engineered networks might be to create a completely new product or process by creating or bringing together radically new combinations of knowledge, or partnerships which are geared more towards adopting and embedding innovative ideas and which has a specific aim to get traction on some aspect of an innovation problem through networking (Tidd, 2006).   Innovate UK, the British government's innovation agency runs programmes designed to connect diverse types of businesses and provides funding to work on challenge or theme-led initiatives such as sustainable energy, and the digital economy and resource efficiency. But working with an external network takes a new set of management skills and the skills might change depending on the type of network and its main objectives. There is a significant difference between the set of skills needed when partners are working at the frontier of innovation where issues such as intellectual property and risk are important, and in a network with a more established innovation agenda, such as using a supplier to enhance product or processes. Figure 2.2 helps to show how different innovation networks are needed for different types of innovation objectives.

2.5   Small firms and Innovation

Every firm has an innovation process, whether or not it is recognised as such, in so far as it is subject to the forces of competition and must innovate, however incrementally, if it is to survive. The quality of the innovation determines, in part, its competitive abilities (Potts & Morrison, 2009). But the lack of strategic centrality of innovation in many small businesses means that few of them attempt to engage in formal R&D as large firms do, having fewer resources and insufficient slack (Vossen, 1998). Innovation in small businesses is very often an *ad hoc* activity driven by opportunity or interest rather than strategy, and usually undertaken informally alongside the firms other activities (Hewitt-Dundas, 2006). There appears to be no shortage in generating product ideas and concepts but the majority of

SMEs seem to get stuck in bringing successful innovations to the market place in a controlled way or with any kind of developed management approach or the application of a proper structure (Jones *et al.*, 2001). Where SMEs are able to create some level of momentum in the developmental stages of an innovation, there are difficulties in the commercialisation stages which seem particularly onerous for them to overcome (Hanna and Walsh, 2002). This has been put down to a number of factors: their lacking an ability to substitute for the lack of sales and profits through other products in the meantime (Kaufmann and Todtling, 2002); a relative lack of capacity to seek and absorb external information (Cohen and Levinthal, 1990, Chesbrough, 2010) or sometimes, just the fact that because they are so small, they make unattractive cooperation partners for others in more formal innovation alliances (Chesbrough, 2003).

The lack of resources which inhibit innovation in small businesses can take many different forms. It may be lower financial resources and technical assets (Vossen, 1998) which constrain the practical steps of launching an innovation idea. Smaller top management teams may mean that there is a weaker internal knowledge base which may not be able to sustain for sufficiently long, the relative investments and momentum required to cover the range of innovation activities required to successfully realise an innovation (Lee *et al.*, 2010). There is also the difficulty for many small businesses in managing and protecting their IP and appropriating the benefits of the innovation (Kitching & Blackburn, 1998; Chesbrough, 2010) which heightens the risk aversion towards investing scarce resources and assets. But if there were no risk in the innovation process, if there were no uncertainty, anyone could innovate easily and then innovation would provide little advantage for any business over their competitors. The sense of risk seems to be particularly heightened for small businesses. A focus on the status quo is appealing because it produces returns that are positive, proximate and predictable whilst a focus on

the novel produces returns that are distant and uncertain (Dodgson and Gann, 2010). Yet firms need to innovate to survive and small firms are no exception. With fewer internal resources small firms with innovation aspirations are often forced to turn to external networks to plug their internal resource and knowledge gaps and so form informal transactional innovation relationships stimulated by necessity and geared towards incremental innovation. In this way, it could be said that contemporary small firms have tended to side-step using early innovation models and moved straight into boundary-spanning activities linking them directly with outside others.

Innovation is challenging even for large firms with an historical track record of innovation activity (Hargadon, 2003). It can often be a laborious process, idiosyncratic and occurring frequently in its own unique set of circumstances. Typically innovation has emergent properties with outcomes which may not always be known or expected when it begins. As a process it needs to successfully encompass complexity, dynamism and uncertainty and many innovation projects fail (Dodgson & Gann, 2010). There are arguments that innovation is inherently a practical activity – try, fail a bit, learn, adapt, try again. As Thomas Edison, the American inventor and businessman is believed to have said "I have never failed, but have discovered 10,000 ways that didn't work". Like Edison's approach to the task, the most innovative organisations have systematic and well-organised innovation processes and learning routines, but not all firms have sufficient resources and slack within their day-to-day operations or have the skills or knowledge to adapt their business models to this ideal working state. Small businesses particularly, suffer from barriers to innovation and many small firms as a consequence experience only modest growth over their lifetime - the number of small firms that increase in size is found to be very similar to their counterparts whose firms decline (Mason *et al*, 2009).

Recent studies suggest that SMEs are increasingly working with external partners to innovate (Van de Vrande, *et al*, 2009; Edwards *et al*, 2005). Opening up the boundaries of the small firm extends their networks and may increase access to new technologies as well as increase the probability of obtaining useful and useable new knowledge from outside sources (Leiponen and Helfat, 2010). Where small firms expand their networks it seems to help them find knowledge that is often complementary to their firm's internal knowledge and helps shape their innovations (Roper *et al*, 2008). Research suggests that small firms have been found to have more to gain than their larger counterparts when taking advantage of external links. But, by choosing to adopt this 'open' innovation approach, partner choice is seen, for small businesses, as a particularly important issue (Vahter, Love and Roper, 2012).

2.5.1   A Move toward Open-Innovation in Small Firms

Open-innovation involves opening up an organisations boundary with the aim of using purposive in-flows and out-flows of knowledge to accelerate internal innovation (Chesbrough and Crowther, 2006, pp.1). It involves working with external knowledge sources as partners (Lee *et al.,* 2010). The potential value of openness is seen in the way it can stimulate creativity, reduce the risk in the innovation process and accelerate or upgrade the quality of the innovations made (Powell, 1998).

Recent open-innovation studies suggest that in recent years small businesses have increasingly been exploring the benefits of 'openness' (van de Vrande *et al*., 2009) with some recent empirical evidence suggesting that it is beginning to be found as a purposely integrated part of their business strategy (Brunswicker and Vanhaverbeke, 2011). Perhaps we shouldn't be surprised to learn this, given that by the nature of their scale and scope, SMEs have always had to rely more heavily on inter-organisational relationships and

external ties to remain competitive (Edwards *et al*., 2005.) Motivations for pursuing and

adopting open-innovation activities in SMEs are found to be largely similar to those in

larger businesses in that they are market-related and determined by the search for growth

in revenues and new products (Chesbrough and Crowther, 2006). Drivers might include

market developments, meeting customer demands, improving product development,

integrating new technologies, reducing costs and preventing businesses from being

outperformed by competitors (van de Vrande *et al., 2009;* Lee *et al,* 2010). The

opportunities it presents to share risk and uncertainties; to gain from the benefits of

spillover; in the reduction of development time and cost; in a reduced time to market; and

access to requisite knowledge and resources which aid the realisation of learning effects all

contribute to the rationale for search activities outside the boundaries of the firm (e.g.

Kurokawa, 1997; Gassmann and Enkel, 2004; Koruna, 2004; Chesbrough, 2006, Keupp and

Gassmann, 2009, van de Vrande, 2009.)

External innovation and operational assets are highly relevant and attractive to SMEs as a

way to extend their skills base and resources (Baum *et al*., 2000). The external innovation

linkages they develop extend the SME's network and by increasing the different types of

linkages it increases the probability for SMEs of obtaining useful and useable knowledge

(Leiponen and Helfat, 2010).

Different levels of open-innovation relationships offer different types of knowledge in-

flow. Universities and research organisations can be a relevant source of new, often very

novel knowledge but for small businesses interactions with these types of agent can

present barriers such as cultural differences between parties and particularly perspective

differences on timescales (Harryson, 2008). More formal types of (rather than

transactional) relationships with network partners are usually oriented at the long-term

and aim for achieving joint value-creation rather than efficient transactions (Goffin and

Mitchell, 2005).   Extending network relationships for innovation to this kind of level are a

highly important source for new ideas in longer-term, more complex innovation

partnerships (van de Vrande *et al*., 2009), but small businesses are often seen as making

unattractive co-operation partners (Chesbrough, 2003) at this level.   SMEs instead find

other sources and directions for open-innovation through interactions along the value

chain, among customers, indirect customers and suppliers. Searching down-stream to get

sticky information on customer needs and context or upstream to benefit from the

specialised (usually technological) expertise of suppliers can provide ideas for improved

technological solutions or process innovations (Tsai, 2009). Suppliers may be very relevant

early-stage open-innovation partners for SMEs because they concentrate on solutions and

commercial value in the short-term (Dyer and Singh, 1998), they may help consolidate and

enhance an SME's core competencies, reduce its development time and cost for projects

and shorten innovation and market cycle. Supplier innovation relationships can improve

the efficiency and the performance of the SME's innovation performance overall. (Praest,

Knudsen and Mortensen, 2011).

On the surface, open innovation may offer many advantages for small businesses in that

their more flexible structures and lack of bureaucratic constraints mean they have the

ability to make and implement decisions faster, benefiting their open-innovation

partnerships. But graduating along the innovation spectrum to the 'fifth generation'

process of open-innovation can brings its own problems. A firm needs particular skills to

navigate the highly uncertain and distributed environment which opening up its

boundaries to outside organisations can bring them and the differences between firms can

enhance the difficulties and problems already associated with innovation. The

opportunities which open-firm boundaries offers such as contributing knowledge to

innovation outcomes and accelerated speed and quality of development can be offset by

difficulties related to issues of motivation, communication and co-operation and challenges of utilizing the external knowledge efficiently (Knudsen, 2007). Characteristics such as the learning culture can affect a company's attitude towards the acquisition and absorption of the new knowledge that is discovered (Tidd and Bessant, 2005, pp. 488-95) which presents challenges for the successful implementation of open-innovation attempts (van de Vrande, 2009; Villa and Antonelli, 2009).

Key issues for small businesses attempting open-innovation pivot around three main constraints. Firstly, around managing the imbalance between pursuing open-innovation activities, maintaining daily business and the sometimes conflicting needs between the two. Secondly, around people factors which are found to have much more importance for small business in creating a successful open-innovation mindset, far more important than strategic factors. And thirdly, having the skills and experience to find the right partners (Enkel *et al.*, 2009). High levels of commitment, communication and trust between parties are a key to open innovation relationship success (Lin and Zhang, 2005; Tidd and Bessant, 2005, pp. 478-99).

Openness is potentially seen as offering significant benefits to small firms, both in helping them to overcome barriers to innovation and in increasing the market success of their innovation (Roper and Love, 2010) but managing the constraints which create the barriers to successful knowledge implementation and transfer still remains a key challenge.

2.5.2   Constraints and Barriers to Open-Innovation in Small Firms

The literature on open-innovation suggests that organisations who collaborate in their innovation efforts find greater opportunities to enhance their innovation success. But collaboration or partnering with an external player who is not always bound by the same

rules can be risky and difficult and partnerships are often seen to fail, either in totality or in falling short of achieving full innovation objectives. Innovation failures can have particular implications for small businesses in so much as it requires a re-investment of already scarce resources and attempting to innovate may already have tested the weaker ability of a small firm to invest in in-house knowledge creation, exposing the more difficult job they have, due to their relative lack of capacity, to seek and absorb external information (Chesbrough, 2010).

Small businesses start, on average, with lower overall levels of knowledge resources so the benefits they gain by adding more, or new types of innovation linkages is likely to have a large proportionate effect on their innovation performance (Vahter, Love and Roper, 2012). But if they perhaps have more to gain than their larger counterparts when drawing on external links, their internal resources are restricted, which makes appropriate partner choice a particularly important issue (Vahter, Love and Roper, 2012). The approach to partner selection and the criteria that small firms use is found to vary, reflecting, Joen *et al*., (2011) believe, the internal capabilities available in the firm and their innovation ambitions. In small firms, particularly those that do not have hard ambition or aspiration for innovation, a lack of internal capabilities, bounded rationality and suppressed choice heuristics can create barriers to establishing innovation relationships (Conlisk, 1996).

Firm level innovation systems fail when the internal capabilities and resources constrain the ability to co-ordinate and manage the innovation process into a fluid self-regulating and fully functional system.   This problem occurs most often and is compounded when the innovation process is operating over a network of businesses or organisations and the outcomes are dependent on the connections taking place between the elements in the system (Drejer, 2004). Innovation systems failure is particularly characteristic of 3rd, 4th and particularly 5th generation innovation ecosystems where failures manifest at some,

many, or all points as knowledge and information flows between and around the system.

There are several common failures on the supply side, but ultimately, failures are related

to a business or individual in the innovation process who fails to embrace, absorb or retain

the change that needs to take place to reach a successful innovation outcome (Potts and

Morrison, 2009):

- Communication problems between partners or the failure to connect with appropriate

  partners;

- Difficulties sharing knowledge between partners due to tacit dimensions or differing

  knowledge capabilities;

- Different or incompatible strategic objectives, or strategies that seek to exploit

  partners;

- Business model incompatibility; and

- Different expectations, time horizons, or other operational aspects.

Where small businesses get as far as establishing an open-innovation relationship the

business owners seem to be particularly prone to initiating a sequence of behavioural

biases which affect them as they attempt to innovate (Morrison and Potts, 2009). As the

new relationship is established and begins to develop, as the SME experiences conditions

which are less familiar, particularly for those businesses who have less experience working

with an external innovation partner, and where there is the necessity for the transfer of

novel or creative information, an individual's rationality or 'working rules' can fail leading

to a dysfunctional response (Conlisk, 1996). This domain of 'bounded rationality', where

one is not sure which alternative is best, where preferences may be inconsistent and

payoffs unknown, trust, not only in judgement and competence, but in unselfish values,

play a determining role in the relationship (Rosanas, 2004). If differences between

partners are seen as a potential source of behaviours and actions that may create

difficulties in an open-innovation partnership, trust, in turn, appears to play an important role for the opposite reason.

Innovation attempts usually involve changes of direction, agreement disputes and potential opportunism, all of which may take over an individual's normal sense of what is right and wrong. This creates an environment with high levels of ambiguity and where individuals have to deal with it without actually having the confidence of knowing where the relationship might end up (Nooteboom, 2002). Accepting the sense of ambiguity and indeed utilising the dynamics of uncertainty requires trust to be active and there is evidence that where it is manifest relationships operate more successfully and when it is not, there is a greater probability that they will fail (Nooteboom, 2002). Trust is important for collaboration (Woolthuis *et al.*, 2005) and appears to influence outcomes of innovation at many different levels. But while it may be recognised that trust is fundamental to a successful relationship it is also recognised as complex and difficult to pin down. While trust may be based on current or past information or experience, there is never certainty concerning future conduct – trust can be won and lost (Athaide *et al.*, 1996). The uncertainty gap is bridged by making a 'leap in the dark' or of giving someone the benefit of the doubt and that is done by applying a cognitive framework to help us assess reliability at the surface level of values, social norms and moral imperatives and at the deeper level of empathy, identification, affect and friendship (Nooteboom, 2002). Trust and trustworthiness begin where control ends and is often the result of established codes of conduct which are based on widely shared norms and values or habits. In small businesses particularly, which tend to lack systematic and embedded routines and procedures and which often do not have the tools and techniques nor motivation to implement strict and far ranging contracts and formal relational dictats, trust in your open-innovation partner

and the willingness to give them room to contribute their creativity and competence is significantly important (Athaide *et al*., 1996).

2.6   Similarity versus Difference for Innovation Success

In the previous section we learned that there can be benefits to open-innovation for small firms but there are also barriers which constrain the potential of the innovation relationships. One of these barriers is the difficulty in finding the right firm(s) or organisation(s) with which to partner, as the 'open' feature of the relationship reduces the ways in which parties can control each other's behaviours and actions. Differences between partners are seen as one potential feature that could contribute to innovation project failure (Potts and Morrison, 2009).

The literature offers two perspectives on whether similar or different features within the partnership offer the best potential for enhanced innovation performance. There are the arguments for a monotonic relationship between similarity or diversity and differential effects on innovation performance, and then there is the more complex non-linear relationship proposed by cognitive-distance (Nooteboom, 1996) where there a trade-off between the degrees of novelty in the knowledge being transferred and the ability to understand and absorb that knowledge in a way that impacts innovation performance.

The aim of this section is to explore the different perspectives surrounding similarity versus difference for innovation performance - at the organisational-level in terms of previous empirical studies and at the individual-level concerning different types of attitudes or behaviours that might influence behaviours especially with regard to cooperation or collaboration.

2.6.1   Organisational Level

Studies exploring similarity at the collective and organisational unit of analysis have

encompassed aspects of social network theory, organisational ecology and institutional

theory which has given attention to the social structures and norms of the subject and

attempted to illuminate the dynamics and outcomes of partner similarity (Scott, 2001).

Similarity studies have been conducted in the context of inter-firm alliances and

collaborations for innovation at the multi-national (Gomes-Casseres *et al*, 2006), national

(Homburg *et al.*, 2002; Smith, 1998) and SME level (Darr and Kurtzberg, 2000). The effects

of similarity dimensions have been tested broadly and encompass features such as

industry (Eisenhard and Schoonhoven, 1996; Gomes-Casseres *et al.*,2006), sector

(Eisenhard and Schoonhoven, 1996) and geographic location similarity (Darr and Kurtzberg,

2000; Gomes-Casseres *et al.*,2006; Rosenkopf and Almeida, 2003), internal dimensions

such as firm profile (Gulati *et al*,. 2000), strategy (Darr and Kurtzberg, 2000; Luo and Deng,

2009), customer base (Darr and Kurtzberg, 2000), R&D intensity (Gomes-Casseres *et al.*,

2006), network characteristics (Gulati *et al*., 2000), and technology (Gulati *et al.*, 2000;

Gomes-Casseres *et al.*, 2006; Rosenkopf and Almeida, 2003).

Studies around strategic similarity have been the most popular (Gomes-Casseres *et al*.,

2006; Homburg *et al*., 2002; Luo and Deng, 2009; Darr and Kurtzberg, 2000) with the

emphasis on organisational characteristics and/or combinations thereof (Argote and

Ingram, 2000). Similarity between organisational profiles is explored by Luo and Deng

(2009) and other studies have focused on geographical and technological similarity

(Rosenkopf and Almeida, 2003) and customer similarity (Darr and Kurtzberg, 2000).

Recently, some studies have begun to focus on where heterogeneous resources come

from, how they can be accessed, and on the effectiveness of the various mechanisms that

firms may employ (Rosenkopf and Nerkar, 2001; Rosenkopft and Almeida, 2003; Ahuja and Katila, 2004).

Even so, the benefits of similarity at the organisation level when pursuing innovation projects is not at all clear.

On the positive side it has been conceptualised as a condition that enhances cooperation (Homburg *et al.*, 2002) and as a feature for greater interpersonal effectiveness (Argyle, 1991). Partner similarity at organisational level is seen as aiding the search through a universe of potential knowledge sources, it attracts the attention of managers and influences their partnering selection (Darr and Kurtzberg, 2000). This search for, and transfer of knowledge and the leveraging of the skills of others is one of the principal functions which greatly improves a firms innovative capacity (Pennings & Harianto, 1992) whether that knowledge is from within or across firm boundaries (Garud & Nayyarm, 1994; Gilbert & Cordey-Hayes, 1996; Szulanksi, 1996). Prior research also suggests that similarity can enhance innovation for at least two reasons; firstly that as coordination costs appear to increase as a function of the differences between collaborating organisations (Whetten, 1981, pp19), partner similarity may reduce those costs through mutual identification, reduced barriers and enhance the exchange of information (Darr and Kurtzberg, 2000). Secondly, similar organisational routines are seen as helping overcome problems such as the transfer of tacit or un-codified knowledge and to facilitate communication and understanding. This allows partners to engage more quickly into a mode of knowledge sharing and creation (Kraatz, 1998; March, 1988). Similar partners with similar routines and processes may be more capable of recognising and using valuable knowledge in each other's repertoires because compared with dissimilar partners, there is a greater overlap in prior knowledge (Cohen and Levinthal, 1990; Lane *et al*., 2006).

But there are as many studies that provide seemingly opposing accounts of the effects of collaboration and co-operation between similar partners. There are arguments that it is difficult for similar partners to work together because the occupation of similar resource spaces can make them competitive against each other and their knowledge is less likely to be complementary (Bell *et al.*, 2006; Das and Teng, 2000; Harrison *et al.*, 2001; Khanna *et al.*, 1998; Silverman and Baum, 2002; Stieglitz and Heine, 2007). Competition may hinder collaboration between partners in the same industry because in needing to share their knowledge and physical assets with their competitors in strategic alliances, they may be concerned that such sharing could threaten their own competitive advantage (Mitchell and Singh, 1996). Other studies suggest that collaboration with competitors is more difficult to manage (Hamel *et al.*, 1989) and more likely to trigger learning races (Khanna *et al.*, 1998). Similar partners may bring fewer new skills to each other and may be less likely to complement each other's needs. In contrast, collaboration between different but complementary partners may be more likely to tap the potential of synergy and some studies show that alliances involving partners with complementary assets are more likely to improve organisational performance (Das and Teng 2000; Harrison *et al.*, 2001; Tanriverdi and Venkatraman, 2005). Firms that manage diverse innovation partnership portfolios are expected to develop superior coordination capabilities (Lavie and Miller, 2008). In addition, diverse innovation partners potentially exposes firms to new sources and variety of information (Laursen and Salter, 2006; Leiponen and Helfat, 2010). Extant research has shown that learning takes place through collaborations with different types of partners (e.g., Reuer *et al.*, 2002). Different partners can benefit a company by facilitating access to a broader pool of technological opportunities and knowledge acquisition options and by allowing the exploitation of synergistic effects between different partnership strategies (Belderbos *et al.*, 2006). Partnership portfolios of innovators are found to have

typically more diverse and internationally oriented compared to non-innovating and imitating firms (Duysters and Lokshin, 2011).

But at the organisational level, using successful and ongoing relationships as a proxy for 'attraction', there are few dimensions of similarity which appear to be consistent predictors of success in innovation collaborations or co-operative B2B innovation partnerships. There are also few clear definitions or consistent measures of organisational similarity, and studies have varying measures of innovation outcome success.   For example Luo and Deng (2009) define strategic similarity in the bio-tech industry as innovation partners coming from the same industry and measure innovation success as the number of patents issued over a year. Darr and Kurtzberg (2000) take a narrower definition of strategic similarity as firms having similar business strategies and experiencing similar problems in their market sector and measure innovation in terms of how knowledge transfer helps adapt production processes which lead to greater production. Neither measure is directly suitable for the research study here, but strategic similarity as a general concept has been widely used (Luo and Deng, 2009; Simonin, 1999; Dranove *et al*., 1998; Duysters and Hagedoorn, 1995; Darr and Kurtzberg, 2000) and has shown, perhaps more than other dimensions of similarity, some relationship with the outcomes from innovation partnerships.

The literature offers, however, an alternative view which goes beyond the issue of whether firms benefit most from sharing similar or heterogeneous resources, asking the question from a different perspective - 'how do different types of resources, once accessed, effect the interfirm learning process, and, what are the implications for a firm's innovation performance?

From this viewpoint, proposed by the Cognitive Theory of the Firm, (Nooteboom, 2006), increasing degrees of resource heterogeneity are seen in terms of *cognitive-distance*

between the firms that hold these different kinds of resources, and there are differential

performance effects when resources are either very similar, or alternatively, very different.

This approach marries the various bodies of innovation literature where distance is

presented as only a problem, instead of an opportunity, and also with the diversification

literature which argues that most is to be learned from partners with related knowledge

and skills (Tanrierdi and Venkatraman, 2005). The notion of c*ognitive-distance* specifies

causality and provides a stronger analytical grip and a clearer guide for empirical

evaluation than the more general notion of resource heterogeneity (Nooteboom, 2006-

33). This concept may better enable us to understand why, when combining resources,

some innovation partnerships fail, and some succeed. For the firm, the challenge, in terms

of resource and knowledge exchange, may be to find partners at sufficient cognitive-

distance to tell something new, but not so distant as to preclude mutual understanding.

2.6.2   Individual Level

Open-innovation partnerships involve opening up the boundaries of the organisation with

the aim of seeking out new knowledge and information which might enhance innovation

performance and prospects. Sourcing that information is the domain of the boundary-

spanner whose role it is to seek out, and establish the relationship(s) which will produce

information which has some value to the organisation. The role, then, of the boundary-

spanning individual in open-innovation relationships appears to be key.

Earlier in the chapter we learned that whilst open-innovation potentially offered many

benefits to small business, opening up the boundaries of the firm and embracing new

innovation-focused partnerships also introduced potential difficulties, particularly where

the small business begins to experience conditions which are less familiar and where there

is the necessity for the transfer of novel or creative information. In these kind of conditions, an individual's rationality or 'working rules' can fail, leading to dysfunctional responses (Conlisk, 1996). These difficulties include aspects such as communication problems, difficulties sharing knowledge, issues of opportunism or exploitation of partners and differing expectations in terms of things such as time-scales.

Within the literature on factors which might help to overcome some of these behavioural problems, the association between interpersonal-similarity and effective relationships appears to have a long and established track-record of positive correlation.

The relationship between association and similarity is evidenced as far back as Aristotle where he noted in his Rhetoric and Nicomachean Ethics that people "love those who are like themselves" (Aristotle, 200BC/1932 p. 1371). Plato, Aristotle's pupil, later observed in Phaedrus that "similarity begets friendship" (Shorey, 1933).

But, there is more contemporary evidence of similarity breeding fellowship in many aspects of homophily where it is seen as a basic organising principle between people in groups. It has been found to exist in a wide range of socio-demographic and behavioural dimensions including gender (Maccoby, 1998); age (Blau *et al*. 1991); religion (e.g. Louch, 2000); education, occupation and social class (Louch, 2000); and network positions (Lawrence, 2006). In studies of similarity, it has been identified at the individual level in social networks at the levels of character, education, competence, attitudes, values and personality (Creed and Miles, 1996; Ladegård, 1997). An extensive literature in experimental social psychology established that attitude, belief and value-similarity lead to attraction and interaction, in so much as shared values are found to promote synergistic social behaviours and organisation-specific investments (Jones and George, 1998, p540).

For interpersonal and social relationships similarity is viewed positively as a condition that

has characteristics which favour the development of an effective relationship. At the

individual personal level, attitude similarity is found to aid knowledge transfer (Ounjian &

Carne, 1987), to evoke empathy for similar experiences (Burkhardt & Brass, 1990; Cohen

and Levinthal, 1990) and to lead to the quicker development of trust (e.g. Doney and

Cannon, 1997) which helps reduce the probability of conflicts (Mohr and Spekman, 1994).

People seem to be attracted to, prefer and support relationships with similar others

because interaction is easier and less cognitively challenging due to similar attitudes,

values, activities and experiences (Turner, 1999). Information is more likely to be believed

when it comes from similar others (Levin *et al.*, 2004). In free-choice situations people have

a tendency to choose somebody they are attracted to and who is somehow similar to

themselves. This has been observed in interpersonal settings (McPherson and Smith-Lovin,

1987) as well as in organisational settings (Mehra, Kilduff and Brass, 1998). Similar results

have been found documented in both laboratory conditions with experimental

manipulations (e.g. Byrne & Nelson, 1964; Storms & Thomas, 1997) and in field

investigations of existing relationships (e.g. Carli, Ganley & Pierce-Otay, 1991). Based

largely on the strength of the results from the laboratory data, Byrne and Rhamey (1965)

called the positive linear relationship between the proportion of similarity and attraction,

the *law of attraction*. Subsequent research over the following decades replicated the

findings and established the similarity-attraction relationship as a fundamental rule of

attraction.

Similarity was also seen as a condition that had application outside of the personal setting.

In relationships between individuals in a business setting it was found to enhance

cooperation (Homburg *et al,* 2002) and that it could predict relationship satisfaction

(Morry, 2005).   Similarity in values and attitudes was found to aid knowledge transfer

(Ounjian & Carne, 1987) and to contribute to the creation of trust (Jones and George, 1998; Rosanas, 2004).

If similarity in these sorts of features has potential benefits for individuals in interpersonal relationships, then it might mean that similarity could be a condition that also improves relationships for innovation and might overcome some of the behavioural constraints mentioned earlier. Similarities supposed ability to help develop trust, might have particular benefits for innovation partnerships where, in many studies, trust is seen as a key element in creating the goodwill that reduces opportunistic behaviour and improves performance (Silva *et al*., 2012).

Theoretical explanations for the association of similarity and liking have focused on the motivational processes that underlie people's involvement in relationships. Byrne (1997) posited that similarity is attractive because it is reinforcing. That is, one prefers similar others because they tend to corroborate one's own attitudes and beliefs.

However, despite overwhelming empirical evidence and ubiquitous anecdotal evidence in support of the strong positive link between similarity and interpersonal attraction, questions began to be raised around the integrity of the effect, with some researchers discounting the results as a result of demand characteristics (Sunnafrank, 1991); established awareness of other's actual attributes (Newcomb, 1961), or methodological flaws (Bochner, 1991). Other researchers have questioned the order of causality (Morry, 2005; 2007), or demonstrated that the similarity effect is eliminated by initial interaction (Sunnafrank, 1983). The main thrust of the controversy was that the similarity relationship may only exist within the laboratory and did not influence 'real' relationships.   In addition, researchers began to make the distinction between *actual* similarity and *perceived* similarity, the latter being the degree to which one *believes* oneself to be similar to another.

The actual verses perceived similarity question was put to the test by Montoya _et al.,_ (2008) who tested the attraction theory both in the laboratory and in field investigations. They also investigated the relative influence of actual and perceived similarity in respect to the degree of interaction, setting up tests for pairs who had no-interaction before they were surveyed (using something called the _phantom-other_ technique), had had a short interaction before they were surveyed (the participant and a previously unacquainted target meet for 5 – 10 minutes), or who were in an existing relationship (partners who had interacted at great length and in a variety of contexts).   Montoya _et al_ (2008) operationalised the similarity effect using only the attitudinal dimensions of the individual's character and specifically they assessed the possible moderating effects of proportion of attitudes used in the manipulation of similarity. Their findings in the field, did not generalise from the findings in the laboratory. Infact, they found that the effects of _actual_ similarity decreased as interaction increased, diluted, they hypothesised by environmental cues such as what the individual believes about attractiveness, dominant behaviour, specific attitudinal processes, etc. Montoya _et al_ (2008) also questioned the suitability of their own techniques for assessing the similarity effect in the field, suggesting that it may not be possible for similarity studies involving any interactions to tap into core traits or attitudes. They suggested that in short-interaction relationships, the pattern of communication that individuals use when they first meet, in seeking to establish stable, predicable communication patterns means people exchange information on predictable topics. As a consequence it is possible to be attracted to both similar and dissimilar others regardless of attitudes, at least in the short term.

Although overall the literature on close relationships has strongly favoured the association between perceived similarity and relationship well-being, Aron and colleagues (Aron & Aron, 1986; Aron _et al.,_ 1995, Aron _et al_, 2006) propose an alternative model, whereby

greater perceived *dissimilarity* may be associated with greater attraction and relationship satisfaction.   This model is based on the idea of 'self-expansion' and suggests that expanding the self-concept is a basic human motivation that may be fulfilled by incorporating the attributes of a partner into the self. From this perspective, the most attractive partners are those who offer the greatest opportunity for self-expansion. Rather than choosing a partner who is most similar, people may be motivated to prefer partners perceived as dissimilar in order to expand the self. Aron and colleagues reason 'it is dissimilarity that enhances attraction by increasing the potential for self-expansion – the more different a person is, the more new perspectives the person can add to the self (Aron *et al.*, 2006).

The work by Aron *et al.*, (2006) began to directly address the discrepancy between the preference for similar partners predicted by the attraction literature and the preference for dissimilar partners predicted by self-expansion. One finding from the self-expansion research suggests that similarity governs processes of attraction among strangers, whereas dissimilarity may sometimes facilitate ongoing relationships and that the moderating force may be around the level of commitment in the relationship.   It proposes that an individual's level of commitment may alter the priority given to similar versus dissimilar characteristics in evaluating the desirability of a partner and of one's satisfaction in a relationship. Rusbult *et al.*, (2006) found that on the one hand, relationships which involve high commitment may reflect interest in longer term perspectives that value long term compatibility, ease of interaction, and mutual understanding. For these compatible relationships, similarity was seen as the condition which should prevail; that is, greater perceived similarity to one's partner should be correlated with a more positive attitude towards him or her (i.e. greater liking) because similarity contributes to factors such as mutual understanding between partners . But on the other hand, in relationships that are

less committed, different features of the relationship may be important. Some of these relationships may be exploratory, characterised by self-expansion, new experiences and changes in social networks or social status. If these less-committed relationships are valued for their potential to offer new experiences, then liking for one's partners might actually be greater when one sees the partners as being dissimilar from the self. Where there is less concern about long-term compatibility, a dissimilar partner may be right for drawing out unique sets of personal attributes, offering new social contacts and facilitating new behaviours. For individual's engaged in self-expanding activities, Aron *et al.*, (2006) and Rusbult *et al*., (2006) emphasise differences as helping to maintain a successful relationship.

In business contexts, there too are conflicting views about the benefits of similarity and diversity amongst team members though the paths linking aspects of work team diversity to team functioning and performance outcomes are seen as complex ((Harrison *et al*., 2000). The conventional focus on diversity research has been on connecting demographic differences among team members such as age, gender or race, team social integration and performance (Williams and O'Reilly, 1998; O'Reilly *et al*., 1998)). These 'surface level' (Jackson *et al*., 1995) or 'high-visibility' (Pelled, 1996) demographics are easily observed and measured. But, a new paradigm has begun to emerge and involves the investigation of 'deep-level' (Harrison *et al*. 1998) or less readily apparent diversity (Riordan, 2000) and its impact on performance. This form of diversity is based on psychological characteristics of team members and includes individual similarities and differences such as values (Jehn *et al.* 1997), as well as attitudes, preferences and beliefs (Harrison *et al, 1998).*

The literature review of the effects of similarity and difference at the organisational and the individual level have some overlapping propositions and both seem to coalesce around the objectives that are driving the relationships. Similarity findings appear to pivot around

aspects of easy cooperation and fitting in with each other's routines for easier interaction and less cognitive challenge. Whereas, diversity between parties appears more beneficial where the objectives are to leverage the skills and knowledge of others for some organisational or personal self-expansion plan. But the question remains as to how similar or how different do parties need to be in order to achieve the performance that they want? And is there a way to establish how decreasing similarity and increasing diversity between parties makes a difference?

2.7   Models for Testing For Effects of Similarity and Difference between Partners and Performance

The previous sections addressing the benefits of similarity versus diversity for innovation performance identified the conflicting views on this issue and highlighted the common methodological approach of exploring only the monotonic relationship between the two perspectives. There is, however, a third approach which is offered by a Cognitive Theory of the Firm (Nooteboom, 2006) and which has been used in two empirical studies (Wuyts *et al*., 2005-45; Nooteboom *et al.*, 2006-33). Nooteboom suggests there is a *trade-off* between similarity and difference and that performance is optimised when the two parties are neither too similar, nor too different.

A Cognitive Theory of the Firm (Nooteboom, 2006) proposes that the identity that a firm projects and its organisation more generally, together with its boundaries, are determined by a culturally constituted organisational 'cognitive focus' which limits 'cognitive-distance' between people. If this is done sufficiently well, it allows for effective mutual understanding and agreement and leads to effective coordination (Nooteboom, 1992, 1999). This coordination has two features. On the one hand there is the 'competence' side comprising of knowledge, skills and other types of competencies. On the other hand,

there is the 'governance' side made up by goals, motives, interests and steps for conflict resolution.   The cognitive view of the firm as a 'focusing device' may give organisations an advantage over 'the market' in that the experiences of its team creates tacit knowledge which is hard to replicate outside of the organisation, but, its disadvantage, by its very nature, is the risk of organisational short-sightedness or myopia. Nooteboom sees a need for this myopia to be mitigated by a degree of complementary cognition from outside of the organisation and at a greater cognitive-distance, through external collaborations. He calls this external knowledge and experience domain the 'external economy of cognitive scope' (1992) and suggests there is 'optimal cognitive-distance' which is a trade-off between the advantage of increased cognitive distance for a higher novelty value of a partner's knowledge and the disadvantages of less mutual understanding . If cognitive-distance is too narrow, then there is not much to learn from each other. If cognitive-distance is too large, then Nooteboom (1996, 2000, 2005) suggests there will be poor understanding, more chance of conflict, and relationship breakdown. Nooteboom proposes an inverted U-shaped relationship between cognitive-distance and absorptive capacity.

The Cognitive Theory of the Firm from which the notion of 'cognitive distance' is adopted draws on a wide-ranging scope of closely-related theories of the Firm. The competence view from Penrose (1959), the transaction cost view from Williamson (1975) and the evolutionary view from, amongst others, Nelson and Winter (1982) and Hodgson and Knudsen (2004). Penrose (1959) contributes the notion that expansion of the firm is constrained not by limits to economy of scale, or diseconomies of scale, but by the scope of managerial resources. She identifies causal links among resources, capabilities and competitive advantage and sees managers functioning as a catalyst in the conversion of firms' resources into firms capabilities and new product applications. Penrose suggests that new combinations of resources lead to innovation and economic value creation and

that there is a close relation between the various resources with which a firm works and

the development, experience and knowledge of its managers. These managers and/or

entrepreneurs are seen as a 'bottle-neck' for a firm's growth rate because firm-level

resources only supplied firm-specific knowledge whose value beyond a certain point begins

to decline. Nooteboom, in A Cognitive Theory of the Firm (2006), extends this point of

view and asserts that organisations more widely are limited by the ability to coordinate

cognition. Managerial resources, he argues, should primarily exist as forces for guiding and

coordinating cognition in the firm.

Nooteboom's work on the cognitive theory of the firm takes this first Penrose principle –

that firms achieve competitive advantage on the basis of organisation-specific resources –

and then having established this foundation, he overlays it with the 'dynamic capability'

approach developed later on (cf. Teece *et al*., 1997; Dosi *et al*., 2000).   Dynamic Capability

is what allows organisations to overcome a key problem of combining structural stability

for the sake of efficient operational functioning in terms of using existing resources and

competencies in the short term, and on the other hand the need for structural change to

enable learning and competence building and expansion for survival in the long term.

Nooteboom proposes that the emphasis in organisational cognitive focus lies in developing

dynamic capabilities which reflect an organisations ability to achieve new and innovative

forms of competitive advantage despite path dependencies and core rigidities in the firms'

organisational and technical processes (Winter,2003). In Economics, this is known as the

problem of combining exploitation with exploration (March, 1991). Nooteboom draws on

Transaction Costs Economics to support his 'governance' and relational risk strand of

'cognitive focus'. TCE proposes that, given bounded rationality, organisation services to

manage risks of opportunism by means of hierarchical monitoring and control.   Cognitive

focus, Nooteboom suggests, through aligning goals, value and motives may reduce

opportunism and that by building loyalty and intrinsic motivation of individuals may replace the need to dictate, coerce or provide material incentives.

 Evolutionary Theories of the Firm (Nelson and Winter, 1982; McKelvey, 1982; Baum and Singh, 1994; Aldrich, 1999; Hodgson and Knudsen, 2004) use the idea of variety generation, selection, and replication to analyse the dynamics of firms and industries. The principles of Darwinism are abstracted in terms of the survival of the fittest firms (Hodgson, 2002b). Here Nooteboom sees variety generation in the form of learning as wholly a matter of cognition, and replication as fundamentally a matter of communication. He sees a clear and logical fit between the evolutionary and cognitive theory of organisation.

For the purposes of a cognitive theory of the firm, Nooteboom (2006) defines organisations as

> *Myopically goal-directed, socially-constructed, cognitively-focused systems of co-ordinated activities.*

His definition draws on several, though not all, elements from definitions of the organisation by McKelvey (1982) and Aldrich (1999). There is agreement around the proposition that goal-directed systems of activity generally entail a certain focus on distinctive or core competencies, and that a certain stability of system is needed for an organisation to function, compete in its market and to build 'absorptive capacity' (Cohen and Levinthal, 1990). There is also agreement on the need to build and retain competencies, attract and train new talent, and to build internal and external relationships. Where his definition differs to that of McKelvey and Aldrich, in the cognitive theory of the firm, is the belief that there is no need to stipulate the need for stability of the organisational boundaries for an organisation to remain the same. The cognitive

theory of the firm allows organisations to outsource or share activities without becoming a different organisation.

For Nooteboom's Cognitive Theory of the Firm, he adopts a view of knowledge and learning known as the 'activity theory' (Blackler, 1995). According to this view, mental models (or categories or schemas) of knowledge are developed from experience through interaction with the (physical and social) world (Kolb, 1984; Levitt and March, 1988). In keeping with these roots, Nooteboom sees any element in the system as an outcome of the relations with other entities and in which individuals are both constitute and are constituted by society (Hodgson, 1993).

Nooteboom sees this organic, inter-actionist view as crucial to the Cognitive Theory of the Firm and 'cognitive-distance', as it provides a perspective allowing the idea to transcend the significant gap between economics and its methodological individualism, and sociology, with, in some branches, its tendency towards methodological collectivism. A Cognitive Theory of the Firm sees the individual as social in that one perceives and derives one's individuality in and through interactions with others. But, what one makes of that interaction is not necessarily the same of what others make of it.   Individuality is seen as a function of inherited endowments of mental constructive potential and the interactions experienced along individual courses of life yield the experience needed for construction. Hence, there is 'cognitive distance' between people to the extent that they have developed along different paths, in different environments. This distance can be both a problem because one has to potentially contend with a lack of mutual understanding and the strains that puts on collaboration [or relationships]. But, if handled properly it presents an opportunity to learn something new from people who have constructed their cognition and their knowledge differently (Nooteboom, 1992, 1999).

Whilst the perspective of cognition that Nooteboom adopts is connected with interpretive views of knowledge and meaning, he views it as less subjective than some of them. He maintains, that even though we cannot claim to know the world in an objective sense, since we cannot step outside the mind to test that claim, it is not unreasonable to assume that there is external reality. Nooteboom's Cognitive Theory of the Firm is a broad notion which includes feelings, emotions and value judgements and in a more substantive side also includes a narrower sense in terms of job-related knowledge and skills. On the more intentional or normative moral aspects, it covers an individual's goals, values, personal interests and ways of resolving conflict with others.

Nooteboom sees one of the attractions of embodied cognition as its synergy or continuity with social psychology which has established insights into decision heuristics which mingle both emotion and rationality (Bazerman, 1998). According to various branches of social psychology (Kahneman, 2003, Lindenberg, 2003), it is possible to have multiple, sometimes conflicting mental frames as complexes of mental schemas. It is through these we interpret events, attribute competencies and intentions to the people we interact with and which in turn guide our own actions. One mental frame may be oriented at 'guarding our interests' while another at 'act appropriately' in any situation and the actions we take are interpreted by others as signalling our underlying mental frame at that time (Lindenberg 2003). At any one moment, and given an unfamiliar particular circumstance or event, one of our mental frames may be salient or in 'focal awareness' (Polanyi, 1962) but signals emitted through interaction with others and signals received may yield a switch to another frame as our view of what is happening and actions which may need to be taken suddenly switches. For example, it is possible to vacillate quite quickly between self-interest and the decision to act appropriately. Where this fits with learning and innovation is that learning takes place on the basis of experience and through interaction with others.

The Cognitive Theory of the firm suggests that our ability to learn or to absorb unaccustomed information is dependent on cognitive-distance between parties being sufficient but not too large.

2.7.1   Cognitive Distance

Nooteboom argues that new ideas arise from applying one's existing knowledge in novel contexts which in turn are supplied by new areas of applying that knowledge or new relations. But, he states, the problem of achieving collective goals between members of a group or between collaborators is compounded by the differences between them.   He calls this the 'cognitive-distance' between entities which may manifest at the individual level or at the organisational level.   He sees two sides to cognitive distance, the competency side which is formed by the range of capabilities and knowledge, and the governance side created by the norms and values of conduct. As a consequence of differences in physical and cultural environments, that are embodied in cognition, our perception, interpretation and evaluation are path-dependent and idiosyncratic to a greater or lesser degree. By path-dependent, Nooteboom works with the condition that cognition takes place on the basis of compartmentalised knowledge that has developed in interaction with a certain context of action so that the latter predisposes the thinking. This means that people see the world differently to the extent that they have developed in different social and physical surroundings and have not interacted with each other (Kolb, 1984; Levitt and March, 1988).   This differing level of our past exposure to different experiences and situations determines something Cohen and Levinthal (1990) call absorptive capacity which they see as the level to which new experiences and knowledge have been absorbed and embedded and drive our actions and behaviours. It is this difference in past exposure and our ability to absorb new types of information that Nooteboom (1992, 1999) defines as cognitive-distance.

An implication for cognitive-distance is that in order to achieve a specific joint goal the categories of thought between people in inter-firm and intra-firm relationships must be aligned to some extent (Nooteboom, 1992, 2000). For innovation, cognitive-distance needs to be limited, or at least controlled to get the best possible outcomes. This does not entail the need for people to agree on everything or to see everything in the same way. But rather that there is a trade-off between cognitive-distance which is needed for variety and novelty of one's knowledge or experience; and cognitive proximity, which is needed for mutual understanding and agreement. Figure 2.3 shows a conceptual model of cognitive-distance. Nooteboom (2002) suggests that if the most effective state of learning by interaction is the product of novelty value and understandability,

Figure 2.3: Conceptual model of cognitive-distance

then it is possible to construct an inverse U-shaped model of cognitive-distance where optimal cognitive-distance lies at the maximum of the curve. A downward line would represent understandability in terms of 'absorptive capacity' (Cohen and Levinthal, 1990) with an upward line representing the novelty value of the information input into the system. The optimal level of cognitive-distance for learning is seen by Nooteboom as lying in the range between low levels of cognitive-distance and very high levels of cognitive-distance. The model implies a difference between reducing cognitive distance and crossing it on the basis of the level or quantum of information that can be successfully absorbed at any one time. The difference between ACAP and CD is seen as similar to the relationship between empathy for another's situation and identification with it. To empathise with

someone means you have sufficient grasp of another's language and the way they think so that you can understand them but do not necessarily subscribe to the same perspective. Identification suggests you 'think the same' and see life from the same viewpoint.

Nooteboom applies the Cognitive Theory of the Firm and its concept of cognitive-distance in an empirical form to the aggregate level of the organisation using alliances and collaborations between large and small businesses engaged in innovation partnerships. His methodologies vary the interpretation of cognitive-distance, applying it in the narrow sense to one dimension (such as technical cognitive-distance) and in a broader interpretation (such as both technical and organisational dimensions). In some empirical settings there is a direct measure of innovation performance and in others there is not. Nooteboom recognises that large assumptions have been made in his work and that some of his hypotheses are derived. Whilst the empirical tests find evidence of the inverted-U shaped curve proposed by cognitive-distance in partnerships for innovation, the researchers in these previous studies recognise the flaws in their constructs and call for a test which has both a measure of cognitive-distance and a clear measure of innovation output.   Those tests are found here.

2.7.2   Previous Empirical Measures for Testing Similarity and Difference

Similarity studies vary across sectors, types of firms, similarity dimensions and

measurement approaches. As such, there are no standardised approaches for measuring

variables of similarity or difference. The measures reported in this section here are those

used in previous studies and highlight the diversity of empirical approaches.

A. Organisational level

Similarity measure: Innovation activity defined as volume of patents issued in a year

(Luo and Deng, 2009) - Strategic alliances between SMEs in knowledge-intensive industries

which explores the effects of similar or dissimilar partners in a firm's innovation alliance

portfolio. Firm level moderators were organisational age and industry norms of

collaboration. Similarity is found to have benefits up to a threshold at which point similar

partners led to a decrease in innovation.

Similarity measure: Strategic defined as price positioning, quality positioning,

orientation of marketing and sales, and organisational culture

Homburg et al., (2002) – This study looked at similarity in business orientation between

manufacturers and their distributors. It found that relationship effectiveness was positively

affected by similarity.

Similarity measure: Strategic similarity defined as 'cost cutters' or 'expansionists'

Darr and Kurtzberg (2000) – investigates similarity and the effects of knowledge transfer

on production efficiency in a fast-food franchise network. Customer and location

similarities were found to aid knowledge transfer.

Similarity measure: Strategic defined as the number of different partnership ties and how many regions are represented in the partnership portfolio and whether they were "persistent-same-type"

Lokshin (2011) – investigates relationships between Dutch firms in technological innovation partnerships. Dependent variables use a simple binary response format of yes/no for "have you experienced a 'bumpy road' when engaging in collaboration?" Unstable technological partnerships were found to hamper innovation activities.

B. Individual level

Similarity measure: aspects of life stage, gender, cultural background, work attitude and personality.

Smith (1998) provides a conceptual model for similarity but relates it to relationship management behaviours and relationship quality of organisational boundary-spanners but not in the context of innovation.

2.7.3   Psychometric Instruments for Measuring Personal Values and Attitudes

There are three prominent psychometric measures of values:

1. Rokeach's Value Survey (1983) – requires ranking of 18 values. No ipsative (either/other) option.

2. Schwartz's 52-item scale (1994) – requires ranking of 52 items. No ipsative (either/or) option.

3. Allport-Vernon-Lindzey Study of Values (4th ed. 2003) – places respondents in realistic behavioural-choice situations, situations in which the choice is clearly value driven.

All three psychometric instruments were compared by Peng *et al*. (1997) who found

serious internal-validity problems with both Rokeach's value-survey and Schwatz's 52-item

scale. The rankings correlated only modestly with themselves (across samples) and

showed little or no correlations with ratings. Further, they found that neither the ratings

nor rankings related to an external criterion. In contrast, the behavioural scenario of the

SOV showed high external validity.   Their recommendation was that behavioural scenarios

should be used when assessing personal values.   Similarly Gibbins and Walker (1993)

suggested that "the apparent independence of each Rokeach value being measured is a

consequence of the fact that the survey measures each value quite badly". There is

evidence that values presented in an abstract sense are viewed differently from those

presented in a contextual form (Peng, Nisbett & Wong, 1997) and that abstract rankings of

personal values have been shown to change depending on the individual's mindset (i.e.

personal life –v- societal perspective) and location, e.g. at work –v- at home (Brown &

Crace, 1996).

In fairly recent times Connor and Becker (1994) issued a research request for the

development of an instrument that incorporated realistic behavioural-choice situations

and similarity. Peng *et al*. (1997), p.341) concluded "….the low criterion validity of common

used value-survey methods might be avoided by using the behavioural scenario method".

This type of measurement exists in the *SOV* and its redesign in the 4th edition has made it a

relevant test for measuring values in the 21st century (Kopelman *et al*., 2003).

Allport Vernon Lindzey Study of Values

The AVL *Study of Values* (AVL *SOV*) is an established ipsative (forced-choice) psychometric

questionnaire which is used to measure the relative importance of six classes of personal

values. The *SOV* 4th edition was reconstructed in 2003 and is the version used here. Based

on Spranger's (1928) work on personality types, it is designed around six 'dominant attitudes' (also called 'ideal types') which Spranger believed influenced the way that individuals view the world. A full description of these 'dominant attitudes', are given later in this section. The *SOV* questionnaire consists of forty-five items which yield 120 individual score values with a total possible score of 240 points. Each 'attitude' dimension is tested twenty times and can attract a score of between ten and seventy points. In the first part of the test, thirty question couplets allow the respondent a maximum allocation of 3 points each. In the second part, fifteen question quartets allow an overall allocation of ten points. The ipsative nature of the instrument means that the user is forced to allocate points between attitude alternatives which are relatively more acceptable to them. Example of a question from each of the two parts of the survey is given here and the full item bank of questions can be found in appendix 1:

A question *couplet*: 'The main objective of scientific research should be: A) the discovery of truth rather than; B) its practical application'.

Question A relates to the Theoretical attitude. Question B relates to the Economic attitude.

Possible answer responses: A) 3   B) 0 = a very strong preference for answer A

A) 0   B) 3 = a very strong preference for answer B

A) 2   B) 1 = a slight preference for answer A

A) 1   B) 2 = a slight preference for answer B

A question *quartet*: 'Do you think that a good government should aim chiefly at:

a. more aid for the poor, sick and old;

b. the development of manufacturing and trade;

c. introducing the highest ethical principles into its policies and diplomacy;

d. establishing a position of prestige and respect among nations.

Question A. relates to the social attitude, question B. to the economic attitude, question C. to the religious attitude and question D. to the political attitude.

Possible answer responses: A) 4   B) 3   C) 2   D) 1

                                            A) 3   B) 2   C) 1   D) 4

                                            A) 2   B) 1   C) 4   D) 3

                                            A) 1   B) 4   C) 3   D) 2

In the first part the thirty questions yield sixty individual scores with a total value of ninety points. The fifteen questions in the second part also yields sixty individual scores but with a total value of one hundred and fifty points. No numeric value can be allocated more than once for any question.

The underlying construct of the *SOV* questions emanate from theory and are based on Spranger's (1928) work that postulated the essence of a person is best captured by understanding the individual's value-philosophy. The SOV yields ipsative measures of values grounded in Spranger's six 'dominant attitudes': theoretical, economic, political, aesthetic, social and religious. Spranger's work has been criticised for being overly abstract and systematic, but his defence is that he does not suggest that any one of his ideal types really exists but the abstraction successfully serves to clarify and bring order to what are confusing and complex real life forms. The approach was seen as the first steps in understanding basic cognitive models which operate at the higher level of mental life and which help to differentiate the contemporary population. Spranger believed the definition of these 'types' brought insights for practical everyday life and could help to bridge our understanding of the mental gaps between people and groups.

Spranger's ideal types are founded by considering in each case, one definite meaning and value- direction as the dominant one in an individual's cognitive structure. This view was driven by the belief that the mental character of an individual is principally determined

through the value structure by which they live and shapes their own life.   Whilst

acknowledging that in every mental act the whole mind is engaged, Spranger believed that

some actions are transformed in such a way that in certain situations they seem to become

subordinated to a dominant value-direction which prevails and drives our behaviour.

Sometimes the subordinated values contribute their 'colour' to the dominant value, or if

that is not possible in a certain situation, they are repressed to meaningless status.

Spranger symbolises this relationship in the figure of the die, which when rolled will always

fall with one side lying uppermost. The other sides are not absent, but are instead in a

definite relation to the figure on top. Spranger used this isolating and idealising method as

a framework for constructing a few most general forms of personality. Each type differs

(Spranger calls them "primary values") and each has a unique structure. Spranger believed

that all phenomena of mental life can be understood as permutations of these simple,

partial structures.

Spranger's Dominant Attitudes

The *Theoretical* Attitude: Theorists believe that education is the only road to progress and

they see the world as a network of possible inter-relations that can be understood through

intellectualising and analysing. They exhibit self-control, consistency of behaviour and are

heavily guided by principles and motivated by maxims. They have a decided feel of

superiority because of their mental achievements and see themselves as individualists who

believe that social and family ties are only important if they contribute to a brotherhood

which seeks truth and knowledge through research. People with a theorist disposition are

driven to solve a problem, to explain a question or formulate a theory. They strive for

concrete understanding through gathering facts, and strive for objectivity and feel

comfortable only when things are ordered or categorised in such a way that the mind can

master them.   They believe in a body of laws which produce a system and their aim is to

strive for rational completeness. But, in this striving for inner consistency they can become pedantic, overbearing and then impossible. Truth, as a virtue, is so important to them that they will set it above anything else in their interaction with human relations. They are, though, sometimes inclined to see only truths that are convenient and to forget that knowledge is really of positive value only when one knows how to use it.   Their executive ability is lacking, they like to broadcast opinion and intuition is beyond them. They only really feel at home in a community where their attitude is understood and reflected. The theorist dislikes the economic attitude and is directly opposed to the aesthetic attitude.

The *Economic* Attitude: Spranger believed that most people belong to the economic type, or at least embody strong traits of it. At its base is the conception that life depends upon the ability to satisfy one's needs and that one's needs increase with one's development. For a pure economic attitude, the point of satiation is seldom or never reached but they are aware that the utilities which provide the capacity to survive are not unlimited, and rationale activity (i.e. purposive behaviour) is necessary to bring those goods from different places and to transform them through the expenditure of energy into commodities that they need or value. To this attitude-type work is only economic when the gain in power overbalances the expenditure of energy. Where an individual is unrestrained in his economic drive, wants do not cease at an average, but grow beyond the expected point of satisfaction. This is the powerful drive by means of which economic and technical behaviour grow beyond the individual need and become a more widely-based phenomena. The economic individual is, in general, the type which in all relations prefers utility to other values. They see everything as an aid in the natural struggle for existence and strive towards a possibility to render life pleasant in that they economise goods and forces, time and space, in order to gain the maximum possible effect for themselves.   They might also be known as the 'practical type' in that they see cognitive activity from a

purposive viewpoint. Where the theorist seeks truth for itself, the economic type asks 'how can this fact be used? Unapplied knowledge to this type is merely intellectual and unnecessary ballast. Disregarding the purely objective context of wisdom, they are interested only in combining knowledge in terms of its application and organisation for practical use. At the higher levels it become more than just common sense or instinct, but is about gathering theory and using it to calculate factors which will help them comprehend risk. This creates an individual with a 'business head' and an imaginative intuition which allows one to 'take a chance'. This particular point touches the region of aesthetics or religion but the economic type has a purely utilitarian character and the role of beauty is discounted - we have seen that 'splendid landscapes are destroyed by economic motives, works of art are demolished and happy moods spoiled'. If something is aesthetically portrayed but is also economically important it is regarded as luxury and luxuries may over time become economically necessary goods through a refinement of wants. For the economic type, possessions in social relations become a factor of prestige and signify to others that the narrow needs of existence have been outdistanced and luxuries can be afforded. The acquisition may be a means of social elevation but at heart there is a failure to appreciate the inner significances. Things that cannot be replaced take on a very high exchange value. The purely economic is egotistical since they regard it as their first duty to preserve their own life and everybody else is consequently of lesser importance. Altruism, when it is displayed must be born from some other motive. They see man only from the point of view of economy, that is, a producer, consumer or a buyer and even in business relations a person is necessarily only a means to an end – all forms of goodwill or sympathy enter into the economic relation – they make for 'good business'. But for the purely economic type such relations do not go beyond business interests. The person guided by economic motives is more closely related to reality than the other types. It can go beyond mere striving of personal advantage and the idea of the useful, and the

productive, can become an unstoppable passion. But the net return, the rent-ability and profit are the decisive factors and it is this that determines the limit of the economic type.

The *Aesthetic* Attitude: Classic aesthetics are guided by an inner urge for self-development. They have the advantage of being able to project their experiences into any form (colours, tones, pictures), i.e. they have the power of self-expression which transforms their impressions of the world using their imaginative grasp and powers of emotion. Though pure aesthetics may live entirely in their internalised appreciation of beauty and impression, real experiences of life can mean they can work impressions over into form and show objective 'sensible' creative powers.

There is an easy-going but mostly superficial association with people in which neither personal needs nor professional interests are important, but the manner of receptivity to each other and similar self-expression is key. They have the power of imagination and the 'play' impulse. They are guided by good taste, by tact and a sense of decorum or fitness. Mental growth is not just a cramming of knowledge, but a free many-sided and peculiarly mental drawing-in of the 'world'. They regard the world as material to form their personalities and classify all mental goods according to their fruitfulness for culture. They like to fill in the gaps of their experience and use bad situations to expand their understanding of the world. Aesthetics have a special way of understanding the world in which they live – they have an empathic intuition and trust their 'hunches' but they very much see themselves as individuals and can tend to eccentricity and self-importance. They can show energetic mental work if it will provide material to further develop their form and personality. Aesthetics can lack inner self-discipline; they may withdraw and become self-sufficient under pressure and threat. They are unable to cope mentally with the hard world of power.

The *Social* Attitude: Social behaviour contains a unique act, namely the value-affirming interest in another being and the taking-the-place-of-another. There's is a sympathetic spirit and this interest in others may show itself in a feeling of community and an ability to recognise the dormant possibilities of others. The very strong social type does not live immediately through oneself but in their relations with other people. This may be carried to the point where they see their own value only as it is reflected in other people. In its highest development, it is called 'love'. They can have selfless motives, aren't calculating and do not want to control. They may overemphasise the positive and disregard the negative and will give and do well without being conscious of their actions or their influence. The social type not only experiences from the content of the values which they further in the other person a reflected value, but also experiences this social behaviour as a personal value enhancement. Social types can create strong loyal ties. Through experiencing sympathy, elevation, surrender and forgiveness, these elements of self-sacrifice rather than self-preservation create tensions between the social and economic types. Science seems to the social type to contain too much of the object and too little of the soul. Purely social values are usually interwoven with the other groups of values and it is not always clear which motive takes the lead, for example social types can be 'altruistic', though this dimension of personality also belongs to the economic realm.

The *Political* Attitude: Those with the political attitude have the capacity and (usually) the will, to posit their own personal value direction in another, either as a permanent or a transitory motive. They see power as a total affirmation of one's own being before all individual achievement, vitality and energy. Even in the most narrow and modest circles there are relations of power and competition. Everyone is both a centre and an object of power. The effects of power on others always appear in the form of determination, it is about gaining ends which are valuable to the possessor of power and for some can spread

over into physical coercion. The purely political type makes all value regions of life serve

their will to power. Cognition is for them only a means for control and practices the maxim:

'knowledge is power' and the means to achieve ascendency over others through some

social technique.   They see others through their own eyes and from the outset, regard

them from the point of view of how people, being what they are, can be controlled.   They

investigate the most effective motivations and are inclined to ascribe low motives to

people, largely because a majority of mankind can easily be influenced that way.

According to a pure political attitude, everyone has their price.   For the political type,

people are a means to an end, in a favourable case a means to their own good. Truth may

degenerate into a political tool and inside their political system it can be about expediency

not about whether it is moral or objective. Truth and falsehood are considered equal if

they serve the system of power: 'the end justifies the means'. Rhetoric can take

possession of the entire personality and the goal can become not to convince but to cajole.

There is a will to be 'on the top' and not 'at the bottom'. They can be self-deceiving.

Pretension is fundamentally characteristic of the political type and they can be prepared to

acquire goods by means of diplomacy and treatises, by conquest or force, without

following the immanent law of economics, that of saving and industry. The character of

the modern entrepreneur is not purely economic but is also partly based on political

relations. The aim of great enterprises is often less directly about the acquisition of wealth

than the developing of power on a big scale, ascendency not only over material goods but

over people. The economic seems to be subordinated to the political. The pure person of

power is the person of self-emphasis and self-assertion. Not a warm-hearted person but a

misanthrope. Viewed in extreme isolation, the political type is the opposite of the social

nature. They aim at the satisfaction of their own vital or mental drive for existence, even

at the cost of others. It is the will to live, to stay at the top at all costs and to maintain their

advantage. The prestige of the political type seems to increase with the expansion of its

sphere of influence. It makes a decided difference whether one appears with a following of two or of a large body of people. Regardless of the energy of the individual, the extent of their influence also depends on the ideal of eminence which they have set for themselves. Some people are content to play a leading role in their home-town and experience their big moments in this way. Others feel themselves sufficiently elevated by belonging to some social class. The intensity as well as extensity of its relations also comes into question. The pure type of political Individual, however, appears very seldom.

The *Religious* Attitude: The search for experiences which have significance for the total meaning of one's life and the value of individual existence is at the core of this attitude. Even a single moment, if it is deemed to have significance, can radiate meaning over the whole of an individual's entire mental life. It is the condition, instinctive or rational, in which a single experience is either positively or negatively related to the total value of the individual's life. It is about the search for meaning in the world and inner revelation and about being able to make a leap of faith for something that cannot be cognised or proven. A religious person is that whose whole mental structure is permanently directed to the creation of the highest and absolutely satisfying value experience. They are striving towards the condition of highest tranquillity, toward unity and identity and searching, ultimately, for salvation. They may accept fate and honour it as one's 'destiny'.

Extreme religious value relations can be expressed as dogmas or cults. There is an ongoing tension between the theoretical attitude (science and knowledge) and the religious attitude (belief).

2.7.4 Inter-study Comparison of SOV Attitude Profiles

The early edition of the Allport Vernon Lindsey Study of Values was used in a number of studies to compare the dominant attitude profiles of different types of groups. These

studies predominantly investigated the differences in SOV attitudes between people in different job roles, professions, and between gender groups. The AVL General Population norm group was produced in 1970 and all the studies beyond this date have drawn upon its data as their mode of comparison.   There is little information now available about the method for constructing the General Population norm group and it provides little more than a breakdown of mean averages by gender and rank order. There is no document providing information on the number of observations, socio-economic background of the respondents or other contextual information other than some illustrative occupational differences provided in the Study of Values manual. The data from the research conducted here could perhaps be used to provide the start of a more contemporary norm group, albeit very specific to small businesses.

In past research the method for calculating an attitude profile is to produce the mean scores for the relevant group and then to rank those scores by intensity of attitude preference from highest to lowest. Whilst the methodology for this research uses the *SOV* in a different way, out of general interest and as the data was available, the researcher mapped the profiles for the SME and creative cohort and compared them with the profiles from previous studies. The table on the next page reports the profiles from previous empirical SOV work and illustrates the similarities and differences between the profiles of different sample groups.

A first observation is that the profiles of earlier samples seem to share a dominant economic attitude regardless of sub-section by gender or business sector. This dominance by the economic attribute confirms Spranger's view that most people belong to the economic type, or embody strong traits of it. The economic attitude is about satisfying the needs which make life pleasant and of obtaining the maximum of useful effects for oneself. A similar dominant attitude features in each of the research results from Cameron (1979)

onwards (with the exception of black female entrepreneurs, (Hodgetts & Casio, 1981). In all the studies since this point, the economic, theoretical and political attitudes have dominated the top three rankings for male respondents. In the female samples, the aesthetic attitude ranks in the top three, replacing the theoretic attitude in the top three places, in all but one study. The social attitude in the studies compared features commonly in the lower part of the ranking tables for most studies with the exception of the General Population female sub-sample and black female entrepreneurs.

Table 2.4: Comparison of SOV profiles from previous studies

Research Sample	
2013	
Male (n = 58)	Female (n = 24)
Economic	Economic
Theoretical	Social
Political	Theoretical
Social	Aesthetic
Aesthetic	Political
Religious	Religious

Real Estate Professionals, USA		Business Managers		Supervisory Candidates	
Salek, 1987		Boulgarides, 1984		Lash, 1981	
Male (n = 50)	Female (n= 50)	Male (n = 108)	Female (n = 108)	Male & Female (n = 229)	
Economic	Economic	Economic	Economic	Economic	Economic
Political	Political	Theoretical	Aesthetic	Theoretical	Political
Theoretical	Aesthetic	Political	Theoretical	Political	Aesthetic
Religious	Theoretical	Aesthetic	Political	Aesthetic	Religious
Aesthetic	Religious	Social	Social	Religious	Social
Social	Social	Religious	Religious	Social	Theoretical

Anglo, Latin & Black Entrepreneurs	Anglo Entrepreneurs - Female	Black Entrepreneurs - Female	Latin Entrepreneurs		Bank and Insurance Managers - Male	Bank and Insurance Managers - Female
Hodgetts & Cascio, 1981			Hodgetts & Cascio, 1979		Cameron, 1979	Cameron, 1979
Male & Female (n = 333)			Male & Female (n = 109)		Male & Female (n = 264)	
Economic	Economic	Social	Economic	Economic	Economic	Economic
Theoretical	Aesthetic	Economic	Political	Political	Political	Aesthetic
Political	Political	Religious	Theoretical	Aesthetic	Theoretical	Political
Aesthetic	Theoretical	Political	Social	Theoretical	Aesthetic	Religious
Social	Social	Theoretical	Religious	Social	Religious	Social
Religious	Religious	Aesthetic	Aesthetic	Religious	Social	Theoretical

Successful Managers - Female Hodgetts & Pryor, 1978	Executives - Male Singer, 1975	General Population - Male AVL (1970)	General Population - Female AVL (1970)	Executives - Male Tagiuri, 1965	Research Managers - Male Tagiuri, 1965	Scientists - Male Tagiuri, 1965
(n = 51)	(n = 100)	Male (n =unknown)	Female (n =unknown)	(n = 555)	(n = 236)	(n = 204)
Political	Political	Political	Aesthetic	Economic	Theoretical	Theoretical
Economic	Economic	Theoretical	Religious	Theoretical	Economic	Economic
Aesthetic	Theoretical	Economic	Social	Political	Political	Political
Theoretical	Social	Religious	Political	Religious	Aesthetic	Aesthetic
Religious	Aesthetic	Social	Economic	Aesthetic	Religious	Religious
Social	Religious	Aesthetic	Theoretical	Social	Social	Social

2.8   Open-Innovation Partnerships between Small Businesses as a way to Research the Effects of Partner Similarity on Innovation Success

There is no clear-cut view in the literature around whether similarity or difference between innovation partners, or perhaps something in between, is the best condition for enhanced innovation performance.

Open-innovation has its own challenges, particularly for small businesses where innovation is very often an *ad hoc* activity driven by opportunity or interest, rather than strategy and usually undertaken informally alongside the firms other activities (Hewitt-Dundas, 2006). A relative lack of capacity to seek out and absorb external information for better innovation performance is seen as another constraint for small businesses (Cohen and Levinthal, 1990, Chesbrough, 2010). Where small firms do expand their networks, it seems to help them find knowledge that is often complementary to their firm's internal knowledge and helps shape their innovations (Roper *et al.*, 2008) and indeed, it seems that small firms are found to have more to gain than their larger counterparts when taking advantage of external links. But, by choosing to adopt an open-innovation approach partner choice is seen, for small businesses, as a particularly important issue (Vahter, Love and Roper, 2012). But where small businesses get as far as establishing an open-innovation relationship, the business owners seem to be particularly prone to initiating a sequence of behavioural biases which affect them as they attempt to innovate (Morrison and Potts, 2008). As the new relationship is established, and begins to develop, as the small business begins to experience working with an external partner, and where there is the necessity for the transfer of novel or creative information, an individual's rationality or 'working rules' can fail, leading to a sub-optimal response to the situation or opportunity. In this domain of 'bounded rationality' where no one is sure which alternative is best, where preferences are inconsistent and payoffs unknown, there needs to be trust not only in judgement and competence, but in unselfish values (Rosanas, 2004).

Previous studies exploring the role of similarity and differences between partners have mostly taken place in multi-national firms or high-tech SMEs in formal collaborative partnerships and alliances (e.g. Baum *et al.* 2000; Lee *et al,* 2010*;* Nooteboom *et al.*, 2006*;* Dahlander and Gann, 2010*)* and involve quite complex innovation systems and relationships and few direct measures of similarity and innovation performance*.*

The research context here provides the opportunity to assess the role of similarity and difference on innovation partnerships which are operating within more defined boundaries and with simpler innovation objectives. This offers several benefits:

1. Because the small business owner is in almost all cases the innovation project lead as well as the main-boundary spanning individual between the small firms and its creative partner, this reduces the influences of external factors which may play a role in more complex innovation partnerships.

2. There is less opportunity for the knowledge in-flows into the small business to be restricted or diluted because the information passes through fewer transfer points.

3. There is a better chance that the same individuals are involved for the duration of the innovation project.

4. There is an opportunity to explore the effects of similarity at the individual level and to identify how similarities or differences between individuals influence their behaviours, especially with regard to cooperation or collaboration which may reasonably be linked or related to innovation partnerships. This is an area of similarity as yet unexplored.

5. The restricted duration of the innovation projects, which last a maximum of six months, allows us to identify the effects of partner similarity on the firm's innovation performance in a relatively short timescale.

2.9   Summary and Research Questions

The existing literature has provided a foundation for this research by establishing an understanding of innovation and innovation models and how small businesses appear to currently interact with those models. We find that approaches to innovation are changing and moving towards a more 'open' model (Chesbrough, 2003) which involves interactions between organisations and external sources of knowledge such as other businesses, research specialists or the higher education establishment and which involves multiple actors, expanding networks and linkages, and the need for boundary-spanning competencies. This opening up of the firm's boundaries introduces further complexity into a challenging process that some consider to be laborious and idiosyncratic and occurring in its own unique set of circumstances.

Next, factors which might impact on open-innovation relationships were considered and the role of similarity or dissimilarity between partners was considered as a possible feature which might create or mitigate some of the constraints and barriers associated with cross-boundary working. Here the literature provided conflicting accounts of the benefits and draw backs of similarity or difference at the organisational level with many studies reporting the positive effects of similarity and others the benefits of diversity that different partners bring. Similarity effects, in different populations and at different levels of analysis are difficult to perfectly isolate and appear to be as much a result of the social context in which the organisation dyad operates as in the high-level operational features of the dyad itself (Luo and Deng, 2009).

At the individual level of similarity, the ubiquitous relationship between similarity and attraction (Byrne, 1971) was challenged by Aron *et al*.,(2001) whose self-expansion model proposes that under certain conditions and particularly where individuals are seeking out

new experiences, or making changes in their social networks, relationships with dissimilar others are the most conducive.

The apparent contradictory position between those that argue for the benefits of similarity and those that argue for the value of difference is bridged by a model from a Cognitive Theory of the Firm (Nooteboom, 2006). This more sophisticated method for assessing the impacts of similarity and different on performance proposes that there is a 'trade-off' somewhere between both states where learning or performance improves up to a point and then begins to decline.

Nooteboom calls this range cognitive-distance, which is the product of novelty value of new knowledge and understandability. The optimal point for learning lies at the maximum of the curve where partners are neither too similar, nor too different.
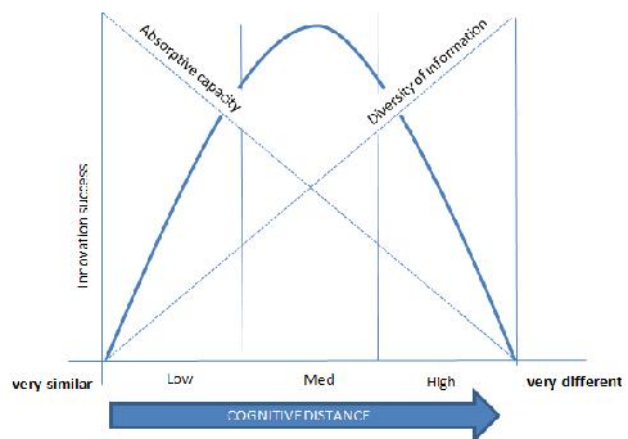
Figure 2.5: Nooteboom's conceptual model of cognitive-distance

The inverted U-shaped relationship proposed by cognitive-distance helps to overcome the methodological and theoretical constraints of a linear relationship between similarity and performance. The model has been tested twice empirically at the aggregate level of the organisation using alliances and collaborations between large and small businesses engaged in innovation partnerships (Wuyts *et al.* 2005; Nooteboom, *et al.*, 2006). These empirical tests find some evidence of the inverted U-shaped curve characteristic of cognitive distance but the researchers raise concerns over the derived measures of both cognitive distance and innovation performance which limit the value of the work. They call

for a test of cognitive-distance which has both a measure of similarity and a clear measure of innovation output.

This work offers both these items and, further, expands the range of the cognitive-distance concept to very small businesses in transactional, incremental, innovation partnerships. The research here goes further still, by testing for the inverted U-shaped relationship at both the level of the organisation and at the level of the individual leading to the following research questions:

1. How does the relationship between similarity and difference impact innovation performance of small business innovation partnerships using measurement constructs at the *organisational* level?

2. How does the relationship between similarity and difference impact innovation performance of small business innovation partnerships using measurement constructs at the *individual* level?

3. Does the relationship between similarity and difference and innovation performance follow the model of an inverted U-shaped curve proposed by cognitive-distance.

3.   METHODOLOGY

3.1   Introduction

The purpose of this section is to outline the paradigmatic assumptions on which this

research is based and to justify the epistemological and methodological approach selected.

Here the research design is reported, the selection of a quantitative methodology

discussed and the theoretical and conceptual approaches reviewed. The contextual and

temporal characteristics of the research are reported, and the approaches for deriving

similarity and innovation measures are clearly explained.   The study draws on

Nooteboom's (1996) model of cognitive-distance which proposes that there is a trade-off

between the advantage of increased cognitive-distance for a higher novelty value of

partner's knowledge, and the disadvantages of less mutual understanding. Cognitive-

distance propounds that if the value of learning is a product of novelty value and

understandability, there is an inverted U-shaped relation, with an optimum level that

yields maximal knowledge exchange which sits at the peak of the curve, somewhere

between high levels of similarity and high levels of difference. The methodology section

explains how the idea of cognitive-distance is applied to a sample of small businesses

working together on short-term transactional innovation partnerships. The chapter

outlines the method used to test for the cognitive-distance relationship at both the

organisational and the individual level.

or both organisational and individual-level similarity there appears to be no prior similarity

measurement construct that can be validly applied, given the type and nature of the data

available for predictor and outcome variables. This research, therefore, creates unique

measures of similarity both at the organisational and individual level.

3.2   Research Design

Research design determines the logical sequence that connects the empirical data to a

study's initial research questions (Yin, 2003). Yin, defines the research design as "*an action*

plan for getting from here to there, where *here* may be defined as the initial set of

questions to be answered, and *there* is the set of conclusions (answers) about these

questions" (p.19 original emphasis). In other words, the research design makes sure that

the research questions can be sufficiently answered by the way the empirical part of the

research is composed. The research design covers issues such as the statement of the

research question, the definition of the unit of analysis and the selection of suitable sector

and case studies. Each of these issues is addressed in this section.

3.2.1   Research Questions and the Units of Analysis

The research questions which inform this study are:

1.   How does the relationships between similarity and difference impact innovation

performance of small business innovation partnerships using measurement

constructs at the *organisational* level?

2.   How does the relationship between similarity and difference impact innovation

performance of small business partnerships using measurement constructs at the

individual level?

3.   Does the relationship between similarity and difference and innovation

performance follow the model of an inverted U-shaped curve proposed by

cognitive-distance?

The first step in deciding how to analyse the data is to define a unit of analysis. The unit of analysis is the 'who' or what' that is being analysed within a study.   Previous work on cognitive-distance has established the unit of analysis at the aggregated level of the organisational (Wuyts *et al.* 2005, Nooteboom *et al.*, 2006) and conducted the studies on this basis.

A crucial point for the Cognitive Theory of the Firm is that learning for innovation takes place on the basis of experience and of interaction with others at sufficient but not too large cognitive-distance. Nooteboom argues that in both cases (experience *and* interaction) what is essential is that ideas arising from applying one's existing knowledge in novel contexts are supplied by both experiencing new areas of application *and* new [interpersonal] relationships (Nooteboom, 2006). This yields two levels of embedding for cognition; of individual's minds in organisations, and of organisations in networks of organisations (Nooteboom, 2003) in a form of 'double-embeddedness'. Figure 3.1: shows the double-embeddedness model of cognitive-distance developed for this study. This double-embeddedness suggests that the 'trade-off' relationship proposed by cognitive-distance and represented by an inverted U-shaped curve might potentially be found within both the competency strand and the governance strand of the Cognitive Theory of the Firm. That is, at both the aggregated organisational level and also at the individual personal level.

Measuring cognitive-distance only at the organisational level has been highlighted in both previous studies as a limitation within the cognitive-distance research paradigm. One of the propositions for future research made by Wuyts *et al*., (2005) was to construct direct measures of cognitive-distance and innovation output and another by Nooteboom *et al.* (2006) was to separate out differences in different dimensions of cognition at the individual level (Nooteboom *et al.*, 2006).

Exploring cognitive-distance at both the organisational and individual-level analysis in this study fulfils those methodological recommendations. The analysis conducted here therefore uses a methodology which investigates cognitive-distance at the dual-level, using two different units of analysis:

1. Organisation level, where characteristics are organised into three areas of similarity: strategy, search technique; and knowledge application; and

2. Individual level, where characteristics are organised into six different dimensions of cognition defined as 'attitude types': theoretic, economic social, aesthetic, political, religious.
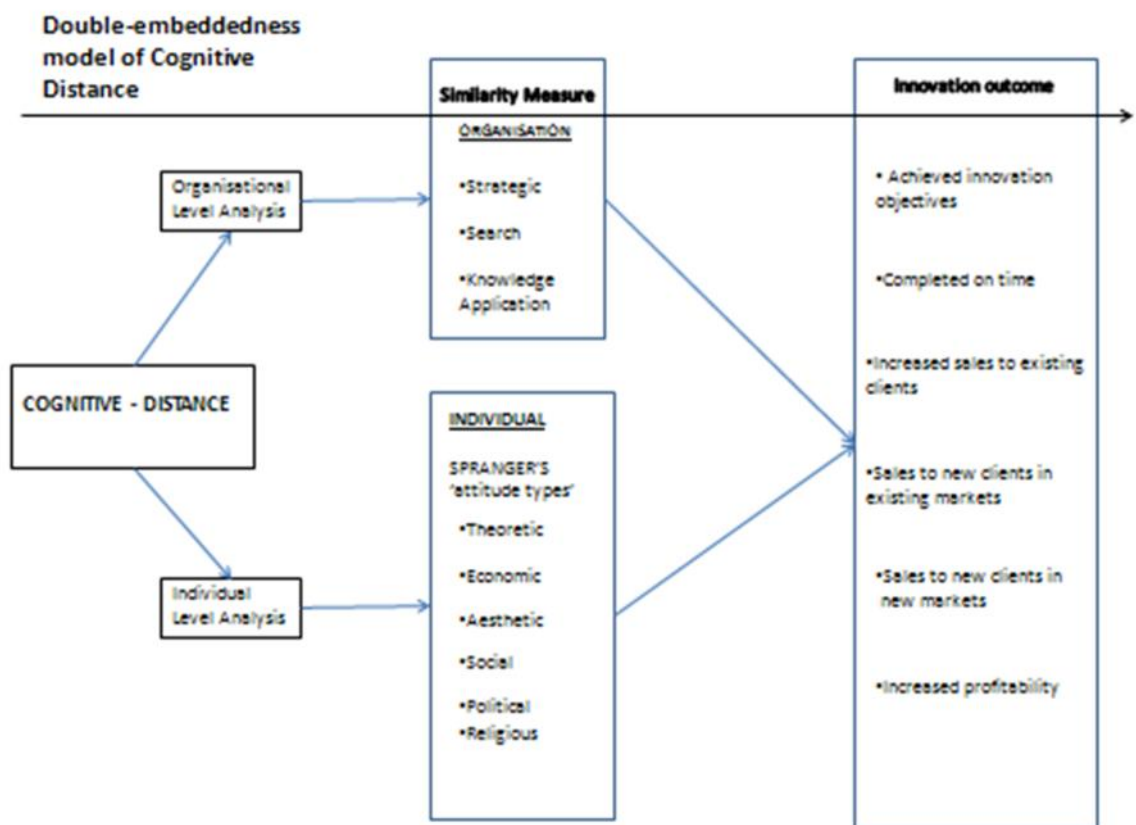
Figure 3.1: Double-embeddedness model of cognitive-distance

3.2.2 Using a Quantitative Methodology

A research method describes the flexible set of guidelines that links the theoretical

paradigms to research design and data collection (Denzin and Lincoln, 2000). Research

methods tend to be linked to a specific body of literature illustrating history, exemplary

works and preferred ways of putting research methods in to practice (Denzin and Lincoln,

2000).

The research focus here is on looking for relationships and not looking for meaning. The

research, with its aim to collect 'facts' takes a positivist epistemological position. The

researcher aims to undertake the study in a value-free way where the assumption is that

the researcher is independent of, and neither affects nor is affected by the subject of the

research (Remenyi, 1998:33). Positivist researchers like to use highly structured

methodologies in order to facilitate replication (Gill and Johnson, 2002) and produce data

which lead to quantifiable observations that lend themselves to statistical analysis. The

social survey is typically seen as the instrument of choice in this field because it can be

readily adapted to such things. Through questionnaire items concepts can be

operationalised, objectivity is maintained by distance between observer and observed,

replication can be carried out by employing the same research instrument in another

context.

Quantitative methods reflect one of the assumptions of a positivist paradigm which holds

that behaviour can be explained through objective facts. The design of the positivist model

and the instrumentation used are intended to persuade by showing how bias and error are

eliminated (Firestone, 1987). The quantitative researcher typically employs experimental

or correlational designs to reduce error, bias and other noise that keeps one from clearly

perceiving social facts (Cronbach, 1975). Quantitative research stresses the measurement

and analysis of causal relationships between variables, not processes, it is highly structured

and does not generally allow the researcher to adapt or follow new lines of enquiry, even if

they look promising. The sample survey is an appropriate and useful means of gathering

information under three conditions (Warwick and Lininger, 1975), first when the goals of

the research call for quantitative data, secondly when the information sought is reasonably

specific and familiar to the respondents and lastly, when the researcher themselves have

prior knowledge of particular problems and the range of responses likely to emerge. This

research fits the conditions in all three areas.

3.2.3   Research Sample

3.2.3.1 Choice of Sector and Number of Cases

The research data is drawn from a cohort of small businesses in the North-West of England

which applied for and was successful in receiving funding to undertake an innovation

project via a B2B innovation voucher scheme called *Creative Credits*. The scheme was run

by the National Endowment for Science, Technology and the Arts (NESTA), an independent

body which funds programmes aimed at understanding and stimulating innovation in UK

businesses.   The researcher was part of the Warwick Business School team administering

and evaluating the *Creative Credits* Scheme.

The *Creative Credits* cohort comprised of 150 SMEs, typically trading within the services

and retail sectors, and suppliers from the creative industries, whom they selected to

partner them in their innovation project. NESTA's scheme set base criteria which both the

SME and their creative supplier needed to meet: They were required to be VAT registered,

their main office had to be located in the Greater Manchester area, the number of

employees could not exceed two hundred and fifty, and their turnover had to be less than

Eur46 million at the time of their application. The firms could be structured as a limited

company, a limited liability partnership, a general partnership or an industrial or provident society. The SME had free-choice in selecting their creative industry partner from an on-line gallery of creative businesses who had applied to be included. Creative businesses were also allowed to approach the SMEs direct.

NESTA's *Creative Credits* programme was devised to explore two earlier research findings. One, that supply chain relationships, in particular, may contribute to innovation through the variety of interactions that take place between buyers and sellers that support exchanges of information and the generation of new knowledge (Roy *et al*, 2004) and two, that there is evidence that firms with linkages to the creative industries had significant positive impacts on some dimensions of innovation behaviour. It seemed that firms with these stronger B2B linkages into creative services are more likely to introduce product innovations (Bakhshi *et al*., 2008).

The sample group used here provides an unusual opportunity to examine a large number of small businesses in a similar geographical location working together on an innovation project with similar time scales and with similar levels of project funding. .Small businesses are increasingly seen as an important focus of policymakers as they form a large part of any developed economic structure, most employment is concentrated in this group and they play an increasingly important role in economic growth and job creation (Hoffman *et al*., 1998).

3.2.3.2 Choice of Research Organisations and Access

The SMEs which make up this research sample where those that took part in NESTA's *Creative Credits* B2B innovation voucher scheme between 2009 and 2012. A profile of firm characteristics is found in the next chapter. The researcher, as part of the Warwick Business School/Aston Business School team helping administer and evaluate the scheme

was granted access to the data collected during the scheme for use in a PhD research project.

Predictor and outcome variables for organisational-level similarity could be constructed directly from the *Creative Credits* dataset, but, the data for individual-level similarity needed to be collected from the sample group after the official end of the scheme. For the individual-level data physical access to the businesses was not required, but cognitive and virtual access to the innovation project leader was and as the businesses were no longer part of the scheme when Part B data collection began, access became more problematic. The difficulty of obtaining access in relation to more intrusive methods such as this has been recognised many times in the literature (e.g. Buchanan *et al*., 1988; Easterby-Smith *et al*., 2008) though management and organisational research suggests that one is more likely to gain access where existing contacts are established (Buchanan *et al*., 1988; Easterby-Smith *et al*., 2008;). Moving to quasi external-researcher status meant the researcher had to call on the continued goodwill of the parties involved. The main *Creative Credits* contact in the firm was approached by email explaining the purpose of the research, the benefits that researching innovation for small business offered, and details of what would be involved. A link to the on-line survey was included in the email. The researcher was aware that there may be several concerns on the part of the target organisation about being involved in the study. First, concerns about the amount of time or resources involved in the request for access (Easterby-Smith *et al*, 2008) and confidentiality and anonymity. To compensate for their time, the firms were offered a summary of the research tailored to reflect useful findings for their firm specifically, as suggested by Johnson (1975). One dilemma arose due to lower than ideal numbers who had responded by the deadline. The dilemma was around incentivising the respondents to complete the questionnaire by way of a prize. As the use of web-based surveys as a collection mode

continues to grow rapidly the value of utilising prize draws as incentives has increased. In order to gain the right number of responses, each respondent that completed the survey in full was told they would be entered into a prize draw for an Apple ipad. But even the incentive of winning a prize of this value did not persuade a large number of those invited to participate.

The Creative Credits programme was open to SMEs and the innovation vouchers were randomly allocated to 150 of those businesses which fitted the scheme's criteria. The vast majority of those firms which applied to the scheme, however, were small or micro-businesses which were owner-managed.   The results found in this study, therefore, relate very much to that type of group, and the method devised here may produce different results, for example, in very large MNCs or high-growth high-tech SMEs.

3.3   Data Collection

3.3.1   Organisational Level Data

Over the course of 18 months, between October 2009 and May 2011, four questionnaires were administered to the 150 SMEs and forty-seven creative industry suppliers involved in the innovation voucher scheme. The questions used in the baseline survey drew strongly on those used in the UK Innovation Survey (CIS6, 2009). Completion of the surveys by the respondents was a contractual pre-requisite of acceptance on the *Creative Credits* scheme and of the firms receiving innovation funding. The self-administered questionnaires were designed and hosted on surveymonkey.com, and links were sent out to the SMEs at different points over the eighteen month duration of the programme. Guidelines for completing the questionnaires were provided as were a contact email address and telephone number to report any difficulties with completion or understanding.   A clear statement at the beginning of the questionnaires assured the respondent of the confidentiality of their responses as financial and personal data were included, and that

the aggregated nature of the results would ensure that in the final report their business would remain anonymous. When the first questionnaires were returned it became apparent that quite a few of the businesses had skipped questions and this created a large amount of work calling the firms to fill in the gaps. Questionnaire 2 was adapted so that key questions became mandatory.

Survey 1:   Administered at the beginning of the innovation voucher scheme.

                Data collected on the structure and ownership of the business, historical

                and current innovation activities, protection of innovation, business

                strategy and practice, motivations for applying to the scheme and for

                innovation funding, project planning and choice of creative partner.

Survey 2:   Administered at the completion of the innovation project.

                Data collected on experience and background of working with the creative

                business, the progress of the project, achievement of innovation

                objectives, emerging benefits as a result of the project, problems

                associated with the innovation itself or the creative partner, financial

                metrics reflecting the impact of the project and future plans for continuing

                to innovate.

Survey 3:   Administered 6 months post innovation project.

                Data collected on changes in business performance as a direct result of the

                innovation project, continuing innovation activity either in-house or with

                external partners, business benefits as a result of the innovation,

                continuing plans for innovation and cooperation with external partners.

Survey 4:   Administered 12 months post innovation project.

                Data collected on recent business performance in terms of sales change,

                continuing innovation activity and further work with the same or different

creative businesses, impact of the innovation and benefits experienced,

plans for future innovation.

Despite a contractual obligation to complete the surveys as part of the scheme, many

telephone calls were required to chase up firms who did not respond or had only partially

completed the survey. This need to chase-up responses was a very resource-intensive and

time-consuming part of the data collection but did ensure, in the end, a high response rate

of fully completed surveys. Another problem, once the data collection had closed and the

data were being organised was the large number of 'don't know' responses which made

some innovation outcome variables unusable. As a consequence, different innovation

dependent variables used in this study differ in their response levels.

3.3.2   Individual Level Data

The AVL *Study of Values* (AVL *SOV*) is an established, ipsative (forced-choice), psychometric

questionnaire which is used to measure the relative importance of six classes of personal

values. Based on Spranger's (1928) work on personality types, it is designed around six

'dominant attitudes' (he also called them 'ideal types') which Spranger believed influenced

the way that individuals view the world**.** A full description of these 'dominant attitudes' is

found in the literature review on page 80.

The *SOV* consists of forty-five items which yield 120 individual scores with a total possible

score of 240 points. Each 'attitude' dimension is tested twenty times and can attract a

score of between ten and seventy points. In the first part of the test, thirty question

couplets allow the respondent a maximum allocation of 3 points each. In the second part,

fifteen question quartets allow an overall allocation of ten points. The ipsative nature of

the instrument means that the user is forced to allocate points between attitude

alternatives which are relatively more acceptable to them. Examples of questions from

each of the two parts of the survey is provided on page 54 of the literature review chapter and the full item bank of questions can be found in appendix 1**.**

3.4   Profiling the Sample Group

This research is aimed at understanding how similarity and difference between two parties involved in an innovation project may impact performance. In order to create a good foundation for interpreting the results of the statistical analysis, a profiling exercise took place, comparing and contrasting the characteristics of the SMEs cohort with the creative businesses. The results of the profiling and a discussion of the results in found in the Data Analysis Part A. Data is explored using a variety of techniques including frequency data, histograms, scatter plots and pie-charts. This profiling helps to establish the context and environment in which these innovation partnerships exist and should also help to better understand and interpret any findings from the research.

Descriptive data explores the characteristics of the SMEs and creative firms on each of the organisational level measures and then expands the descriptive insights further by exploring:

- **Socio-economic Data**

- **Sector data**

- **Prior Innovation Activity**

- **Innovation Project Types**

- **Selection of an Innovation Partner**

3.5   Data Reduction

Data reduction refers to the process of reducing the dataset to the content of the final

report. Data reduction is a form of analysis that sorts, focuses, discards and organises data

in such a way that the final conclusions can be drawn and justified. Data reduction largely

occurs in quantitative research after the data has been generated and recorded. But to

some degree data reduction also takes place before data collection begins in deciding the

research questions, epistemological position, conceptual framework and data collection

approaches. Once data collection has been finalised the next stage of the data reduction

involves the further distillation of data through, amongst other things, grouping, summing

and clustering to find themes.

For this research the first analytical decision was made when focusing on measuring

innovation using numbers and values. The second analytical choice was made by choosing

to gather the data by questionnaire and following a positivist approach to look at high-

ranking relationships rather than looking for the deeper interpretive meanings underlying

the results. Further data reduction occurred when devising the measures used to assign

similarity to create new variables.

3.6   Data Display

Data display can be defined as an organised, compressed assembly of information that

permits conclusion drawing (Miles and Huberman, 1994). Data display forms part of the

data analysis process as decisions need to be made about what data to present and that, in

turn, has implications for data reduction. The most frequent form for the presentation of

quantitative data is through charts, graphs and statistics. Data displays were used

extensively throughout this research to present large amounts of information in a more

straightforward format. Formats ranged from spreadsheets into which data was imported

from two web-based survey tools to tables, scatterplots, histograms and line graphs to

display descriptive statistics. The aim was to gain a good understanding of the data distribution and patterns before deciding on whether to use parametric or non-parametric statistical tests and in how to interpret the findings. In designing the analytical framework, hand-drawn figures and models were produced to help visualise how the various concepts used in the research interacted. Key information in the compacted form is used in the various chapters as figures and tables.

3.7   Response Rate

The study here gathered data at two levels. At the organisational level for comparisons of strategic, search and knowledge application similarity, and at the individual level for comparisons of six different dimensions of personal values. Each of these datasets was created from data collected through questionnaires. At the organisational level, the questionnaires were administered via a formal randomised controlled industrial experiment called *Creative Credits* which required the questionnaire to be completed as part of the terms and conditions of the programme. As a consequence, the response rate was very high, though only after a certain amount of chasing by email and telephone. As a consequence the total number of questionnaires completed was 100 percent for survey one and 91% for survey 2 which are the two surveys which provide data for this study. This meant, when combined with the creative servicer's questionnaires, it was possible to create 121 pairs at the organisational level.

The sample size at the individual data collection level had more constraints leading to a reduction in the number of surveys returned. The key constraint was that the response at this level became voluntary. Based upon papers by Baruch and Holtom, (2008), the typical response rate for studies that utilise data collected from individuals is expected to be around 53%, which would have provided a sample response-rate of 80 questionnaires from the SMEs and 42 questionnaires from the creative servicers. As it was, the response rate

for the SMEs at the individual level was a little higher than anticipated at 55% (providing 82

fully completed questionnaires), but only 29% from the creative servicers (providing 23

fully completed questionnaires). Due to the research methodology with its requirement to

match the SME with its creative industry partner, it meant that only 39 dyads could be

created on which to base the individual-level analysis (the 39 dyads differs from the 23

creative questionnaires returned because some of the creative suppliers were serving

more than one SME, as mentioned earlier in this section). It is difficult to assess how

typical this kind of sample size might be for this kind of study, as it is a the first time this

methodological approach to measuring similarity between individuals has been

attempted. Whilst we should not expect full response in studies where responding is

voluntary (Demaio, 1980), the aim for any scholar is to try and gain as high as possible a

response-rate as higher response rates tend towards findings that have greater credibility

among key stakeholders (Rogelberg & Stanton, 2007).   The author of this study has made

reasonable efforts to increase return rates of the individual-level voluntary questionnaires,

by sending polite reminders by email and by contacting recipients by telephone if they did

not respond. However, there is a threshold beyond which chasing becomes a nuisance

and a line has to be drawn based on restrictions of time, costs and consideration for

individuals who are trying to run their businesses. Some issues were raised in

Organizational Research Methods (2007, volume 10, number 2) which addressed the topic

of survey non-response. One of the main factors is over-surveying in a growing number of

areas which means that business owners (and employees) are flooded with questionnaires

(Weiner & Dalessio, 2006). The result is a large number of target individuals or firms who

are fatigued and therefore refuse to respond to non-essential questionnaires.   In

particular, there is a general decline in the response-rates among voluntary surveys

targeted at executives (Cycyota and Harrison, 2006), such as those in this sample.

The relatively small sample sizes for this study are recognised and in both cases the ability to generalise from any results found here is limited. The study, therefore, offers itself as a starting point, providing some results within a certain industrial context and for a certain sample group, but does not attempt to establish itself as an authority within the empirical domain of similarity, cognitive-distance and innovation performance.

To check for any response bias between those 121 organisations paired for this study and those 29 which were not, the basic characteristics and innovative behaviours of the two groups were checked and found not to be systematically different. The results of the non-response testing can be found on page 112 in the Data Analysis Part A (organisational level) chapter.

For the individual level data a non-response bias exercise could not take place, as there is no data to compare attitude profiles of those individuals that did complete the Study of Values psychometric questionnaire, and those individuals that did not.

3.8 Similarity Measures

The aim of creating a quantitative measure of similarity is to provide a proxy of an underlying construct which cannot be directly observed and which will allow computational accessibility and wide usage. By assessing the relationships between measures, we infer, indirectly, the relationships between the constructs (DeVellis, 2003).

For both organisational and individual level similarity there appears to be no prior similarity measurement construct that can be validly applied here, given the type and nature of the data this study has available for predictor and outcome variables. This research, therefore, creates unique measures of similarity both at the organisational and individual level. Descriptive statistics for the similarity measures can be found in the organisational and individual level results chapters on pages 107 & 135.

3.8.1   Organisational Level Similarity Measures

With no standard definitions or measures of organisational level similarity identified by the literature review, new concepts and measures of similarity are created here. This lack of formal constructs applied to the study of similarity allows for the exploration of new methods and approaches. Typically predictor variables are given weights in such a way that the resulting linear composite predicts some criterion of interest. Improper linear models are those in which the weights of the predictor variables are obtained by some non-optimal method; for example, they may be obtained on the basis of intuition, derived from an expert's predictions, or set to equal (Dawes, 1979). There is evidence to suggest that such improper linear models are superior to other models at predicting a numerical criterion from numerical predictors (Dawes, 1979). In social science, where the subject matter cannot easily be controlled and as measurement becomes poorer, less precise models become more desirable for making inference about a population of interest from a sample of data (Dawes, 1979). Equal weighting models (also known as 'shrinkage' or 'regularised' regression models) are quintessentially imprecise yet they often cross – validate better than 'proper' regression models for social science data (Dawes, 1979). These models bias predictions conservatively in light of ill-posed prediction problems. Hence they have the Bayesian motivation of beginning with a prior that predictive power is poor, rather than beginning with diffuse priors about the values of coefficients for various cues. By applying this conservative bias, shrinkage, including improper linear models, avoid the serious errors that regression makes and on average lead to better out-of-sample predictions (Dawes, 1979). Because data in social science domains are unreliable, the less precise improper models are the proper models for attaining maximally efficient predictions. These models have been used successfully in a variety of contexts such as predicting ratings of graduate students by faculty staff (Dawes, 1971) where the improper

linear model resulted in a correlation of .48 which was significantly higher than the corresponding 'expert' judgement of faculty staff of .19. It has been used in studying marital relationships and happiness (Alexander, 1971) producing a correlation of .40 ($p <$ .05). The studies presented the conclusion that a simple weighted sum of the cues will typically predict better than a human judge and as well as cross-validated regression regardless of how the weights are chosen (Dawes, 1979; Dawes & Corrigan, 1974). Several empirical investigations using improper models identify single variables outperforming regression and other models in picking one of multiple alternatives that has the largest value on a criterion (Gigerenzer & Goldstein, 1996; Gigerenzer & Todd, 1999; Hogarth and Karelai, 2005). Proper linear models are good at integration of information where the predictions have a conditionally monotone relationship to the criterion and where sample sizes and observations are adequate, but they are less powerful in situations where a concept has no good, precise definition as yet.

Organisational level similarity here investigates exactly those sort of as yet fully undefined concepts in the shape of strategic, search and knowledge application similarity. This research explores the predictive power of a non-optimal weighting scheme, in this case, a model that uses fixed binary equal-weights for predictor variables (Dawes, 1979; Dawes & Corrigan, 1974; Einhorn & Hogarth, 1975; Schimidt, 1971; Wainer, 1976).

Organisational level similarity measures are count variables constructed using data extracted from the four *Creative Credits* surveys. Each of the individual items making up the four predictor variables is allocated an equal weighting. Similarity between the firms in the dyads is allocated a value of 0; difference between the dyads is allocated a value of 1.

1. *Strategic Similarity*

This construct works on the proposition that similarity in the structural aspects of a business will reduce co-ordination costs and aid the transfer of knowledge across organisational boundaries. Structural similarity has been positively correlated with knowledge transfer and building positive inter-organisational relationships in other studies (e.g. Simonin, 1999; Darr and Kurtzberg, 2000; Homberg *et al*., 2002).

Score range = 0 – 4.

Variables combined to form strategic similarity:

1. Number of employees
2. Current financial turnover
3. Legal status of the business
4. Age of the business

2. *Search Similarity*

This construct tests the proposition that firms which are similar in their activities and approaches to developing, sourcing and exploiting new information and knowledge will have similar capacities for problem solving and new knowledge absorption. Similarity in the way firms engage and interact with new sources of information and knowledge has been positively correlated with innovation capacity (e.g. Cohen and Levinthal, 1990; Lane *et al*., 2006; Garud & Nayyam, 1994; Szulanki, 1996).

Score range = 0 – 5.

Variables combined to form search similarity:

1. Internal R&D activities in last 3 years

2. Acquisition of external R&D

3. Acquisition of external knowledge in the form of patents, know-how etc.

4. Training for innovation activities

5. Innovation cooperation with external partner such as suppliers, customers, universities

3.   *Knowledge Application Similarity*

This construct builds on the notion that in business, knowledge is an esoteric state which has no value until it is transformed into something tangible and applied to create some economic value or return. Innovation performance is defined as the aspiration levels for introducing new products or services over time and the sum of the individual innovations successes (Salomo *et al.*, 2007).

Score range = 0 – 4.

Variables combined to form knowledge application similarity:

1. Innovation of new goods or services in the last 3 years

2. Innovations new to market

3. Innovations new to business

4. Acquisition of machinery, equipment, software for innovation

3.8.1.1 Predicted Signs of Estimated Coefficients for Organisational Level Data

Explanatory variables		Predicted sign of the coefficients of the explanatory variables	
Variable			
	Operationalization	**Predicted effect**	**Rationale**
Predictor variables			
Cognitive Distance - STRATEGIC **Cognitive Distance²** (squared term of CD variable)	An indicator variable for the cognitive distance that characterises the differences between the organisational scale of the innovation partners. It is constructed by comparing the differences in the number of employees, the revenues, the number of years since the business was founded and its legal status. Increasing values stand for increasing difference between the focal firm and its innovation partner.	+ −	Similarity in scale between businesses working in partnership has been shown to reduce co-ordination costs, aid the transfer of knowledge across organisational boundaries and help build positive inter-organisational relationships. Effect if firm size on innovation direction in prior literature has shown positive, negative and non-significant results.
Cognitive Distance - SEARCH **Cognitive Distance²** (squared term of CD variable)	An indicator variable for the cognitive distance that characterises the difference between the strategies that organisations use to develop, source and exploit new information and knowledge. It is constucted by comparing whether the firms have undertaken internal R&D activities, acquired external R&D, acquired external knowledge in the form of patents etc., undertaken training for innovation or have cooperated with external partners for innovation in the previous three year period. Increasing values stand for increasing difference between the focal firm and its innovation partner.	+ −	Firms which are similar in approaches to developing, sourcing and exploiting new information and knowledge will have similar capacities for problem solving and new knowledge absorption. Similarity in the way firms engage and interact with new sources of information and knowledge has been positively correlated with innovative capacity.
Cognitive Distance - KNOWLEDGE APPLICATION **Cognitive Distance²** (squared term of CD variable)	An indicator variable for the cognitive distance that characterises the difference between the results of applying new knowledge into the business. It is constructed by comparing the organisations track record over the previous three years of producing new goods or services, goods or services new to the market or new to the business and the acquisition of machinery, equipment or software for innovation. Increasing values stand for increasing difference between the focal firm and its innovation partner.	+ −	In business knowledge is an esoteric state which has no value until it is transformed to create some tangible economic value or good. Innovation performance is defined as the aspiration levels for introducing new products or services over time and the sum of the firms innovation success.
Dependent variables			
ACHIEVE INNOVATION OBJECTIVES	A binary variable indicating whether or not the innovation project met all or just some of its innovation objectives.		A firms perception that the innovation project was successful.
PROJECT COMPLETED ON TIME	A binary variable indicating whether or not the innovation project finished within its original planned timescale.		A measure of whether the innovation project completed in the planned timescale.
INCREASED SALES TO EXISTING CLIENTS	A binary variable indicating whether as a consequence of the innovation project, sales to existing clients increased.		A measure of the effects of the innovation project on the firms current customer base.
SALES TO NEW CLIENTS IN EXISTING MARKETS	A binary variable indicating whether as a consequence of the innovation project, sales to new clients in existing markets were made.		A measure of the effects of the innovation project on attracting new customers within its current market sectors.
SALES TO NEW CLIENTS IN NEW MARKETS	A binary variable indicating whether as a consequence of the innovation project, sales to new clients in new markets were made.		A measure of the effects of the innovation project on attracting new customers in unpenetrated market sectors.
INCREASED PROFITABILITY	A binary variable indicating whether as a consequence of the innovation project the firm experienced increased profitability.		A measure of the effects of the innovation project on bottom-line financial success.
Control variables			
FORMAL BUSINESS PLAN	A binary variable indicating whether the firm had a formal written business plan.	no expectations regarding directional effect	Controls for the effects of having developed a formal business plan for the firm.
NUMBER OF COMPETITORS	A categorical variable indicating how many competitors the firm perceives it has.		Controls for the intensity of competition in the firms market sector or industry.
PER CENT OF EMPLOYEES WITH DEGREE	A categorical variable indicating what proportion of employees have studied to higher education level.		Controls for the number of employees with higher education in the business.

Table 3.1: Predicted signs of estimated coefficients for organisational level data

3.8.2   Individual Level Similarity Measures

Constructing individual similarity measures

Individual level similarity measures are constructed using data collected using the Allport-

Vernon-Lindzey *Study of Values* (AVL *SOV*) 4th edition (2003)*.*

The AVL SOV has the following attributes:

1. The *SOV* is a psychometric test which has an ipsative (forced-choice design)

2. It places respondents in realistic behavioural-choice situations, situations in which the choice is clearly value-driven

3. It collects data on six classes of personal values which are theoretically grounded in Spranger's (1928) work on personal values which drive dominant attitudes.

    a. Theoretical attitude: driven by intellectualising and analysing

    b. Economic attitude: driven by the need to satisfy one's needs and to render one's life as pleasant as possible

    c. Aesthetic attitude: guided by an inner urge for self-development and has the power of self-expression, imagination and creativity

    d. Social attitude: driven by the value-affirming interest in others and a feeling of community

    e. Political attitude: the capacity and (usually) the will to posit one's own personal value direction in another. Sees power as a total affirmation of one's being

    f. Religious attitude: driven by the search for experiences which have significance for the total meaning of one's life and the value of individual existence.

A full description of Spranger 'dominant attitude types' can be found on page 56 in the

Literature and Theory chapter.

Structure of the questionnaire:

- The *SOV* is organised into two sections, part A has thirty question cuplets allowing the respondent a maximum allocation of three points each; and part B, which has fifteen question quartets allowing an overall allocation of ten points

- The questionnaire consists of forty-five items yielding 120 individual scores with a total possible score of 240 points

- Each individual SOV attribute is measured twenty times and can attract a score of between ten and seventy points

- The total score is reached by summing all the values for each individual attitude

- Similarity between the dyads is calculated by subtracting the SME score from the creative supplier score in a given attitude which provides a figure for the range of difference between the two parties

- Where dyads are the same on a dimension the similarity value for an attitude would be zero

- As similarity between the dyads decreases, the value moves increasingly away from zero

Table 3.2 gives an example calculation of the similarity scores for a creative supplier and its two separate SME partners.   Figure 3.2 provides similar information but in the form of a line graph and shows the relative differences between one creative firm and its three different SME partners.

	Theoretical	Economic	Aesthetic		Political	Religious
Creative 11	40	58	31	40	42	29
SME 9277	53	58	29	32	49	19
SME 9034	48	48	31	43	32	38
SME 9277 total difference	13	**0**	2	8	7	10
SME 9034 total difference	8	10	**0**	3	10	9

Table 3.2: Example calculation of similarity scores for individual level data
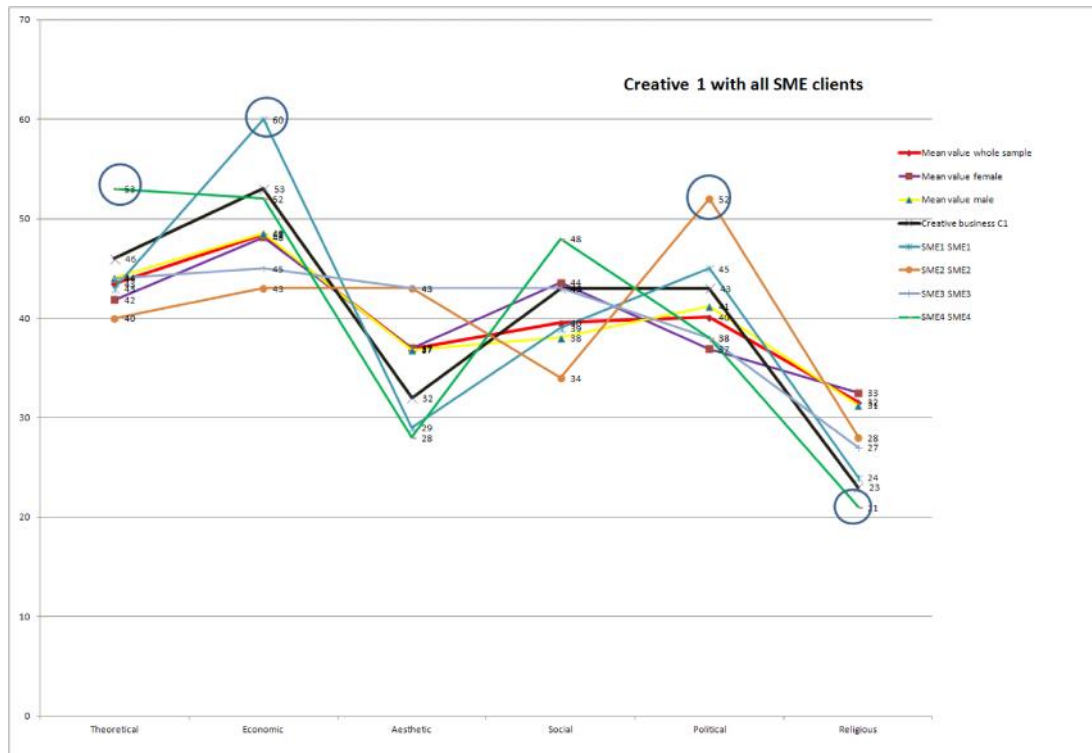
Figure 3.2: comparing a creative supplier to its SME clients on each attitude dimension

3.8.2.1 Predicted Signs of Estimated Coefficients for Individual Level Data

To assess for the effects of cognitive-distance at the individual level, the data is split into three sections – low levels of similarity, medium levels of similarity and high levels of similarity. In comparing the low level similarity with the medium levels of similarity. Nooteboom's hypothesis of cognitive-distance would predict a positive sign on the coefficient for better innovation performance (as similarity begins to move away from very low levels to medium levels, more innovation performance indicators are expected to move from 'no' to 'yes'). In comparing the medium levels of similarity to the high levels of similarity Nooteboom's hypothesis would predict the reverse, producing a negative sign on the coefficient for better innovation performance (as similarity begins to move away from medium levels of similarity to very high levels of similarity, more innovation performance indicators are expected to move from 'yes' to 'no').

We would therefore expect to see the following results:

Predicted Signs of Coefficients for Cognitive-distance at Individual-Level		
	Similarity measure, i.e. Theoretical	
Innovation measure	Low/Med	Med/High
1. Achieve innovation objective	+	−
2. Completed on time	+	−
3. Increased sales to existing clients	+	−
4. Sales to new clients in existing markets	+	−
5. Sales to new clients in new markets	+	−
6. Increased profitability	+	−

Table 3.3: predicted signs of the coefficients for cognitive-distance at individual level

3.9   Innovation Performance Measures

Previous studies using measures of cognitive-distance or similarity as their independent

variable don't provide measures for potential dependent variables which are relevant

enough to use in the study here, which is concerned with small and micro-firms mostly

operating within the services and retail industries. Table 3.4 shows the dependent

variables used in some of those previous studies.

Organisational level – cognitive distance	Dependent variable	Study
	Number of patents	Nooteboom *et al.*, (2006)
	Likelihood of technological innovation Likelihood of alliance formation	Wuyts *et al.*, (2005)
Organisational level - similarity		
	Number of patents or patent citations	Lou and Deng (2009); Gomes-Casseres *et al.*, 2006)
	Increased production	Darr and Kurtzberg (2000)
	Probability of firm undertaking innovation Percentage of sales derived from innovative products	Roper and Love (2010)
Individual level – partner selection	Critical success factors around learning outcomes, enhanced relationships, reduced risk	Cummings and Holmberg (2012)

Table 3.4: Dependent variables used in previous similarity studies

Innovation performance measurement itself is not without its complexities having

measures on two sides of the innovation coin. Firstly around measuring the innovation

behaviour of firms, such as the kind of measures which form the bi-annual European

Community Innovation Survey (CIS), which informed some of the *Creative Credit*s

questionnaire and from which, in turn, the similarity measures for this study are

constructed.

But there are also innovation measures around the impacts and additionality that the firm

experiences in terms of the practical success of the innovation project and the difference

the innovation makes to a firm's bottom-line. These latter measures are more relevant to

the type of sample group available for this research for a number of different reasons.

Firstly, they are the SMEs own assessment of the impact of the project; secondly the

measures relate to the impact of the outcomes during the course of the Creative Credit

projects and so could be argued to be particularly valid of a study which is assessing the

dynamics of the partnerships on innovation performance; and finally, they reflect the

additionality of the project in dimensions which may be very relevant for small and very

small businesses who may be experiencing and assessing their first 'formal' innovation

partnership.

Dependent variables		
ACHIEVE INNOVATION OBJECTIVES	A binary variable indicating whether or not the innovation project met all or just some of its innovation objectives.	A firms perception that the innovation project was successful.
PROJECT COMPLETED ON TIME	A binary variable indicating whether or not the innovation project finished within its original planned timescale.	A measure of whether the innovation project completed in the planned timescale.
INCREASED SALES TO EXISTING CLIENTS	A binary variable indicating whether as a consequence of the innovation project, sales to existing clients increased.	A measure of the effects of the innovation project on the firms current customer base.
SALES TO NEW CLIENTS IN EXISTING MARKETS	A binary variable indicating whether as a consequence of the innovation project, sales to new clients in existing markets were made.	A measure of the effects of the innovation project on attracting new customers within its current market sectors.
SALES TO NEW CLIENTS IN NEW MARKETS	A binary variable indicating whether as a consequence of the innovation project, sales to new clients in new markets were made.	A measure of the effects of the innovation project on attracting new customers in unpenetrated market sectors.
INCREASED PROFITABILITY	A binary variable indicating whether as a consequence of the innovation project the firm experienced increased profitability.	A measure of the effects of the innovation project on bottom-line financial success.

Table 3.5: Dependent variables

These dependent variables are used at both the organisational and individual level analysis

to ensure some consistency around the approach and to provide a link between the two

sets of empirical results. This may help understand if, or how, the organisational and

individual levels of cognitive distance are related.

There are some acknowledged weaknesses to these innovation performance measures, as there are to any others. The first is that the questions responses are dichotomous and so lead to a very direct and simplistic response variable with no room for nuance. Secondly, it is likely, despite the simplicity of the questions, that there may be high levels of subjectivity and interpretive flexibility. And finally, it is important to establish that the information collected from SMEs was at, or around, the end of the *Creative Credits* project and therefore reflects the immediate impacts of the project. They are focused, therefore, more on the short-term organisational impacts and additionality.

3.10   Data Distribution

Many statistical procedures rely on data being normally distributed (Field, 2009). The assumptions of parametric statistical tests are that there is normally distributed data, there is homogeneity of variance, that data should be measured at least at the interval level and that the data is independent.   Normality can be tested in a number of ways: visually, by looking at values that quantify aspects of a distribution (i.e. skew and kurtosis) and by comparing the distribution we have in a research sample to a normal distribution to see if it is different.

Checking normality visually can be done by compiling a frequency distribution, or histogram, where, if the data were normal it would be distributed symmetrically around the centre of all scores and characterised by the familiar bell-shaped curve. It can also be checked visually by looking at charts of the variable values for kurtosis and skewness where the values for a normal distribution are zero.   Another way of looking at the data distribution is to see whether the distribution as a whole deviates from a comparable normal distribution. This can be done by running the Kolomogorov-Smirnov (K-S) test and

the Shapiro-Wilk test. These tests compare the scores in the sample to a normally

distributed set of scores with the same mean and standard deviation. If the test is non-

significant (p>.05) it tells us that the distribution of the sample is not significantly different

from a normal distribution (i.e. it is probably normal). If, however the test is significant (*p*

<.05) then the distribution is significantly different from a normal distribution (i.e. it is non-

normal). Both these tests have limitations, though, with large sample sizes it is very easy

to get significant results from small deviations from normality, and so a significance test,

on its own, doesn't indicate whether the deviation from normality is enough to bias any

statistical procedures that are applied to the data (Field, 2009). The assumption of

homogeneity of variance is also made for parametric tests. This assumption means that as

you go through levels of one variable, the variance of the other should not change. One

way to check this is with Levene's test. Levene's test tests the null hypothesis that the

variances in different groups are equal (i.e. the differences between the variances is zero).

If Levene's test is significant at p < .05 then we can conclude that the null hypothesis is

incorrect and the variances are significantly different. As with the K-S test (and other tests

of normality) where the sample size is large, small differences in group variances can

produce a Levene's test that is significant because the power of the test is improved.   A

general rule is to plot the data, run the normality tests and to make an informed decision

about the extent of non-normality (Field, 2009). The results of the normality tests on the

data set, are found in the analysis section on page 111.

3.11   Empirical Tests and Explanatory Variables

The organisational level measurement provides a wider interpretation of cognitive-

distance by grouping several variables related to the specific similarity dimension.

Given the binary nature of the dependent variables and the relatively large number of observations for the organisational level sample group (*n* = 121), this work estimated a logit[1] model for the organisational level data. A logit analysis is a specialised regression model used to analyse binomial response variable such as the dependent variables here.

As independent variables we include strategic similarity, search similarity and knowledge application similarity with their quadratic term which is intended to pick up the non-linear element of cognitive-distance. Additionally, three control variables: business plan; number of competitors and proportion of employees with a degree level education are included to control for other business characteristics. Model 1 is the bench-mark, it includes only control variables that are unrelated to cognitive-distance between the firms. In Model II a linear relationship between cognitive-distance and the output variables is explored. In Model III the test is run on the same variables but with a quadratic specification included.

Selecting a statistic test for the individual-similarity dataset was less straight-forward. With only 39 observations a logit estimation was not suitable and so a more pragmatic method was required to explore whether the inverted U-shaped relationship between cognitive-distance and innovation performance still remained valid.

By dividing the individual-level dataset into three approximately equal parts, the similarity values could be grouped into three levels of similarity between the individuals in the pairings – low levels of similarity , medium levels of similarity and high levels of dissimilarity. This way an in-dependent *t*-test[2] could be used to assess whether there were

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[1] The underlying assumption of a logit cumulative distribution function does not affect the results; very similar results were found using a probit specification**.**

[2] The researcher highlights here the non-normal distribution of the individual-level dataset and the use of the independent *t*-test as a statistical approach which is normally associated with tests on a 'normal' distribution of data. Many studies show that parametric statistics are robust with respect to violations of the assumption of normality. Norman (2010)

differences between the three groupings. This made it possible to compare the results of

the low-similarity group with the medium-level similarity group and the medium-level

similarity group with the high-level similarity group to see if the resultant signs on the

coefficients were consistent with those one might expect to see if Nooteboom's

hypothesised inverted U-shaped relationship is found. The aim with the individual level

sample group, given the rather small number of observations, is to look for *indicative*

results which might provide the foundation for further work on cognitive-distance at the

individual level.

3.12 Summary and Reflections on the Process

The methodology of any research project establishes its credentials and the terms and

manner in which the results can be reported and generalised.

At the organisational level of analysis, the approach here follows from, and develops, the

previous work on cognitive-distance reported in the literature (Wuyts *et al*, 2005;

Nooteboom *et al*. 2006) by applying it to very small businesses in innovation partnerships

which are largely focused on exploiting their current value offering, rather than the

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presents a critique of some typical criticisms of statistical methods employed by peer reviewers. Norman suggests the criticisms fail to account for the robustness of parametric tests and ignore a substantial literature that parametric tests on data that do not meet distributional assumptions are perfectly appropriate. He proposes that a more pertinent question is how much using a parametric test on non-normally distributed data increases the chance of an erroneous conclusion, or what statisticians call 'robustness'. That is - to what extent will the test give the right answer even when assumptions are violated. One critique is that *t*-tests can't be used because the data are not normally distributed. Norman (2010) points out that for the standard *t*-tests it is the assumption of normality *of the distribution of the means,* not of the data. The Central Limit Theorem shows that, for sample sizes greater than 5 or 10 per group, the means are approximately normally distributed, regardless of the original distribution. Theory and simulations have concluded that parametric methods examining differences between means, for samples sizes greater than 5, do not require the assumption of normality, and will yield nearly correct answers even for manifestly non-normal and asymmetric distributions.

exploration of new ones. Creating similarity measures has been relatively straight-forward, and output variables of innovation performance are relatively standardised.

At the individual level analysis, the approach has had to be more pragmatic, given the relatively small sample size (n = 39) and so the method devised here is seen only as a first attempt at an approximation of the existence of an inverted U-shaped relationship between the individual level independent and dependent variables.

Collecting data has been a time-consuming exercise, particularly at the individual level which took place outside of the formal innovation programme within which these small businesses were situated and even though eighty-two surveys were completed and returned from individuals out of a possible 198, only 39 pairings could be made between the SMEs and their creative partners. It might be that the design of the *AVL* Survey of Values, used to collect the individual level data could somehow be adapted to provide greater face-validity, or that the accompanying introduction email could better explain how the questionnaire subject related to innovation and partnership performance.

Overall, though, the methodology has been designed to provide an easy-to-follow framework for further work and to provide results which can be easily compared with past, and future, studies.

4. **DATA ANALYSIS PART A – ORGANISATIONAL LEVEL SIMILARITY**

4.1 **Introduction**

This section of the thesis reports the findings from the organisational-level analysis beginning with a comparison of the SMEs and their creative suppliers and a comment about the data distribution, and then organises and reports the results of the estimation exercise and its corresponding curve plots.

The analysis addresses research questions 1 and 3:

RQ1. How does the relationship between similarity and difference impact innovation performance of small business innovation partnerships using measurement constructs at the *organisational* level?

RQ3. Does the relationship between similarity and innovation performance follow the model of an inverted U-shaped curve proposed by cognitive-distance?

4.2   Descriptive Statistics of the Dataset

Overall, the SMEs and their creative counterparts have many organisational characteristics in common. The structure and scale of their businesses are similar and their track record in innovation appears to be similar also. But search strategies are less similar, with the SME businesses appearing to be less 'open' than the creative servicers in their search for new knowledge via routes such as internal or external R&D, innovation cooperation with external partners or training for innovation. When looking at the sample groups overall to get a sense of the degree of total similarity, a fifth of the SME/ creative dyads had very similar characteristics responding the same for ten out of twelve individual similarity items. Half of the firms were neither overly similar nor dissimilar with a typical overlap for the bulk of the dyads on six, seven or eight of twelve similarity points.

4.2.1   Total Similarity

Total Similarity is defined as the sum of similarity scores across all three dimensions of strategic, search and knowledge application, and has a total possible score of twelve points. The largest group of firm dyads are more similar than less similar with one fifth of the sample similar on ten out of twelve similarity items.
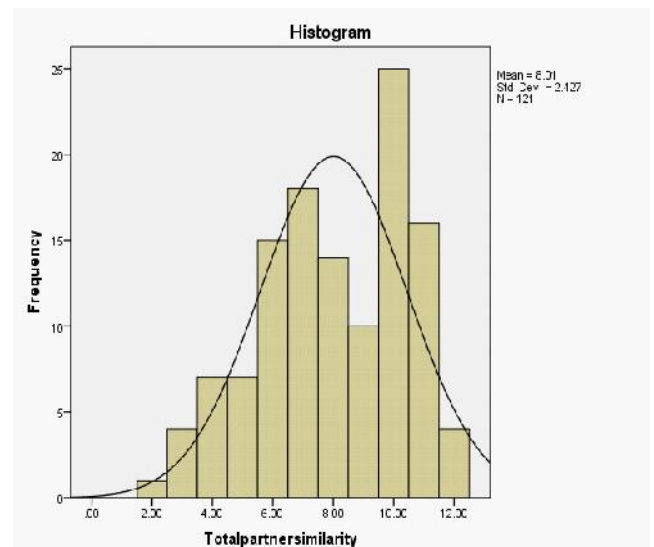
Figure 4.1: Similarity scores for Total Similarity

4.2.2   Strategic Similarity

Strategic similarity is defined here as a combination of structural aspects of the firm which

reflect the managerial propensity for risk and growth. It is a measure produced from

summing values of similarity in four areas of the firm:

1. Number of employees: owners only; 9 employees or fewer; 10 – 24 employees; 25 – 49

employees; 50 – 100 employees; >100 employees.

2. Sales turnover: <£100k; £100k-£249k; £250k - £950k; £1m - £4.9m; £5m - £25m; >£25m.

3. Legal status: independent single site; industrial/provincial society; subsidiary or

associated company; HQ of multi-site

organisation.

4. Age of company: <3 years; 3 – 8 years; 9

– 12 years; 13 – 20 years; > 20 years.

In terms of strategic similarity firm in the

dyads are quite alike with most firms

having three or four similarity measures in

common.
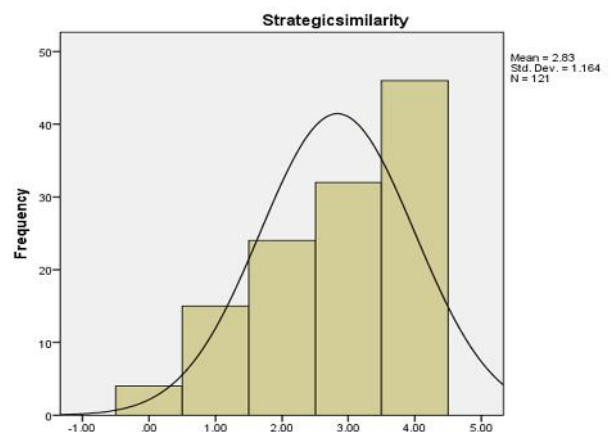
**Figure 4.2: Similarity measures
for Strategic Similarity**

4.2.3   Search Similarity

Search similarity is defined here as the firms drive to produce or discover new knowledge

through their engagement in innovation-related activities. It is a measure produced from

summing values of similarity in five areas of the firm:

1. Internal R&D activities defined as creative work undertaken within the business that

increases knowledge for developing new and improved goods or services and processes.

2. Acquisition of external R&D which is similar to point 1 but performed by other

companies, including other businesses within the group or by public or private research

organisations and which is purchased

by the firm.

3. Acquisition of external knowledge

through the purchase or licensing of

patents and know-how and other

types of knowledge from other

businesses or organisations.

4. Personnel training for innovation

activities through internal or external

training providers and specifically for

Figure 4.3: Similarity measures for search similarity

the development and/or production of innovations.

5. Innovation cooperation or collaboration on innovation projects involving external

partners such as other businesses within the enterprise group, suppliers, clients or

customers, consultants, universities or HEI.

In terms of search similarity dyads within the sample group are neither very similar nor

very different. The largest group of firms are similar typically on three out of a five

similarity points.

4.2.4   Knowledge Application Similarity

Knowledge application similarity is defined here as a similar motivation for applying and

operationalising new knowledge as

outputs or added value. The measure

is produced from summing values of

similarity in four areas of the firm:

1. Acquisition of machinery,

equipment or software for innovation.

2. The significant improvement or

development of new goods or services

in the last three years.
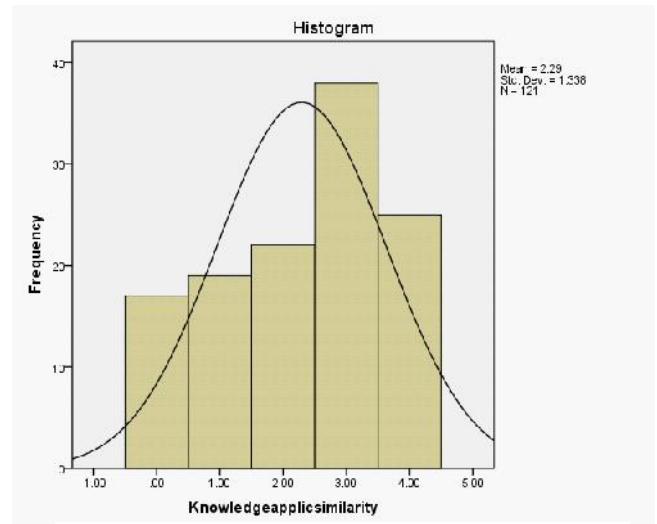
Figure 4.4: Similarity measures for Knowledge-application similarity

3. Innovations new to the business in the last three years.

4. Innovations new to the market in the last three years.

Firms in this measure are more likely to be similar, with half of the dyads having three out

of four similarity aspects in common. But almost 30% are not similar at all, or have very

little similarity on this measure.

Table 4.2 summarises the main descriptive values for the dataset, followed by Table 4.3

which presents the results of an analysis between the groups of businesses reporting

successful or unsuccessful innovation performance for each of the similarity measures.

The results suggest that, particularly for search similarity, the degree of similarity between

the organisations has a significant effect on their innovation performance.

Descriptive statistics

Variable	N	Min	Max	Mean	Std. Dev.
Strategic Similarity	121	0	4	2.8347	1.1644
Strategic Similarity²	121	0	16	9.3802	5.8598
Search Similarity	121	0	5	2.8760	1.2555
Search Similarity²	121	0	25	9.8349	6.8256
Knowledge Applic similarity	121	0	4	2.2893	1.3382
Knowledge Applic similarity²	121	0	16	7.0165	5.6950
		No	Yes		
Busn plan	101	41	78		
		Mean	Median	Mode	
Number of competitors	101	6.4	3	10	
		Mean	Median	Mode	
% with degree	101	26%	28%	<15%	

Achieve innov obj	Freq	Percent
Some	37	30.3
All	64	52.5
Total	101	82.8
Completed on time		
No	46	37.7
Yes	63	51.6
Total	109	89.3
Increased sales to existing clients		
No	55	45.1
Yes	22	18.0
Total	77	63.1
Sales to new clients in existing markets		
No	41	33.6
Yes	38	31.1
Total	79	64.7
Sales to new clients in new markets		
No	50	41.0
Yes	30	24.6
Total	80	65.6
Increased profitability		
No	50	41.0
Yes	26	21.3
Total	76	62.3

Table 4.2: Descriptive statistics for the organisational level data

Performance measure		STRATEGIC		SEARCH		KNOWLEDGE APPLIC	
		χ^2	df	χ^2	df	χ^2	df
Achieve innov obj	All/Some	9.284 **	4	10.783**	5	1.592	4
Completed on time	Yes/No	1.184	4	11.447**	5	1.405	4
Increased sales to existing clients	Yes/No	1.723	4	7.786	5	1.207	4
Sales to new clients existing mkts	Yes/No	6.085	4	15.06**	5	5.066	4
Sales new clients in new mkts	Yes/No	1.563	4	7.236	5	4.159	4
Increased profitabilty	Yes/No	3.079	4	12.792**	5	5.969	4

p <.05*, p <.01**, p <.001***

Table 4.3: Differences between successful and unsuccessful groups for each innovation performance measure

4.3   Data Distribution

The type of statistical test one chooses to explore a data sample is normally determined by the type of distribution that the data reflects, for example parametric tests assume certain assumptions based on a normal distribution of data points. It is important, then, to understand which assumptions a dataset meet and which it does not meet. An added complexity for quantitative studies is that the notion of normally distributed data is often misunderstood because it means different things in different contexts, in some cases it is the sampling distribution, in others the errors in the model. The central limit theorem tells us that if the sample data are approximately normal then the sampling distribution will be also. As the sample gets bigger i.e. a sample of 30 or more, we can be more confident that the sampling distribution is normally distributed.   In quantitative studies it is useful to test for normality in a number of different ways ahead of applying statistical tests: visually through the use of histograms and P-P and Q-Q plots and then by quantifying normality with numbers. Incorporating data normality testing into the analysis process ensures that statistical tests are undertaken with an understanding of the assumptions being made which leads to a greater confidence in the interpretation and significance of the results.

Here we use the Kolmogorov-Smirnov test (K-S test) which will tell us whether the distribution as a whole deviates from a comparable normal distribution. The Kolmogorov-Smirnov test allows us to do this by comparing the scores in the sample to a normally distributed set of scores with the same mean and standard distribution. If the test is non-significant ($p > .05$) it tells us that the distribution of the sample is not significantly different from a normal distribution (i.e. it is probably normal). If the test is significant ($p < .05$) then the distribution in question is significantly different from a normal distribution (i.e. it is probably non-normal).   Figure 4.5 show the visual shape of the data, and tables 4.4 and 4.5 show the descriptive results of the tests.
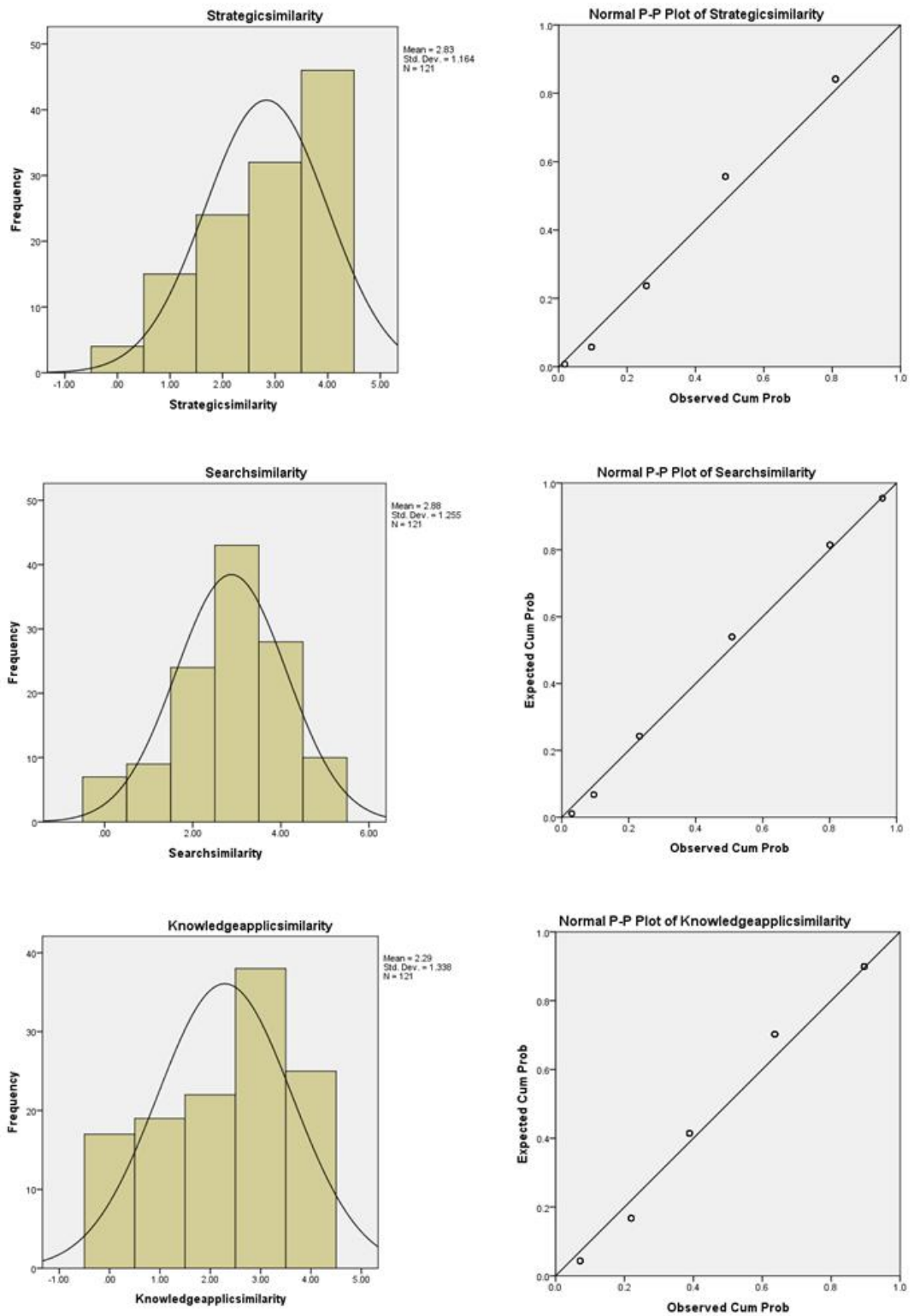
Figure 4.5: Histograms (left) and P-P plots (right) of the organisational-level similarity measures

		Strategicsimilarity	Searchsimilarity	Knowledgeapplic similarity
N	Valid	121	121	121
	Missing	1	1	1
Mean		2.8347	2.8760	2.2893
Std. Error of Mean		.10585	.11413	.12165
Median		3.0000	3.0000	3.0000
Mode		4.00	3.00	3.00
Std. Deviation		1.16438	1.25546	1.33815
Variance		1.356	1.576	1.791
Skewness		-.670	-.456	-.376
Std. Error of Skewness		.220	.220	.220
Kurtosis		-.576	-.069	-1.045
Std. Error of Kurtosis		.437	.437	.437
Range		4.00	5.00	4.00
Minimum		0.00	0.00	0.00
Maximum		4.00	5.00	4.00
Percentiles	25	2.0000	2.0000	1.0000
	50	3.0000	3.0000	3.0000
	75	4.0000	4.0000	3.0000

p <.05*, p <.01**, p <.001***

Table 4.4: Descriptive statistics relating to the normality tests

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Strategicsimilarity	.222	121	.000	.847	121	.000
Searchsimilarity	.209	121	.000	.920	121	.000
Knowledgeapplic similarity	.223	121	.000	.884	121	.000

a. Lilliefors Significance Correction

p <.05*, p <.01**, p <.001***

Table 4.5: Normality test results from the Kolmogorov-Smirnov test

4.3.1   Summary of the Data Normality Tests

The Kolmogorov-Smirnov test shows us that the data across each of the three similarity

dimensions are significantly non-normal.

Strategic similarity, D(121) = 0.222, *p < .001, search similarity, D(121) = 0.209, p = <.001,*

knowledge application similarity, (D121) = 0.223, p < .001.

This finding is consistent with a visual data check using histograms and P-P plots together

with a review of the skewness and kurtosis values.

 4.4   Response Bias

In terms of looking for any potential response bias, the response rate for the overall

organisational level questionnaire was very high, as firms were obliged to complete the

questionnaires as part of the terms and conditions of the innovation voucher scheme.

Indeed, between survey 1 (which was used to create the independent variables) and

survey 2 (which provided the dependent variables) there were only fourteen

questionnaires out of the 150 which were not returned. And again, in general the

response rate for questions was very good, with at least 101 observations out of a possible

150 (67%) usable for statistical analysis. However, because of the methodological need to

match pairs of SMEs and their creative servicers against the variables needed to construct

the similarity measures, this meant that pairings at the organisational level dropped from

150 to 121. For robustness, a check for potential bias between the paired and non-paired

groups was undertaken using the basic characteristics and innovative behaviours of the

two groups. Reassuringly, the results indicate that the characteristics of the paired firms

were not systematically different to the firms which were not paired although there is

weak evidence to suggest that firms in the paired groups were less likely to have a higher-

education qualification. As the relationship between individual's competencies acquired through formal higher-education is positively linked to

	N	% in group	Cramer's V	Signif.
Limited company	117/25	94/88	.090	0.18
Family business	67/18	55/50	.043	0.79
Business plan	119/27	63/67	.029	0.83
Owner with HE qualif	118/28	64/82	.156	0.07
Exporting firm	119/26	37/31	.050	0.65
New products/services	120/27	30/44	.119	0.18
Internal R&D	118/26	66/69	.026	0.82
External R&D	117/25	22/24	.016	1.00
Innovation	120/25	80/76	.037	0.79
Radical innovation	82/21	53/61	.067	0.62

Table 4.6: Characteristics of paired firms versus non-paired firms

behaviours at work, the finding informs the selection of '% with degree' as a control

variable which should pick up any influence of HE in the analysis and remove residual bias.

The results of the non-response tests can be found in Table 4.6. Cramer's V is reported as

a measure of strength of association and modifies the chi-square statistic to take account

of sample size and degrees of freedom. The test restricts the range of the statistic from 0

to 1, which makes it similar to the correlation coefficient. For these data only weak

associations are represented.

4.5   Associations between Innovation Performance Measures

The dependent variables which represent innovation performance measures show some

strong associations. The innovation performance measures were selected to offer two

general perspectives for consideration – firstly around the efficacy of the innovation

relationship, measured by whether all or just some of the project objectives were met, and

also whether the project kept to its original timescale. Secondly, there were measures

aimed at assessing the impacts on the bottom-line of the business and associated with

patterns of sales and the overall financial impact of the project. A range of similar

variables looking at the same underlying dimensions were selected for analytical

robustness and helps to check for consistency within the analysis framework and to ensure

that effects were not specific to particular dependent variables. It is likely to mean, due to

some strong associations, that we would expect to see similar statistical results for the

variables which fall into these two groups.   Table 4.7: shows the chi-square results for the

associations between the dependent variables.

Associations between dependent variables - organisational level

			Achieve innov obj	Proceed on time	Inc sales to existing clients	Sales to new clients existing mkts	Sales to new clients in new mkts	Increased profitability
Pearsons chi-square	Achieve innov obj	χ^2		6.325 (1)	2.380 (1)	4.855 (1)	0.413 (1)	4.707 (1)
		Sig. (2 tailed)		.020	.186	.034	.624	.041
		N		101	75	76	76	73
	Proceed on time	χ^2	6.325 (1)		3.413 (1)	6.118 (1)	3.354 (1)	8.600 (1)
		Sig. (2 tailed)	.020		.076	.021	.101	.004
		N	101		77	79	79	76
	Inc sales to existing clients	χ^2	2.38 (1)	3.413 (1)		11.526 (1)	14.824 (1)	13.285 (1)
		Sig. (2 tailed)	.186	.076		.001	.000	.000
		N	75	77		72	72	67
	Sales to new clients existing mkts	χ^2	4.855 (1)	6.118 (1)	11.526 (1)		14.062 (1)	19.661 (1)
		Sig. (2 tailed)	.034	.021	.001		.000	.000
		N	76	79	72		75	70
	Sales to new clients in new mkts	χ^2	0.413 (1)	3.354 (1)	14.824 (1)	14.062 (1)		24.343(1)
		Sig. (2 tailed)	.624	.101	.000	.000		.000
		N	76	79	72	75		67
	Increased profitability	χ^2	4.707 (1)	8.600 (1)	13.285 (1)	19.661 (1)	24.343(1)	
		Sig. (2 tailed)	.041	.004	.000	.000	.000	
		N	73	76	67	70	67	

Table 4.7: Chi-square results for dependent variables

4.6   Logit Analysis

4.6.1   Estimation Results

The following tables present the main results of the organisational level analysis which

assesses the relationship between three levels of similarity – strategic, search and

knowledge application, on six innovation performance measures in terms of the proposed

inverted U-shaped relationship predicted by cognitive-distance.   As a base case to

compare the results against, the outcome with only the control variables is presented.

Model I in each table represents the impact of the control variables on each of the

innovation performance measures. Model II adds the linear term for each performance

measure to the control variables and Model III includes the quadratic term. Results for

strategic-similarity and search-similarity largely confirm the basic hypothesis that

innovation performance is a parabolic, inverted U-shaped function of cognitive-distance

between partners. Knowledge-similarity provides very inconsistent results and no

statistical significance.

The main aim of this study is to extend the empirical domain of cognitive-distance into a

new industry context. And therefore, the intention is to look for the expected signs on the

similarity measures in Model III where we would expect to see a positive term for the

linear relationship and a negative term for the quadratic relationship as predicted by a

Cognitive Theory of the Firm and the hypothesis of cognitive-distance. In terms of the

control variables, as might be expected, whether or not the firm has a business plan has

some effect on innovation performance, though the level and direction of effect is

inconsistent across the models, as is any significance. The proportion of employees with a

degree-level education has significance on some measures but the contribution is very

weak. Number of competitors also makes a very weak contribution and relates

inconsistently in terms of the direction of the relationship with the dependent variable.

Dependent variable: Achieve innovation objective

	Model I		Model II		Model III	
	Controls only		Linear + controls		Quadratic + controls	
	Est. coeff	SE	Est. coeff	SE	Est. coeff	SE
Constant	-.586	*.616*	-1.385*	*.809*	-2.344*	1.169
Strategic similarity			.299*	*.185*	1.280	*.840*
Strategic similarity²					-.204	*.168*
Business plan	.403	*.385*	.452	*.415*	.499	*.438*
No. of competitors	.044	*.060*	.054	*.883*	.059	*.061*
% with degree	.030**	*.015*	.024	*.016*	0.026*	*.016*
Intercept	-.586	*.616*	-1.385*	*.809*	-2.344*	*1.169*
No. of obs	101		101		101	
Chi-square	101.48		100.351		100.750	
Degrees of freedom	97		96		95	
Constant			-.277	*.741*	-1.574*	*.918*
Search similarity			-.130	*.169*	1.270**	.564
Search similarity²					-.283**	.109
Business plan			.449	*.408*	.566	*.461*
No. of competitors			.049	*.060*	.060	*.063*
% with degree			.030	*.015**	.027*	*.016*
Intercept			-.277	*.741*	-1.574*	*.918*
No. of obs			101		101	
Chi-square			101.880		102.457	
Degrees of freedom			96		95	
Constant			-.500	*.696*	-.262	*.770*
Knowledge application similarity			-.043	*.160*	-.450	.586
Knowledge application similarity²					.100	*.138*
Business plan			.410	*.390*	.413	*.383*
No. of competitors			.045	*.060*	.043	.060
% with degree			.030**	*.015*	.030**	*.015*
Intercept			-.500	*.696*	-.262	.770
No. of obs			101		101	
Chi-square			101.567		100.984	
Degrees of freedom			96		95	

*** $p<.01$ ** $p<.05$ * $p<.10$

Dependent variable: Completed on time

	Model I		Model II		Model III	
	Controls only		Linear 3 controls		Quadratic 3 controls	
	Est. coeff	SE	Est. coeff	SE	Est. coeff	SE
Constant	.059	*.542*	.241	*.710*	-.214	.974
Strategic similarity			-.069	*.174*	.422	*.740*
Strategic similarity²					-.102	*.149*
Business plan	-.175	*.251*	-.178	*.254*	-.177	.248
No. of competitors	-.031	*.057*	-.033	*.057*	-.032	.057
% with degree	.029**	*.014*	.030**	*.014*	.031**	.014
Intercept	.059	*.542*	.241	*.710*	-.214	*.974*
No. of obs	109		109		109	
Chi-square	108.455		108.316		107.954	
Degrees of freedom	105		104		103	
Constant			-.624	*.705*	-1.527	*.943*
Search similarity			.259	*.163*	1.230**	.596
Search similarity²					-.191*	.109
Business plan			-.212	*.269*	-.212	*.254*
No. of competitors			-.039	*.058*	-.037	.059
% with degree			.030**	*.014*	.028**	.014
Intercept			-.624	*.705*	-1.527*	*.943*
No. of obs			109		109	
Chi-square			108.923		108.202	
Degrees of freedom			104		103	
Constant			-.236	*.625*	-.275	*.699*
Knowledge application similarity			.146	*.150*	.210	.536
Knowledge application similarity²					-.016	*.126*
Business plan			-.185	*.258*	-.186	.257
No. of competitors			-.037	*.058*	-.037	.058
% with degree			.029**	*.014*	.029**	*.014*
Intercept			-.236	*.625*	-.275	.699
No. of obs			109		109	
Chi-square			109.012		109.073	
Degrees of freedom			104		103	

*** *p<.01*   ** *p<.05*   * *p<.10*

Dependent variable: Increased sales to existing clients

	Model I		Model II		Model III	
	Controls only		Linear 3 controls		Quadratic 3 controls	
	Est. coeff	SE	Est. coeff	SE	Est. coeff	SE
Constant	-1.436**	.684	-1.629	.934	-2.155	1.334
Strategic similarity			.069	.226	.633	1.006
Strategic similarity²					-.117	.202
Business plan	.162	.244	.163	.225	.154	.227
No. of competitors	.053	.074	.058	.076	.057	.076
% with degree	.003	.017	.002	.018	.003	.018
Intercept	-1.436**	.684	-1.629	.934	-2.155	1.334
No. of obs	77		77		77	
Chi-square	76.311		76.414		76.580	
Degrees of freedom	73		72		71	
Constant			-1.555*	.871	-2.956**	1.389
Search similarity			.046	.204	1.735**S	.968
Search similarity²					-.351*	.189
Business plan			.159	.225	.114	.227
No. of competitors			.053	.074	.045	.078
% with degree			.003	.017	-.000	.018
Intercept			-1.555*	.871	-2.956**	1.389
No. of obs			77		77	
Chi-square			76.369		81.222	
Degrees of freedom			72		71	
Constant			-1.822**	.819	-1.787**	.881
Knowledge application similarity			.181	.199	.111	.689
Knowledge application similarity²					.018	.165
Business plan			.165	.224	.169	.227
No. of competitors			.048	.075	.048	.075
% with degree			.003	.017	.003	.017
Intercept			-1.822**	.819	-1.787**	.881
No. of obs			77		77	
Chi-square			75.934		75.948	
Degrees of freedom			72		71	

*** $p<.01$ ** $p<.05$ * $p<.10$

Dependent variable: Sales to new clients in existing markets

	Model I		Model II		Model III	
	Controls only		Linear 3 controls		Quadratic 3 controls	
	Est. coeff	SE	Est. coeff	SE	Est. coeff	SE
Constant	-1.487**	.746	-1.722*	.932	-3.822**	1.512
Strategic similarity			.087	205	2.134**	1.069
Strategic similarity^2					-.420**	.210
Business plan	.763	.502	.782	.506	.919*	.537
No. of competitors	.122*	.068	.125*	.069	.133**	.071
% with degree	.007	.016	.004	.016	.011	.017
Intercept	-1.487**	.746	-1.722*	.572	-3.822**	.1.512
No. of obs	79		79		79	
Chi-square	77.935		78.026		77.066	
Degrees of freedom	75		74		73	
Constant			-2.705**	.972	-3.547**	1.338
Search similarity			.478**	.207	1.340*	810
Search similarity^2					-.167	.145
Business plan			.622	.505	.609	.509
No. of competitors			.118	.072	.118	.072
% with degree			.006	.016	.005	.016
Intercept			-1.685	.583	-3.547**	1.338
No. of obs			79		79	
Chi-square			76.109		78.672	
Degrees of freedom			74		73	
Constant			-1.573	799	-1.876**	.886
Knowledge application similarity			.052	.173	.557	.614
Knowledge application similarity^2					-.132	.154
Business plan			.753	.502	.778	.511
No. of competitors			.119*	.069	.123*	.016
% with degree			.006	.016	.008	.016
Intercept			-1.573	799	-1.876**	.886
No. of obs			79		79	
Chi-square			78.007		78.063	
Degrees of freedom			74		73	

*** $p<.01$ ** $p<.05$ * $p<.10$

Dependent variable: Sales to new clients in new markets

	Model I		Model II		Model III	
	Controls only		Linear 3 controls		Quadratic 3 controls	
	Est. coeff	SE	Est. coeff	SE	Est. coeff	SE
Constant	-1.408**	.670	-1.378	.869	-1.957	1.312
Strategic similarity			-.012	.215	.586	.999
Strategic similarity²					-.122	.198
Business plan	.057	.226	.057	.226	.049	.225
No. of competitors	.012	.066	.011	.067	.012	.067
% with degree	.035**	.016	.035**	.017	.037**	.017
Intercept	-.867**	0.404	-1.378	.869	-1.957	1.312
No. of obs	80		80		80	
Chi-square	80.082		80.092		80.708	
Degrees of freedom	76		75		74	
Constant			-2.320**	.936	-2.305**	1.088
Search similarity			.327	.209	.310	695
Search similarity²					.003	.131
Business plan			.037	.230	.037	.231
No. of competitors			.010	.068	.010	.068
% with degree			.036**	.016	.036**	.016
Intercept			-2.320**	.936	-2.305**	1.088
No. of obs			80		80	
Chi-square			77.625		77.675	
Degrees of freedom			75		74	
Constant			-1.958**	.800	-1.764**	.842
Knowledge application similarity			.257	.188	-.154	.648
Knowledge application similarity²					.105	.160
Business plan			.062	.227	.083	.230
No. of competitors			.008	.067	.008	.068
% with degree			.035**	.016	.035**	.016
Intercept			-1.958**	.800	-1.764**	.842
No. of obs			80		80	
Chi-square			79.639		80.296	
Degrees of freedom			75		74	

*** $p<.01$ ** $p<.05$ * $p<.10$

Dependent variable: Increased profitability

	Model I		Model II		Model III	
	Controls only		Linear 3 controls		Quadratic 3 controls	
	Est. coeff	SE	Est. coeff	SE	Est. coeff	SE
Constant	-.979	_.696_	-1.280	_.934_	-3.489**	_1.893_
Strategic similarity			.110	_.224_	2.183	_1.424_
Strategic similarity²					-.400	_.263_
Business plan	-.090	_.273_	-.088	.270	-.114	.261
No. of competitors	.005	_.070_	.007	_.071_	.002	.071
% with degree	.016	_.016_	.014	_.017_	.019	_.017_
Intercept	-.979	_.696_	-1.280	_.934_	-3.489**	_1.893_
No. of obs	76		76		76	
Chi-square	75.991		75.807		75.088	
Degrees of freedom	72		71		70	
Constant			-1.214	_.855_	-3.164**	_1.516_
Search similarity			.094	_.193_	2.024**	_.998_
Search similarity²					-.380**	.184
Business plan			-.102	_.280_	-.136	_.272_
No. of competitors			.003	_.071_	.007	.075
% with degree			.016	_.016_	.017	_.017_
Intercept			-1.214	_.855_	-3.164**	_1.516_
No. of obs			76		76	
Chi-square			75.758		89.223	
Degrees of freedom			71		70	
Constant			-1.626**	_.815_	-1.489*	_.898_
Knowledge application similarity			.338*	_.201_	.112	.685
Knowledge application similarity²					.055	_.161_
Business plan			-.087	.280	-.080	_.283_
No. of competitors			-.015	_.073_	-.014	.073
% with degree			.015	_.017_	.015	_.017_
Intercept			-1.626**	_.815_	-1.498*	_.898_
No. of obs			76		76	
Chi-square			76.590		76.728	
Degrees of freedom			71		70	

*** $p<.01$ ** $p<.05$ * $p<.10$

4.6.2   Curve Plots of Estimation Results

Curve plots were created from the coefficients reported in the logit analysis following a similar calculation used in Nooteboom *et al*. (2006-33). The X-axis relates to the similarity measurement and the Y-axis to the estimated contribution of similarity to the innovation performance measure.
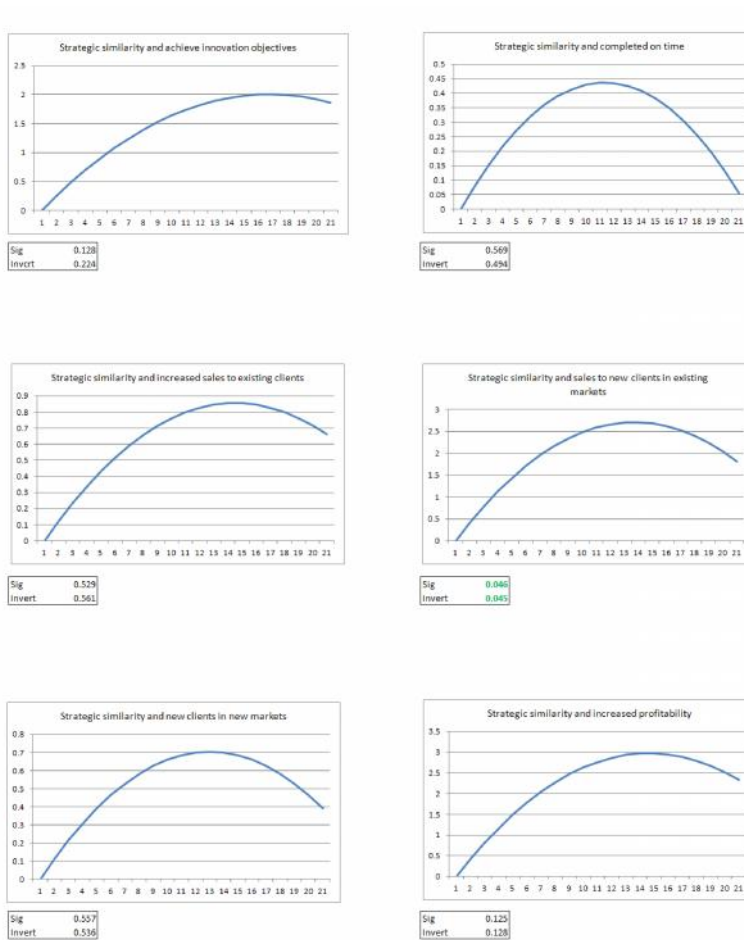
Figure 4.6: Curve plots for strategic-similarity and innovation performance measures
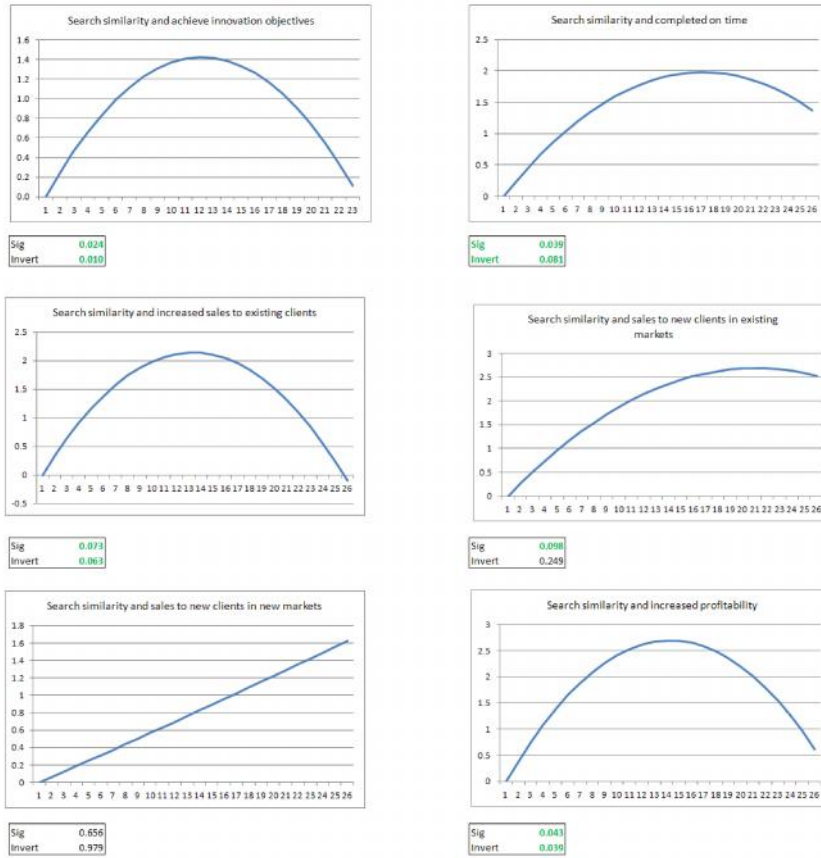
Figure 4.7: Curve plots for search-similarity and innovation performance measures
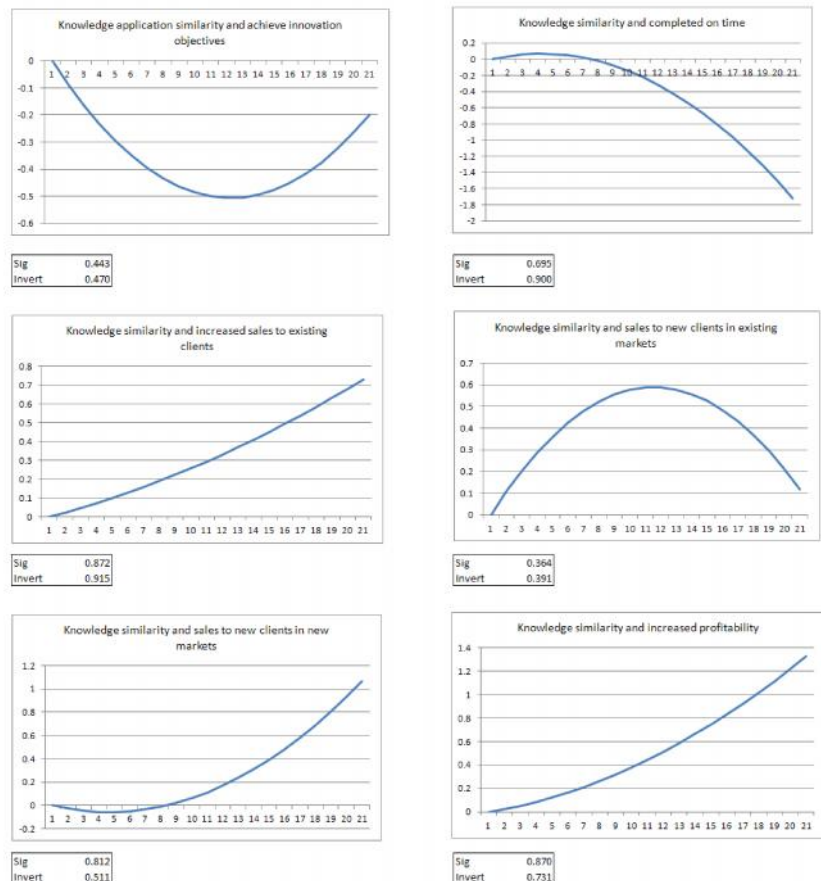
Figure 4.8: curve plots for knowledge-similarity and innovation performance measures

4.7 Summary

This section presents the findings for the organisational-level similarity analysis which used a sample set of 121 small businesses and their creative industry partners to test for the effects of partner similarity on innovation outcomes. The descriptive statistics at the beginning indicate that when compared using their responses to the surveys, the SMEs and their creative partners are quite similar on dimensions of strategic-similarity and knowledge-application similarity but relatively different on the search-similarity dimension. A Kolmogorov-Smirnov test suggests that the data distribution for the sample sets relating to the three different similarity measures is significantly different from a normal distribution though this may be a consequence of the relatively small size of the sample data set rather than a reflection of the sample population. Tests to check for differences between the successful and unsuccessful groups on each innovation performance measure indicate some non-random relationships, particularly for search similarity.

Logit estimations were run for the three similarity measures against each of the six innovation performance measures to explore for the predicted positive and negative coefficients on the similarity measures which would indicate that the results were consistent with Nooteboom's proposed inverted U-shape relationship for cognitive-distance. The predicted relationships were found for some, but not all, of the similarity and innovation performance measures. Using the coefficient values for the similarity measure and quadratic terms in Model III, the formula used in Nooteboom *et al.*, (2006) is applied to visually explore the data and to more clearly interpret the nature of the relationship between variables.

5. DATA ANALYSIS PART B – INDIVIDUAL LEVEL SIMILARITY

5.1   Introduction

This section of the thesis reports the findings from the individual-level analysis beginning with a profiling of the SME and their creative counterparts. A comment about the data distribution is made and then the results of the analysis are given, along with some illustrative graphical interpretations based on the data results.

The analysis addresses research questions 2 and 3:

RQ2. How does the relationship between similarity and difference impact innovation performance of small business innovation partnerships using measurement constructs at the *individual* level?

RQ3. Does the relationship between similarity and innovation performance follow the model of an inverted U-shaped curve proposed by cognitive-distance?

The organisational-level analysis in the previous chapter found evidence to support the hypothesis of the inverted U-shaped relationship for some but not all of the similarity measures, with strategic-similarity and search-similarity having the most consistent findings. Search-similarity results were supported by some statistical significance.

In this chapter we move the unit of analysis away from the organisational-level and look at similarity between the key individuals involved in each innovation project. These are the individuals who, as the main boundary-spanners within the open-innovation process, may have been most influenced by the similarities or differences between them and whose behaviours may have impacted the cooperation and collaboration process, and through that, the innovation outcomes.

The similarity constructs at the individual-level are created from primary data collected using the Allport-Vernon-Lindzey Study of Values 4th edition (2003), an ipsative (forced-choice) psychometric questionnaire designed around Eduard Spranger's six classes of personal values. Eduard Spranger (1928) hypothesised that there are six dominant attitudes which are influenced by an individual's intrinsic personal values and he labelled them the theoretical; economic; aesthetic; social; political; and religious attitudes. Spranger believed that the definition of these 'types' brought insights for practical everyday life and could help to bridge our understanding of the mental gaps between people and between groups. These mental gaps could change depending on the situation, and in certain contexts, a dominant value-direction prevails and drives our behaviour, subordinating or repressing other behaviours.   A full description of Spranger's 'dominant attitudes' can be found in the literature review chapter on page 56.

 The SOV is typically used to collect numerical scores which can then be organised to form a profile of the relative strength of an individual's preference for each of the six 'attitudes'. The most dominant attitude has the highest score. An example of different profiles related to previous studies is found in the literature review section on page 64. The SOV is used differently in this study compared to the others. An attitude score is calculated for each of the individuals in the partnership dyad and then one score is subtracted from the other to derive a value for the range between the two. This figure represents the level of similarity or difference between the individuals, or what Nooteboom (1996) would define as 'cognitive-distance'.

5.2   Descriptive statistics of the Innovation Dyads

5.2.1   No. of cases

One hundred and fifty small business owners and their creative suppliers involved in the

NESTA *Creative Credits* scheme were invited to take part in the research.   Part one of the

research involved exploring similarity at the organisational level. The data available

through the *Creative Credits* Innovation surveys provided sufficient responses to analyse

similarity at the organisational level for 121 SME/creative partnerships. Part two of the

research analyses similarity at the individual level, using different data collected via the

Allport-Vernon-Lindzey *Study of Values* 4th edition (2003).

Eight-two fully completed surveys were returned for the AVL *SOV* representing a response

rate of 55%, just above the average

response rate of 53% which might be

expected for surveys of individuals in

organisations (Baruch & Holtom,

2008). Sixty of the respondents were

male and 22 of respondents were

female, representing 74% and 26% of

the respondent respectively.
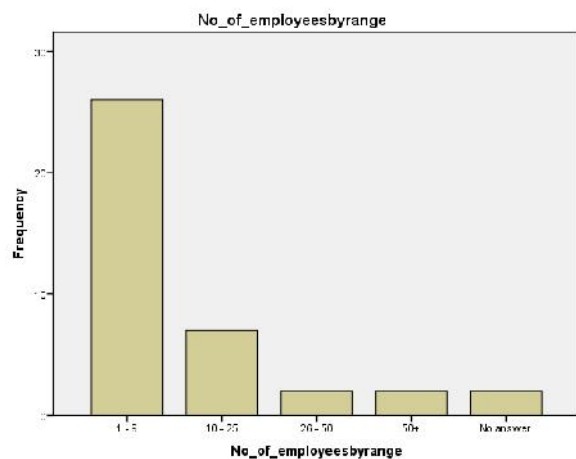
Figure 5.1: No. of employees by range

Of the non-respondents, 9% individuals followed the survey link but did not log-on to the

survey, 36% of those invited did not respond at all.   Of the 82 surveys returned there

were sufficient matches between the SMEs and their creative suppliers to produce 39

working dyads to use as the base for testing the individual-level similarity measures.

5.2.2   Characteristics of the Innovation Partners

Characteristics of the SMEs (*n* = 39) and creative businesses (*n* = 23) which make up the 39

innovation dyads. Amongst the SME sample two main industry sectors - business services

and wholesale and retail distribution - were the most typical**.** Table 5.1 shows a

breakdown of SME firms by industry and operating sectors.   92% of the SMEs are private

limited companies as are all of the creative businesses with the exception of one Limited

Liability Partnership (LLP). Both the

SMES and creative businesses show

some variance in turnover across the

groups but in both cases the largest

proportion of firms in both groups

stated turnover of less than £500k

with 60% of the SME group and over

90% of the creative business group

Figure 5.2: Turnover by range

falling into this category. In fact, 37.5% of the SMES reported a turnover of less than £100k

per year with a nearly a third (30%) of the creative businesses also posting

 financial returns within this range. Figure 5.2 shows the breakdown of turnover by range.

In terms of the number of employees, 67% of SMEs were micro-firms, having less than 10

full-time equivalent staff and a cumulative total of 85% of the SMEs had fewer than 25 FTE

employees. 87% of the creative group were micro-firms.   The mean age of the SME

businesses is 10.67 years with a dispersion of 1 to 84 years and a standard deviation of

15.30.

Broadsector

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Business services	17	43.6	43.6	43.6
	Wholesale and retail distribution	9	23.1	23.1	66.7
	Manufacturing	5	12.8	12.8	79.5
	Construction	4	10.3	10.3	89.8
	Other services	3	7.7	7.7	97.5
	Transport and communications	1	2.6	2.6	100.0
	Total	39	100.0	100.0	

Table 5.1: SMEs by industry sector

The median age of the businesses is 6 years with a bi-model age of 5 and 6 years. For the creative group, the mean age of a business is 5 years with a dispersion of 1 to 15 years, a standard deviation of 3.74, a median value of 4 and a modal value of 2. Five of the SMEs (13%) have been involved in a prior innovation voucher scheme.

5.2.3   Prior Innovation Activity and Current Innovation Project Typology

Of the SME sample group, 85% indicated that they had innovated goods or services in the last 3 years which is significantly higher than the 42.9 per cent of the *Creative Credits* external control group which were made up of non-applicants to the programme selected from the FAME database.   Nearly 50% stated that their previous innovations were new to market with 31% indicating their innovations were new to the business only.   Though the apparent innovation activity for the sample group appears to be higher than normal, only four SMEs had applied for a patent to protect their innovation. Three of the same firms had registered a design at some point and eight firms had registered a trademark.

Innovation project types were mainly centred around website development and business branding with only 9 SMEs (23%) looking for assistance in developing a new (from scratch) website and one firm stating that their new website would be the first experience of digital marketing. Thirty-six per cent of projects involved upgrading or enhancing existing websites, with many opting to use the funds to evolve from static web 1.0 models to more dynamic and interactive web 2.0 versions which offer easier content update, blogging mechanisms and on-line product ordering systems. 41% of projects were focused on aspects of marketing innovation, with video production a popular choice. Overall the innovation projects were incremental and new to the business with no *Creative Credits* investment for these dyads being used for product development or novel approaches to process development.

5.2.4   Selecting an Innovation Partner

Nearly half of the SMEs did not provide information on their approach to partner selection

Number of creative partners considered					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No answer	19	48.7	48.7	48.7
	Two to five	13	33.3	33.3	82.0
	Six to nine	5	12.8	12.8	94.8
	Ten or more	1	2.6	2.6	97.4
	One	1	2.6	2.6	100.0
	Total	39	100.0	100.0	

Figure 5.2: No of creative partners considered

but of those that did provide an insight (n = 20), just over a third of SMEs (33.3%) considered between two and five different creative firms from the online gallery before making a decision about whom to meet. Another handful considered six to nine creative businesses and one firm each considered only one creative or ten or more prospective partners. In converting partners considered to partners approached, the majority of SMEs met up with only one Creative (n = 9) with the next largest group typically meeting with three creative businesses before making a choice.   In the previous three years, the majority of the SMEs who responded to this survey question (n = 11, no answer = 20) had already worked with creative businesses once or twice. Five of the firms had never worked with a creative business before. Figure 5.3 provides pie-charts illustrating the number of creative firms considered and approached and the frequency that SMEs have worked with a creative firm previously.

Figure 5.3: pie charts illustrating features of innovation partner choice

Top – number of partners considered

Middle – frequency with which the SME previously worked with creative services suppliers in the last 3 years

Bottom – number of partners the SME met with before selecting the final creative firm
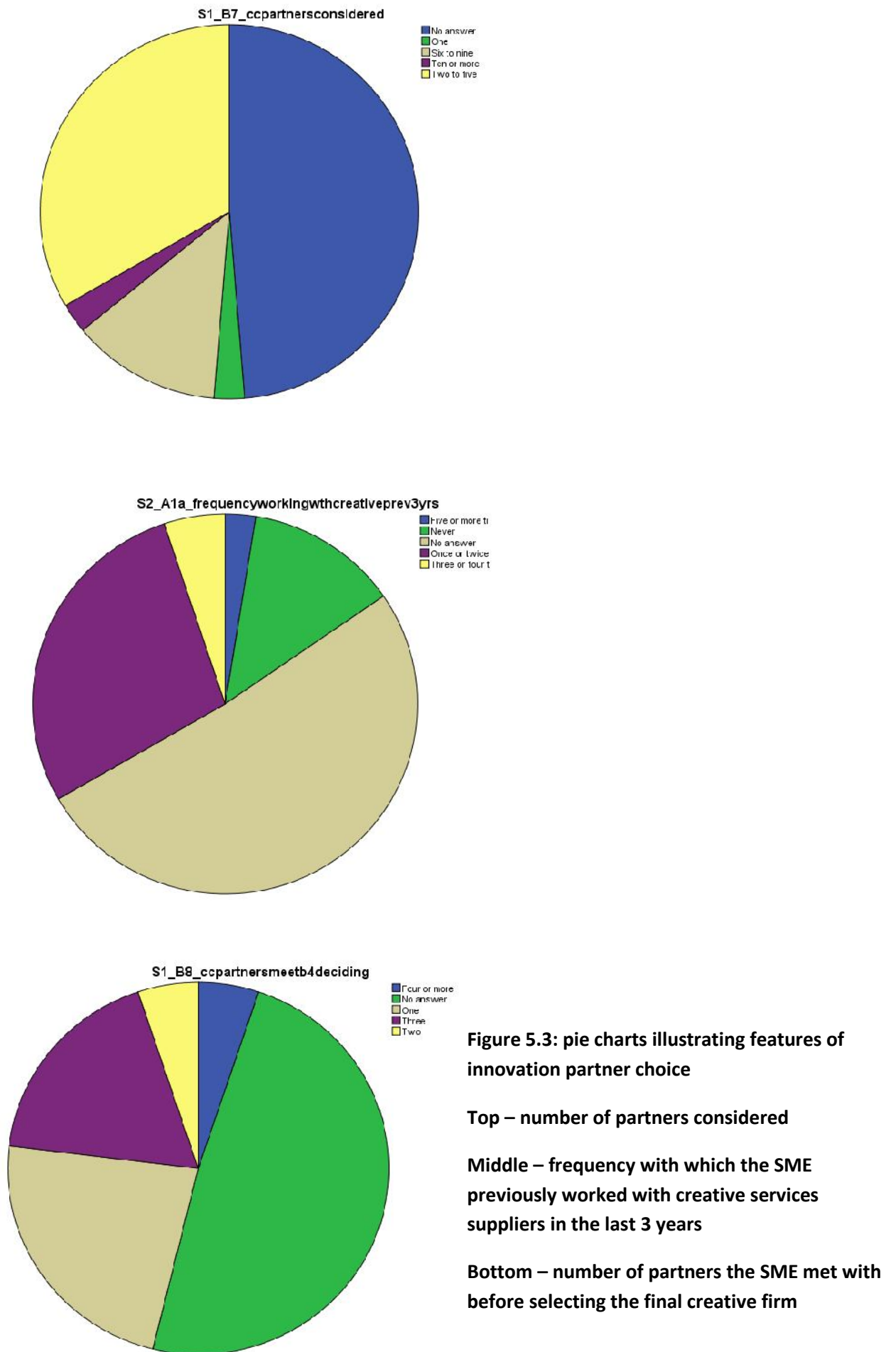
5.2.5   Socio-economic Data

This section reviews the socio-economic composition of the individuals who form part of the individual level similarity dyads and provides some qualitative context and texture to an otherwise quantitative methodology. The data were collected at the same time as the respondents completed the on-line SOV questionnaire.

The average age of a respondent was forty-four years with an age range dispersion of 27 – 66. Most typically the small business owners were in their thirties and forties. Seventy per cent of the group were married. In terms of ethnicity, 83% classed themselves as white, 9% Asian/Asian British and 5% of mixed-race. 96% had English as their first language. The whole sample group were based within the North-West of England and specifically in the Greater Manchester area. Regarding education level, 41% of the sample group have undergraduate degrees, 20% had a Masters degree and one person had a PhD. 16% of the group had 5 or more GCSEs (or equivalent) and 8% had fewer than 5 GCSEs (or equivalent). Forty per cent were involved in Continuous Professional Development (CPD) or were undertaking some form of continuing academic study. Of the 39 SMEs in the dyads, 31% stated previous education or training in some form of creative skills.

The average salary for the group was £52,000 per annum with 19% of those surveyed stating that they earned more than £80,000 per annum and 13% having income of more than £100,000 per annum. The respondents were invited to record how they felt at the point they were completing the survey; 21% stated they were 'tired', 16% were 'stressed', nearly a third (29%) were 'happy' or 'content' and 11% were 'curious' about the research.

Only three of the SMEs had appointed individuals who were not the founder or the most senior person in the firm as the main contact with the creative partner, but of these three all but one was a senior manager.

5.2.6   SOV Attitude Profiles for SME and Creative Businesses

These tables provide some background information about the general attitude profiles of the sample group using the method conventionally applied in previous studies using the SOV. The table presents the attitude profile in ranked order, first for the whole sample group used for the individual-level analysis which includes both the SMEs and the creative services supplier, then broken out into sub-groups organised by gender, then by dyad. The information in this section is used just to illustrate the dominant attitudes in the various groups, which highlights two main consistencies. Firstly, the economic attitude prevails as the dominant characteristic for the types of firms in this sample group at the point this study was done. This dominance of the economic attitude is consistent with Spranger's view that most people belong to the economic type, or at least embody strong traits of it. The other consistent feature is the subordinated role of the religious attitude across all sub-groups. If one reviews the catalogue of profiles used in previous studies which is found on page 64 in the literature review chapter, **it** appears that over time, the religious attitude has become more and more subordinated to other attitudes.

Dominant attitudes profiles broken down by sub-sample

Ranking WHOLE sample n = 82	Ranking males n = 58	Ranking females n = 24	Ranking creatives males n = 25	Ranking creatives females n = 4	Ranking SME males n = 33	Ranking SME females n = 20
48.42	48.52	48.14	47.92	48.50	49.27	47.80
43.49	44.08	43.59	42.68	42.50	45.03	43.95
40.08	41.22	41.86	42.42	42.00	40.24	42.45
39.53	38.07	37.00	39.34	38.00	37.67	37.90
36.89	36.84	36.91	37.96	34.50	34.63	36.75
31.59	31.26	32.50	29.68	34.50	33.15	31.15

Economic	Theoretic	Aethetic	Social	Political	Religious

Table 5.3: SOV attitude profiles for sample group

The data in the second table relates to the similarity measures devised for this study. Similarity measures are calculated by subtracting the raw scores for the SMEs and creative services from each other for each of the dyads. Here we see from the data that the

religious dimension has a very wide range of scores between the most similar and the most

different partners. Individuals are most similar on the social attitude.

Similarity measure	Mean	Std. Dev	Median	Mode	Range
Theoretic	7.82	5.794	7.00	2	0 - 22
Economic	7.85	6.180	6.00	4	0 - 22
Aesthetic	9.13	7.127	8.00	0	0 - 29
Social	6.85	5.388	5.00	5	0 - 24
Political	6.95	4.790	7.00	7	0 - 20
Religious	11.74	10.099	9.00	9	0 - 40

Table 5.4: Descriptive statistics for the SME/creative partners

5.3 Data distribution

An exploratory review of the data using histograms and Q-Q plots and the results of the K-S

test and the S-W test show that the data grouping within the individual level similarity

measures does not conform to a normal distribution. Very often datasets from psychology

(the Study of Values is an ipsative psychometric questionnaire) are not normally

distributed (Micceri, 1989), but it's also not unusual to see non-normal distribution of data

points in small samples such as the one used in this individual level analysis (n = 39).

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Measure2 T_abs	.146	39	.035	.917	39	.007
Measure2 E_abs	.169	39	.007	.913	39	.005
Measure2 A_abs	.140	39	.052	.929	39	.017
Measure2 S_abs	.126	39	.118	.907	39	.004
Measure2 P_abs	.116	39	.200*	.947	39	.063
Measure2 R_abs	.171	39	.006	.870	39	.000

a. Lilliefors Significance Correction

Table 5.5: Test of normality using the K-S test and the S-W test
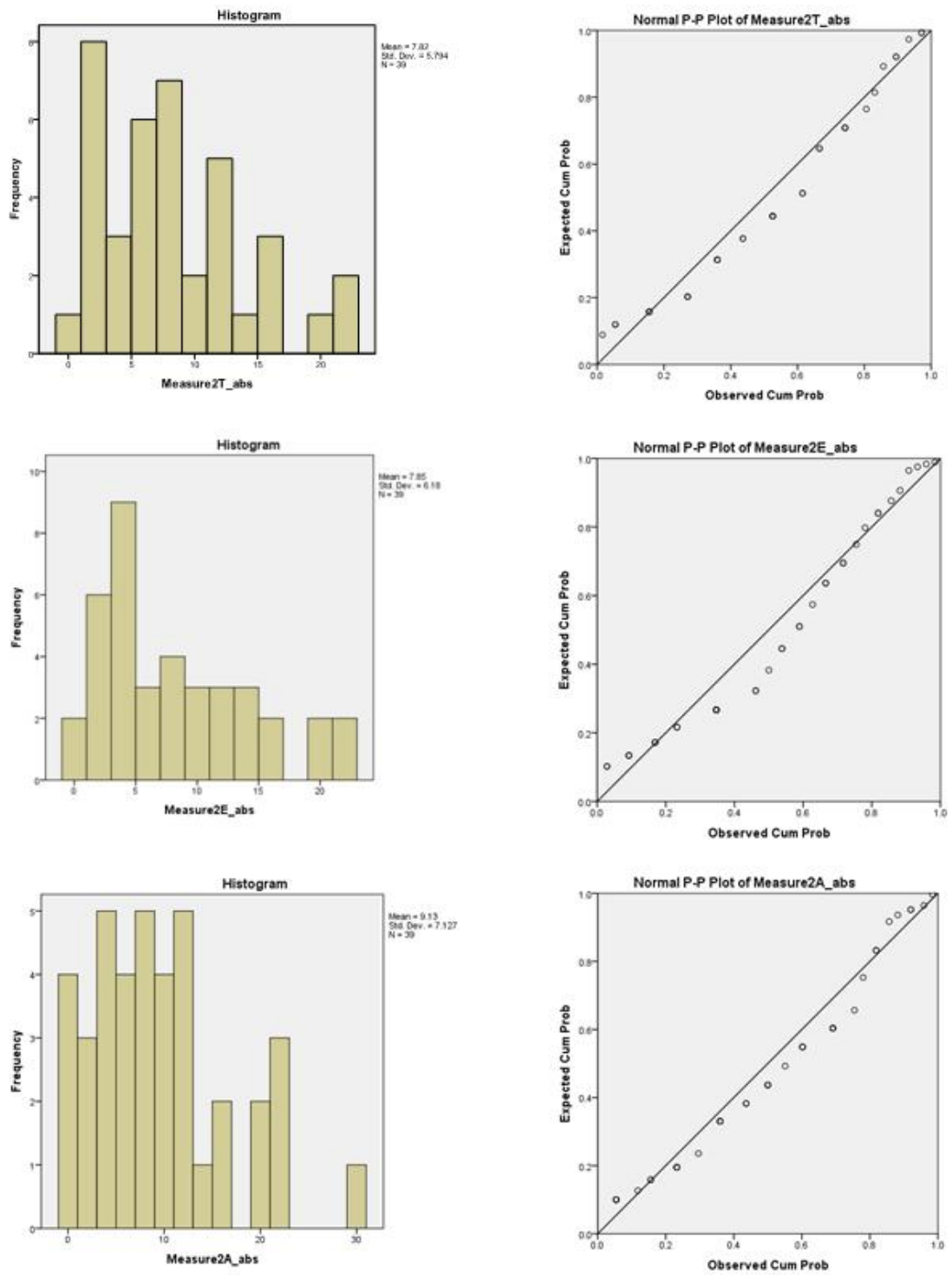
Figure 5.4 Histograms (left) and P-P plots (right) of the individual-level similarity measures for Theoretical; Economic; and Aesthetic.
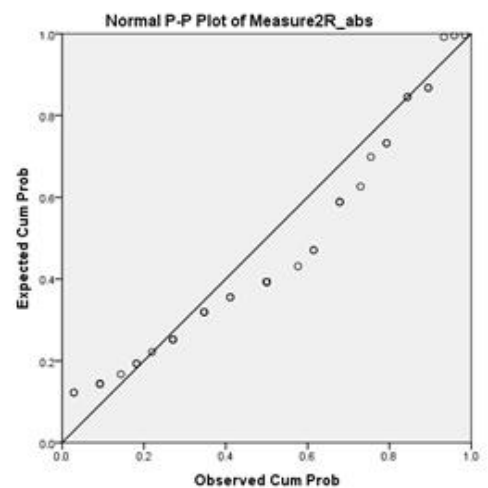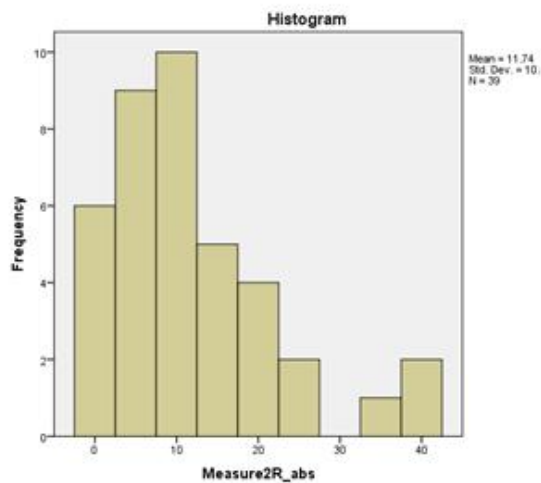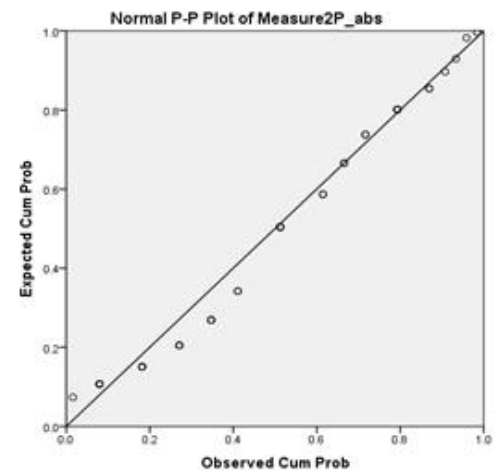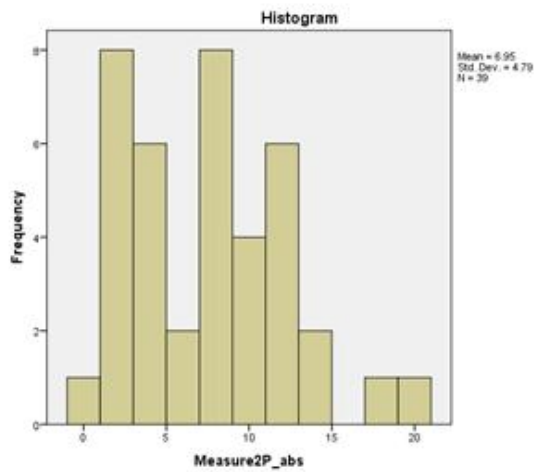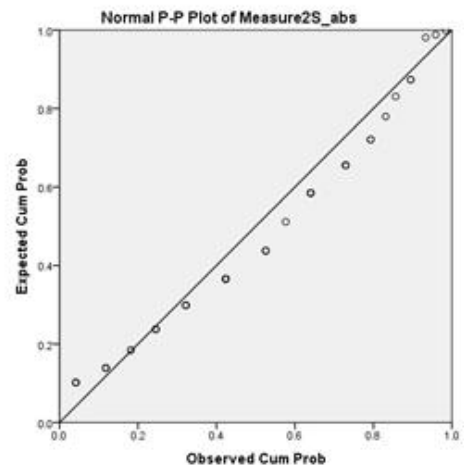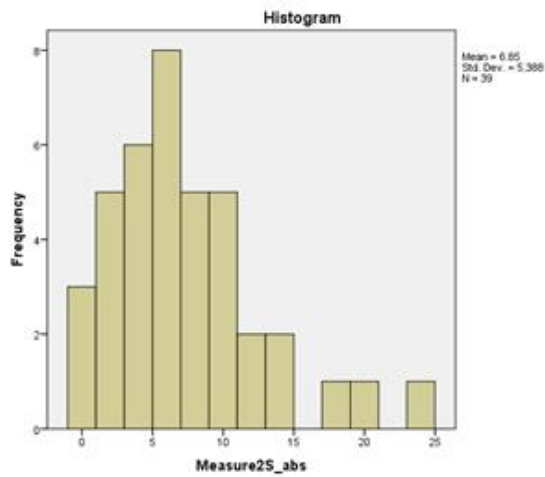
Figure 5.5: Histograms (left) and P-P plots (right) of the individual-level similarity measures for Social; Political; and Religious.

5.4   Independent *t*-tests

5.4.1   Estimation Results

As discussed in the methodology

section, the individual-level analysis

uses the independent-means *t*-test

to perform a theoretically-grounded

directional correlation analysis. The

test here is looking for specific correlations

Figure 5.6: conceptual model of cognitive-distance

and evidence of a representative upward slope

of data for the low/med similarity groups and a representative downward slope of data

points for the med/high similarity groups expressed in the form of a positive-value

coefficient for the former and a negative-value coefficient for the latter. The researcher

recognises that given the relatively small sample group (*n* = 39) at the individual level of

analysis, whatever findings are reported can't be generalised beyond this particular type of

group.

Each individual-level similarity variable is broken down into low, medium and high scores

where a low score means the dyad is very similar and a high score means they are very

different. Ranks of scores for each similarity dimension can be found in Appendix II. For

each of the six innovation output variables, two *t*-tests are run:

1. Differences in innovation outcomes for dyads with low and medium-levels of similarity

(LowMed).

2. Differences in innovation outcomes for dyads with medium and high-levels of similarity

(MedHigh).

If Nooteboom's hypothesis of an inverted U-shaped curve is found to be valid for similarity and innovation performance at the individual level then, as mentioned before, we would expect to see a positive co-efficient for each innovation output variable in the LowMed group and negative co-efficient for each innovation output variable in the MedHigh group. This would indicate that innovation partnerships which fall into the ends of the similarity range are more likely to have selected a 'no' or 'some' response to the innovation outcome variables. We would expect the means of the LowMed group to be higher for the 'all' or 'yes' category and lower for the 'all' or 'yes' category for the Med/High group. This would reflect the cognitive-distance model where for positive innovation performance, similarity moves towards the medium level of the CD range, before dropping off again as difference becomes too great.

Table 5.6 reports the results of the *t*-tests between low/med and med/high groups of similarity scores. Figures 5.7 & 5.8 create illustrative interpretations of the variables relationships which theoretical-similarity and aesthetic-similarity appear to represent.

Innovation measure	Similarity measure: Theoretical						Similarity measure: Aesthetic					
	t (LowMed)	df	r	t(MedHigh)	df	r	t (LowMed)	df	r	t(MedHigh)	df	r
Value range	0 - 10			5 - 22			0 - 10			6 - 29		
1. Achieve innovation objective	0.342	22	.07	-0.488	21	.11	-0.065	20	.01	-0.342	21	.07
2. Completed on time	1.094	25	.21	0.839	24	.17	0.280	23	.06	1.119	24	.22
3. Increased sales to existing clients	0.400	15	.10	-0.080	15	.02	-4.058 ***	14	.74	-0.357	17	.09
4. Sales to new clients in existing markets	0.268	16	.07	-0.684	15	.17	-1.849 *	15	.43	-0.778	17	.19
5. sales to new clients in new markets	1.387 *	16	.33	-2.908 ***	15	.60	-1.923 *	14	.46	-0.282	17	.07
6. Increased profitability	2.193 **	14	.51	-1.275	15	.31	-2.012 *	17	.50	1.497 *	16	.35

Innovation measure	Similarity measure: Economic						Similarity measure: Political					
	t (LowMed)	df	r	t(MedHigh)	df	r	t (LowMed)	df	r	t(MedHigh)	df	r
Value range	0 - 9			4 - 22			0 - 9			4 - 20		
1. Achieve innovation objective	-0.092	18	0.0	1.454	23	.29	0.855	21	.18	-0.178	21	0.0
2. Completed on time	-0.080	22	0.0	0.454	26	.09	-0.644	24	.13	0.576	24	0.1
3. Increased sales to existing clients	0.534	15	0.1	-1.359 *	17	.31	0.842	15	.21	0.655	16	0.2
4. Sales to new clients in existing markets	0.820	14	0.2	1.131	17	.26	0.001	16	.00	0.173	16	0.0
5. sales to new clients in new markets	-1.249	13	0.3	-0.882	17	.21	1.304	15	.33	-0.479	16	0.1
6. Increased profitability	-1.184	13	0.3	1.478 *	16	.35	0.831	15	.21	0.048	13	0.0

Innovation measure	Similarity measure: Social						Similarity measure: Religious					
	t (LowMed)	df	r	t(MedHigh)	df	r	t (LowMed)	df	r	t(MedHigh)	df	r
Value range	0 - 8			4 - 24			0 - 11			7 - 40		
1. Achieve innovation objective	0.394	22	.08	0.927	22	.19	1.434 *	22	.29	0.406	21	.09
2. Completed on time	-0.364	24	.07	-0.903	25	.18	-0.015	24	.00	-0.987	24	.20
3. Increased sales to existing clients	-0.981	16	.24	-0.985	18	.23	-1.351 *	16	.32	0.885	17	.21
4. Sales to new clients in existing markets	0.864	16	.21	-1.296	18	.29	0.479	16	.12	-0.531	18	.12
5. sales to new clients in new markets	0.523	15	.13	-0.750	17	.18	-0.840	14	.22	-0.676	18	.16
6. Increased profitability	0.553	13	.15	0.028	19	.01	-0.246	15	.06	-0.193	16	.05

P< .001***, P< .05**, P < .10*

Table 5.6: Results of the t-tests for similarity measures and innovation performance measures
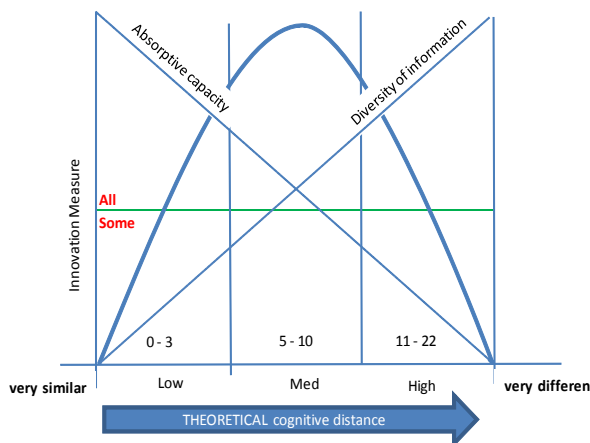
Figure 5.7: Illustration of theoretic cognitive-distance
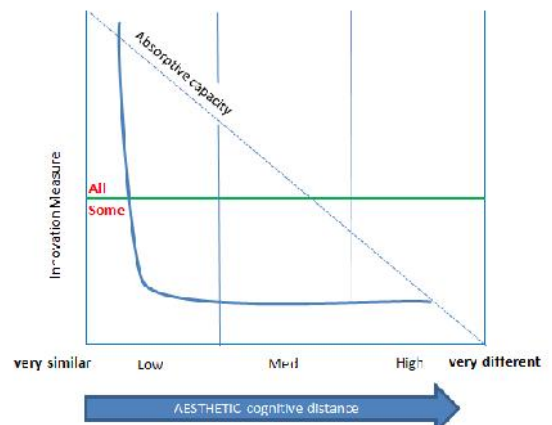
Figure 5.8: Illustration of aesthetic cognitive-proximity

5.5   Summary

This chapter presents the findings for the individual-level similarity analysis which used a sample of 39 small businesses and their creative industry partners. The descriptive statistics at the beginning give an overview of the characteristics of the innovation partnerships. The typical turnover for most firms was less than £500k with approximately a third of firms, both SMEs and creatives, stating revenue levels of less than £100k. The majority of the sample group from both sides of the partnership had fewer than ten FTE employees which establish them as micro-firms. Typically SMEs were trading in the business services and retail sectors. A surprisingly large proportion (85%) of the SMEs indicated they had innovated goods or services in the last three years, with nearly 50% of the sample group stating their innovations were 'new to market'.   Both these figures are higher than the external control group which might suggest that the group of mainly micro-businesses represented here is either more innovative than average, or there is a definitional misunderstanding about what, or how, innovation is.

Innovation projects for the group within the context of this innovation voucher-scheme programme were mainly incremental new-to-business types, mostly associated with website development or digital marketing.   Very few businesses provided information about their partner selection process so it is not possible to make any substantive comments about this point.

In terms of more personal data about the owners of the businesses, most typically they were in their 30s or 40s, under half had a higher-education qualification, but a third said they had previous education or training in some form of creative skills (no specific details on this was collected). The average salary for the group was £52,000, with nearly a quarter earning £80,000 or more. Typically the boundary-spanner for the SMEs is the business owner or founder.

Turning to the main part of the individual level analysis, as mentioned in the introduction, due to the relatively small sample group at this level of analysis (*n*= 39) it was not possible to follow the same method for testing the hypothesis of cognitive-distance (Nooteboom, 1996) as at the organisational-level of analysis which has a larger sample group (*n* = 121). Instead, this section of work undertook a theoretically-grounded directional correlation analysis by applying an independent-means *t*-test. The aim is to look for specific differences in similarity means between the dyads that met the innovation objectives, and those that did not. The approach was to test for some basic evidence of an upward slope of data points for the low/med similarity group producing a positive coefficient and a downward slope of data points in the medium/high similarity group producing a negative coefficient. This would suggest dyads in the medium category of similarity and dyads in the low and high categories were likely to have reported different innovation performance outcomes. That is, as the mean difference increases SMEs are more likely to have responded with 'all' and 'yes', up until a point somewhere in about the middle of the range, when SMEs increasingly begin to report 'some' or 'no' responses.

Two features of the data did emerge as more prominent and these are discussed in depth in the next chapter. But, as a summary, theoretic-similarity appears to be generally consistent with the positive/negative coefficient relationship and inverted U-shaped curve hypothesised by cognitive-distance, at least in terms of more systematic differences between the differences in mean for the successful and unsuccessful dyads. Secondly, while the outcome of the test on the aesthetic-similarity dimension doesn't conform to Nooteboom's predicted inverted U-shaped relationship it potentially presents some evidence of the opposite relationship for the low/medium-similarity– negative values on the coefficients, with some significance as well as medium-to-large effect sizes. This suggests that the low and medium-similarity groups do differ, but this time, there appears

to be some empirical evidence supporting the case for cognitive-*proximity,* where

partnerships between more *similar* firms appear to have better innovation outcomes*.*   A

broader discussion of these findings is made in the next chapter.

The results of a single analysis on this data using an independent *t*-test does not provide,

and cannot provide, any conclusive results about the effects of cognitive-distance for this

sample group. The research methodology at the individual level of analysis is designed to

test a new method of calculating a value for similarity between two individuals and then to

identify whether this measure provides some early, indicative results for the effects of

cognitive-distance to be further tested, ideally with a larger sample group in another study.

6.   DISCUSSION OF THE FINDINGS

6.1   Introduction

The starting point for this research is the concept of open-innovation in which firms seek

out, acquire and then combine externally sourced knowledge to generate new innovations.

Seen as an evolution or alternative to the 'closed', largely internal innovation models used

in the past, the 'open' approach has led to claims of a 'paradigm shift' in the manner in

which firms organise their innovation activity (Chesbrough, 2003a,b). There are

suggestions that by adopting an open- innovation approach, firms can improve their

innovation performance (DIUS, 2008) and much work has been done on considering the

implications of this shift in innovation practice at the individual firm level (Chesbrough,

2006; Dodgson, Gann and Salter, 2006; Laursen and Salter, 2006). In the early evolution of

the concept of 'open innovation' emphasis has been on the importance of knowledge

flows across company boundaries and more latterly, specifically with regard to open-

innovation, the challenges that it poses for SMEs (Chesbrough, 2010). These challenges

have included aspects like the relative lack of capacity in small firms to seek out and absorb

external knowledge.   But despite the apparent difficulties, empirical evidence suggests

that some SMEs do purposively engage in open-innovation (Brunswicker and

Vanhaverbeke, 2011) and that the prevalence of open-innovation among SMEs has

increased in recent years (van der Vrande *et al*. 2009).

Our key concern in this research has been the relationship between openness and

innovation performance in very small firms and the impact that similarities and differences

- in organisational practices and in the personal characteristics of the boundary-spanning

individuals - have on innovation project outcomes. It is reasonable to expect that some

small firms will be less open (Vahter, Love and Roper, 2012) and so the creation of

successful open-relationships could be considered to be important in providing a positive

perception of partnering, thereby stimulating and encouraging further openness. The SME

and creative industry firms in this research almost exclusively fielded their founder as the

key boundary-spanner. The study is therefore aimed at understanding not only the high-

level features which might affect the success of the project, but how different types of

similarities or differences at the interpersonal level might reasonably impact on innovation

enablers such as cooperation and collaboration. Specifically, do different degrees of

similarity make a difference to the innovation project? And if so, how does the range of

similarity appear to work?

6.2   Recapping

6.2.1   The Sample Group

The research data is drawn from a cohort of small businesses in the North-West of England

who applied for and were successful in receiving funding to undertake an innovation

project via a B2B innovation voucher scheme called *Creative Credits*. The *Creative Credits*

cohort comprised of 150 SMEs, typically trading within the business-services and retail

sectors, and suppliers from the creative industries whom they selected to partner them in

their innovation project. The *Creative Credits* programme was devised to explore two

earlier research findings. One, that supply chain relationships, in particular, may

contribute to innovation through the variety of interactions that take place between

buyers and sellers that support exchanges of information and the generation of new

knowledge (Roy *et al.*, 2004) and two, that there is evidence that firms with linkages to the

creative industries had significant positive impacts on some (but not all) dimensions of

their innovation behaviour. It seemed from this previous study that firms with stronger

B2B linkages into creative services are more likely to introduce product innovations

(Bakhshi *et al.*, 2008).

Small businesses are increasingly seen as an important focus of policymakers as they form

a large part of any developed economic structure, most employment is concentrated in

this group and they play an increasingly important role in economic growth and job

creation (Hoffman, *et al*., 1998). The sample group used here provided an opportunity to

examine a large number of small businesses in a similar geographical location working

together on an innovation project with similar time scales and with similar levels of project

funding.

6.2.2   The Theory

The Cognitive Theory of the Firm (Nooteboom, 2003) proposes that the identity a firm

projects, and its organisation more generally, together with its boundaries, are

determined by a culturally constituted organisational 'cognitive focus' which limits

'cognitive-distance' between people.   If this is done sufficiently well, it allows for effective

mutual understanding and agreement and leads to effective coordination (Nooteboom,

1992, 1999). This coordination has two features. On the one hand there is the

'competency side' comprising of knowledge, skills and other forms of expertise. On the

other hand there is the 'governance' side made up of goals, motives, interests and

approaches for conflict resolution. Nooteboom sees the benefit of complementary

knowledge and greater cognitive distance on the 'competency' side of his theory. But, on

matters of 'governance', he proposes that it is better to have relatively smaller differences

in cognitive-distance.

 The cognitive view of the firm as a 'focusing device' may give organisations an advantage

over 'the market' in that the experiences of its team creates tacit knowledge which is hard

to replicate outside of the organisation, but, its disadvantage, by its very nature, is the risk

of organisational short-sightedness or myopia.   Nooteboom sees this myopia as needing to

be mitigated by a degree of complementary cognition from outside the organisation and at a great cognitive-distance, from external collaborations.   He calls this external knowledge and experience domain the 'external economy of cognitive scope' (Nooteboom, 1992). He goes on to suggest there is 'optimal cognitive- distance' which is a mid-point trade-off between the advantage of increased cognitive distance for a higher novelty value of a partner's knowledge and the disadvantages of less mutual understanding. If cognitive-distance is too narrow, there is not much to learn from each other. If cognitive-distance is too large, then Nooteboom (1996, 2000, 2005) suggests there will be poor understanding, more chance of conflict and relationship breakdown.   Nooteboom proposes an inverted U-shaped relationship between cognitive-distance and absorptive capacity.

The Cognitive Theory of the Firm and its concept of cognitive-distance has been explored in an empirical form at the aggregate level of the organisation using alliances and collaborations between large and small businesses engaged in innovation relationships (Wuyts *et al*., 2005, Nooteboom *et al*. 2006). The methodology varied the interpretation of cognitive-distance, applying it in the narrow sense to one dimension (in technical cognitive-distance) and in a broader interpretation (in both technical and organisational dimensions). In some empirical settings tests for the effects of cognitive-distance has a measure of innovation performance such as patent applications (Nooteboom *et al*., 2006-33), and in others hypotheses are derived with recognised large assumptions (Wuyts *et al*., 2005-45). While the tests find evidence of the inverted U-shaped curve characteristic of cognitive-distance, the researchers recognise and highlight the flaws in the constructs and recommended further work which has both a direct measure of cognitive-distance and a clear measure of innovation output (Wuyts *et al*., 2005-45). Those tests have been run here.

6.2.3   The Innovation Measures and Data Collection

This research utilises a quantitative methodology to guide the data analysis using similarity measures at two levels, firstly at the organisational-level, and secondly at the individual-level. Both levels of analysis use the same six output variables taken directly from the second survey administered during the NESTA *Creative Credits* B2B innovation voucher scheme. Independent variables for the organisational level of analysis are constructed from responses to survey 1 in the same scheme. Full details of the similarity measure constructs can be found in the methodology section. But as an overview, at the organisational level input variables are created and organised into three different aspects of similarity:

1. *Strategic similarity* which combines different structural aspects of the firm such as number of employees, sales turnover, legal status and the age of the business.

2. *Search similarity* which collates data on activities and approaches to developing, sourcing and exploiting new information and knowledge.

3. *Knowledge application similarity* which combines data relating to innovation performance such as whether the SME had innovated new goods or services in the past three years, if innovations were new to market or new to the business and whether there had been any acquisition of machinery, equipment or software for innovation.

At the individual level, similarity measures were constructed from the Allport-Vernon-Lindzey *Study of Values* 4th edition (2003) which is based on Spranger's (1928) work on six classes of personal values   These Spranger personal value 'types' are organised into six different categories:

1. Theoretical

 2. Economic

3. Aesthetic

4. Social

5. Political

6. Religious

Spranger's work posits that dominant attitudes drive types of behaviours, particularly in new situations or environments. He proposes that individuals each have a primary attitude that dominates their behaviour, with other attitudes, depending on the situation, becoming subordinated to it.

Individual level similarity measures were calculated by summing the scores an individual attracted on a given attitude in the *Study of Values* questionnaire. The similarity score for the innovation dyads was derived by calculating the range between the SME score and the score of its creative supplier on each different attitude.

6.3   Reviewing the Method and Approach

The organisational-level analysis used a logit model to assess the theoretically-hypothesised relationship between three measures of similarity and their quadratic terms, and six innovation performance variables. A base case introduced control variables for *completed business plan, number of competitors, and % of workforce with a degree*. Model II presented the results for the basic explanatory model which included the linear terms for cognitive-distance in addition to the control variables. Model III added the quadratic-terms for the same measures. Model III was expected to yield a negative coefficient to create the inverted U-shaped relationship anticipated by Nooteboom.

Individual level similarity was measured using data collected via the Allport-Vernon-Lindzey *Study of Values* questionnaire. Thirty-nine pairs of SMEs and their creative suppliers were matched and their similarity measures organised into three groups – low, med and high. An independent means *t*-test was applied to explore the differences between the different groups. Theory predicted that, if the expected inverted U-shaped curve was found then there would be a positive sign on the coefficient for the low and medium similarity groups and a negative sign on the coefficient for the med and high level similarity groups.

Calculating the difference in similarity between the organisations takes time, but is methodologically straight-forward. Where firms are similar on a variable, let's say for example, that on strategic similarity they both fall into the same category for number of employees, they attract a score of zero. Where they are two or more categories different, then they are allocated a score of one. This binary model for scoring is clear and easy to grasp intuitively and allows us to highlight variation and to compile a ranking of firms in order of degree of similarity.

At the individual level, measuring the effects of similarity within the context of innovation projects is very unusual. And the method at this level is more complicated for two reasons. Firstly the businesses involved are likely to have to be approached for data collection directly and just like this study, collecting the amount of data required to be able to pair sufficient numbers of firms is likely to be time consuming and expensive. Secondly, the Allport Vernon Lindzey Study of Values, though a well-validated and credible instrument within the psychology domain doesn't seem, on the surface, to link very strongly to innovation and this feature was highlighted by some of the sample as their reason for refusing to complete it. Though conversely some of the sample completed it because they were intrigued by how the instrument was related to innovation and were interested in

seeing the results. The lesson learned here, then, is that the Study of Values can polarise response and can make collecting data at the individual level more difficult.

Devising similarity measures at the individual level followed a similar system to the organisational level - where answers were the same between the individuals, it attracted a score of 0 and where answers were different it attracted a score of 1. As before, it allowed the firms to be ranked from those with low scores who were most similar, up to those with high scores who were very different, together with a range of scores in between.

Choosing statistical tests was where the method for the two similarity levels began to diverge. With a sample group of 121 pairs at the organisational level, it was possible to use a specialised regression model used to analyse binomial response variables. And using a similar formula to Wuyts *et al*. (2005) and Nooteboom *et al*. (2006) it was possible to plot the coefficients into a graph which provides a graphical representation and output of the results. This helps to more clearly see the shape of the curves for each similarity measure. These graphs can be found on 122 in the results section.

Devising a way to test for the effects of cognitive distance on innovation outcomes at the individual level was more complicated due to the relatively small sample group (n = 39). Though there was a wider range of scores for cognitive-distance between the individuals than between the organisations, fewer observations meant that regression analysis wasn't considered suitable and so a more pragmatic approach was taken. The main thrust of the investigation remained the same though, to see if the test identified the predicted signs of the coefficients. At the individual level, scores for cognitive distance were split into three groups – low, medium and high – for each similarity measure. This way it was possible, using an independent-means *t*-test, to explore for differences between the high, medium and low-similarity groups and their innovation outcomes. If medium levels of cognitive distance led to better innovation outcomes, then we would expect to see a positive sign

for the low/med group (as firms moved towards medium levels of similarity innovation outcomes improved) and a negative sign for the med/high group (as firms moved away from medium levels of similarity towards high levels of similarity, positive innovation outcomes declined). The results of the independent-means *t*-test can be found in Table 5.6.on page 140.

The methodology created for this research and for measuring and testing cognitive-distance on innovation outcomes is a step-by-step process which can be easily replicated by other studies. The two levels of analysis could be used independently where only one level of data is available or combined together as in the approach for this study. Overall, the approach offers a systematic and replicable approach to measuring the effects of cognitive distance on innovation project outcomes at two levels of analysis.

6.4   The Empirical Results versus the Focal Theory

6.4.1   The Competency Strand

Exploring boundary-spanning activities through open-innovation links an organisation into an 'external economy of cognitive scope' (Nooteboom, 1992). This allows firms to seek out complementary competencies which in turn allow them to create more complex or differentiated products or services.

This activity requires interaction with other parties to tap into the knowledge and mental frameworks they have developed in their own individual course and pathways through the world and in different environments (Blackler, 1995). These interactions yield new knowledge, new skills and new expertise.

The competency side of the Cognitive Theory of the firm represents the more substantive side of cognition, in a narrower sense of job-related knowledge and skills that are

embedded in people, organisational structures, procedures and cultures (Nooteboom, 2002). To create the right conditions for knowledge transfer, and particularly for innovation, the novelty value associated with different levels of competency and capabilities between parties needs to be managed and a degree of distance between the skill sets and experience established which allow innovation performance to be enhanced. The hypothesis of cognitive-distance proposes that this is somewhere between very high levels, and very low levels of similarity. The upward line of novelty value and the downward line of absorptive capacity creates an inverted U-shaped curve with optimal cognitive distance somewhere in the middle.

The results of this research identify potential evidence of the inverted U-shaped relationship of cognitive-distance in three areas of similarity. In the *strategic* and *search* dimensions at the organisational level and in the *theoretical* dimension at the individual level. Each of these three dimensions appears to have a similar feature, in that very high levels or very low levels of similarity appear to be linked to poorer innovation project performance for the SME.

The organisational similarity measures constructed for this research relate to firm-level characteristics that are linked to internal routines and processes. Strategic similarity represents aspects of the scale and scope of the organisation and reflects the contribution of elements of the Resource-based View of the Firm (Penrose, 1959) to Nooteboom's Cognitive Theory of the Firm. Search similarity and knowledge-application similarity attempt to operationalise the dynamic-capabilities perspective of the theory.

The results of the search similarity measure is discussed first and represents the key finding from the organisational level analysis, as it displays both the hypothesised inverted U-shaped curve for most of the dependent variables and also shows some significance. Then aesthetic similarity is discussed in relation to the governance strand of cognitive distance.

Finally, the role of theoretical similarity is considered. Given the research creates a new method for measuring similarity between individual's working together on very specific types of innovation projects, an informed speculative discussion is made on why the theoretical and aesthetic measures may have emerged as the most relevant.

Search similarity is defined in this research as the firms drive to produce or discover new knowledge through its engagement in innovation-related activities. It is a measure constructed by adding values of similarity in five areas of the firm – internal R&D activities; acquisition of external R&D activities; acquisition of external knowledge; training for innovation specifically for the development and/or production of innovations; and prior innovation or collaboration on innovation projects with external parties.

On this measure, the SMEs in this sample appear to benefit from being neither too similar, nor too different to their creative partner. On a competency level, these firm-level based activities indicate two things, firstly the development of routines and processes for innovation and secondly an element of 'openness' in terms of seeking knowledge for innovation outside of the firms boundaries. Creating routines for innovation and making them part of the firms culture can yield more successful innovation results and helps to increase the absorptive capacity of the firm (Cohen and Levinthal, 1990). Through interactions with others competencies are developed and domains of knowledge extended (Blackler, 1995) creating a virtuous circle which helps to overcome the cognitive boundaries created by myopically goal-directed organisational activities (Nooteboom, 2006).

The inverted U-shaped relationship demonstrated by search similarity suggests that more successful innovation performance for the SME takes place where there is some overlap in knowledge and skills with its creative partner, but where there is also a range of

knowledge and experience that is new and where there may potentially be the opportunity to learn from each other.

The literature tells us that a central part of the innovation process is the way firms go about conducting their search for new ideas that have commercial potential. Differences in search strategies among firms influence their ability to achieve different levels of novelty in their innovative performance and firms who are more open, those who search widely and deeply, tend to be more innovative (Lauren and Salter, 2006). Search processes, therefore, can be seen as an investment in the ability to create, use and recombine new and existing knowledge. A variety of empirical studies have indicated that the character of a firms search strategy can significantly influence its innovative performance (Ahuja, 2000; Katila, 2002; Katila & Ahuja, 2002) and a formal search strategy is often seen as a dynamic capability that allow firms to gain and sustain competitive advantage (Eisenhardt & Marting, 2000).

The results of the analysis at the organisational level suggest that for this very specific sample group made up of very small businesses in transactional innovation partnerships, some differences in the search strategies between the organisations that is not at too great a distance or too similar, creates a condition that is beneficial to the SMEs innovation performance. How or why this works is difficult to assess given the particular research methodology, but the finding is commensurate with the competency strand of the Cognitive Theory of the Firm which suggests that difference between parties working on open-innovation projects should be managed to create the right conditions for knowledge transfer. The contribution of the search similarity measure and its emphasis on actively seeking out new sources of knowledge for innovation also provides some evidence for the potentially important role of dynamic capabilities in Nooteboom's theory.

6.4.2   The Governance Strand

Opening up the boundaries of the firm can enhance problems of coordination in the technical sense, but it also introduces other problems related to agency and to the intensions of partners to perform to the best of their abilities. This raises the question of how to motivate parties so that mutual interests are met, so that knowledge exchange is not inhibited and problems of hold-up do not ensue (Nooteboom, 2000).

The Cognitive Theory of the Firm draws on Transaction Cost Economics (Wiliamson, 1975) to support the governance and relational risk strand of 'cognitive focus'. Cognitive focus, through aligning goals, values and motives may reduce opportunism and build loyalty and intrinsic motivation between individuals replacing the need to dictate, coerce or provide material incentives.

The governance element generally requires close coordination and entails a narrowing process, in the elimination of redundancy, variety and ambiguity and therefore entails the need for a small cognitive distance

Figure 6.3: Illustrated relationship between aesthetic cognitive-distance and innovation performance

between parties for successful innovation performance (Nooteboom, 2000, 2002). This way categories of thought, motivations and interpretation of behaviour are closely aligned and cognition converges to help overcome problems of value judgements and opportunism (Nooteboom, 2002).

The result of this research provides some early-stage evidence of this type of relationship between the individuals involved as the key boundary-spanners between the organisations, where greater similarity appears to lead to better innovation performance. Identified at the individual level of analysis, aesthetic similarity is consistent with the governance strand of the Cognitive Theory of the Firm and presents a case for cognitive proximity in the additionality performance measures, particularly in increased sales to existing clients which is both highly significant and has a large effect size.

The aesthetic attitude (Spranger, 1928) from which this measure of similarity is constructed, reflects an individual's preference for self-development and the motivation, in interactions, to fill gaps in one's knowledge. Individuals who are strong on this scale, have the ability to project their experiences into many forms, such as colours, or pictures or tones. They have strong powers of self-expression and use this to take real experiences and impressions of the world and work them into objective, sensible creative results. They are very receptive to other individuals who are similar in levels of self-expression and imagination and prefer to work collaboratively, rather than alone.

Collaboration is much enhanced by understanding, supported by explanation (Nooteboom, 2000) and explanation is much enhanced by shared language and meaning (Smircich, 1983). Nooteboom sees a shared language between individuals as the bridge between the competency strand and the governance strand of a Cognitive Theory of the Firm, which develops the mutual understanding required to build up relational-trust (Nooteboom, 2002) which helps reduce the probability of conflict (Mohr and Spekman, 1994).

In the context of this research and the sample group, the role of the aesthetic attitude may represent some specialised mental framework which under these conditions reduces cognitive distance and yields absorptive capacity. Aesthetic similarity may provide a

focusing device (Nooteboom, 1992, 1999) which allows the individuals in the dyad to

achieve a common purpose even with different levels of knowledge and competencies.

6.4.3   Combining Competence and Governance

The previous sections outlined how some of the results found here may contribute to our

empirical understanding of the two issues which the Cognitive Theory of the Firm seeks to

explain. On the one-hand there is the need for medium levels of cognitive distance on the

competency side, discussed earlier in the context of the results for search similarity at the

organisational level. Then there was need for a close level of cognitive distance, better

thought of as cognitive-proximity, discussed in the context of the results for aesthetic

similarity between the individuals in the dyads.

There is a contemporary research strand that looks at how the governance and

competence perspectives of the Cognitive Theory of the Firm can be integrated into a

unified theory (Nooteboom, 2002).   The aim of this particular research was not to

investigate combinations of competency and governance, but as the findings suggest that

both aspects may feature as relevant for this particular sample group, it is perhaps worth a

speculative note on what that might mean, in the context of these types of firms and

individuals.

The small businesses whose innovation performance we are measuring appear to benefit

more when there is some degree of difference in their experience and approaches to

knowledge search activities, compared to their creative partner. Search strategies could

be seen as a specialist area of the 'external economy of cognitive scope' which Nooteboom

(1996) proposes external collaboration offers as a key feature for overcoming

organisational myopia. In potentially being exposed to new search approaches one, or

both, of the small businesses in the partnership may be developing the breadth and depth

of their search techniques (Lauren and Salter, 2006) and, as a consequence becoming more

'open'. Combining aesthetic cognitive-proximity with search cognitive-distance may ease

the effects of behavioural biases associated with the transfer of increasingly novel or

creative information (Morrison and Potts, 2009) enabling the partnerships to increase the

range of their absorptive capacity.

6.5   The Effect of Theoretical Similarity

The emergence of some role for the *Theoretical* attitude and its effect between the

boundary-spanning individuals here is an unexpected result. One might have expected the

Economic attitude to prevail, as it does in the standard profile (see page 134 for the typical

SOV profiles for this sample group) with its focus on purposeful behaviours aimed at

transforming resources into value-laden goods and the desire to gain the maximum

possible benefits from a given situation. The individual with a *Theoretical* attitude, in

contrast, has a different approach to life, which is to analyse problems, to explain them and to strive for objectivity and order. The findings here, albeit within a small sample, appear to

Figure 6.2: Illustrated relationship between Theoretical cognitive-distance and innovation performance

suggest that some difference in the way that the individuals 'think' benefits the project.

Because of the methodology set-up, there isn't a way to fully understand how or why some

level of diversity between the projects boundary-spanners works. But the theoretical

similarity measure is based on how the individuals think about, or value education and

learning and the systemised way in which they approach the gathering and organisation of information. There appears to be some dynamic within the dyadic relationship and between the individuals where some difference in the way they gather and order information creates some advantage up to a point, beyond which the benefits decline.

6.5.1   Speculative Discussion on Deeper Linkages between Measures and Outcomes at the Individual Level

So far in this chapter we have looked at the empirical results of the statistical tests relating to the similarity measures and innovation outcomes and have made a statement of position in terms of suggesting how firms might best align themselves for innovation partnerships based on those results if other studies confirm them as valid.

This section considers the results in a more speculative but informed fashion, going beyond the numbers and making an initial exploration and interpretation of the links which may lie beneath the empirics around the individual levels of similarity and specifically *theoretic similarity* and *aesthetic similarity*.

As mentioned earlier, the Cognitive Theory of the Firm proposes that effective coordination between organisations, or between individuals, is determined by two features. There is the 'competency side' comprising of knowledge, skills and other forms of expertise and capability. And then there is the 'governance side' made up of goals, personal motives and interests, and approaches for conflict resolution. For innovation, Nooteboom sees the benefit of complementary knowledge and greater cognitive distance on the 'competency' side, but on matters of 'governance, he proposes that it is better to have relatively smaller differences in cognitive-distance. This research has potentially shown us an example of each of those features within the individual level of similarity.

Given the objective of the SME – to work with a creative supplier on an innovation project with the aim to positively impact innovation performance and in turn, business performance, one might have expected some role for the economic similarity dimension with its focus on maximising returns and value. But here we seem to see that it is the theoretic dimension which is creating some form of positive impact, when individuals are neither the same, nor different, but somewhere in between.

To try and understand this further, it is worth revisiting the nature of the theoretic to try and understand the results a little bit more.

The theoretic dimension is measured by 20 questions. A possible score on the theoretic attitude runs from zero where someone is not drawn at all to this type of preference, to a maximum of seventy points where, relatively, an individual is very strongly aligned to the theoretical position. The score for the SME is deducted from that of its creative partner in order to get a value for the difference between them. If the dyad had a score of zero then it would mean that they had allocated, overall, the same amount of value to the theoretical questions. If the score was seventy, it would mean that their scoring for questions on this dimension has been completely different. Medium levels of similarity might mean that these partnerships were sufficiently similar, but not too similar and sufficiently different but not too different so that this particular attitude did not become polarised during the transaction.

Those with Theoretic preferences and traits are self-controlled and consistent in their behaviour, they intellectualise and analyse and organise things into an ordered whole so that they can master them. There is a strong desire to understand things and they will systematically gather facts and information to help them do that, working until they have mastered a new skill or solved a problem. Spranger's Theorists enjoy learning and are attracted to intellectual topics such as science or philosophy. They are not scared by

mathematics or formulas and logic-based approaches to thinking and will grapple with

more complex ideas and concepts. They tend to have mathematical minds.   Medium

levels of cognitive distance on this dimension may galvanise and stimulate the relationship

as each party recognises the opportunity to learn new ways of doing things from the other,

but at the same time there is the discipline and consistency within their character which

enables them to apply the learning.

The majority of the innovation projects funded from *Creative Credits* were used to upgrade

or enhance the organisations web-site from static web 1.0 designs to more interactive web

2.0 versions which begins to incorporate content updating options, blogging mechanisms

and improved SEO and social media tools for marketing. As the web evolves, the design

and programming requirements are becoming more complex, particularly around

sophisticated algorithms for searching and organising information. It might mean that

individuals who are natural learners and who are familiar and confident in the 'scientific'

space, react more easily to the degree of diverse knowledge and skills that may be needed

to undertake a project of this type.

Typically, the Spranger Aesthetic attitude is strongly subordinated to the Theorist so it

seems surprising to have these two dimensions both shows some link to positive

innovation performance. But this might reflect the context and be drawn out by the

innovation project typology. By this I mean that in web-design, these two different and

distinct mindsets may be complementary because on the one hand there is the need for a

rational and mathematic mind which can grasp the logic-driven 'back end' of web-design

mentioned before, but as important is the user interface which requires creativity and

imagination and the ability to confidently work with graphics, colour and form.

Spranger's classic aesthetics are very collaborative individuals and prefer working with

others than work alone. They are skilled at projecting their thoughts and experiences into

different kinds of forms, for example into colours, tones and pictures and they are good at expressing themselves, communicating their thoughts and ideas well. Whilst they tend to be very imaginative, aesthetics can also show objective 'sensible' creative powers and this helps build easy-going associations with people who have similar self-expression.

The literature suggests that for small business when drawing on external links and where internal resources are restricted, appropriate partner choice is a particularly important issue and indeed new types of innovation linkages are likely to have a large proportionate effect on their innovation performance (Vahter, Love and Roper, 2012). And as Potts and Morrison (2009) highlight, there are failure related to a business or individual in the innovation process who fails to embrace, absorb or retain the change that needs to take place to reach a successful innovation outcome. Two of these issues are around communication problems between partners, failing to connect with appropriate partners; and difficulties sharing knowledge between partners due to tacit dimensions or differing knowledge capabilities. This speculative discussion on the deeper linkages between the similarity measures and innovation outcomes may have highlighted some aspects of the partnership, particularly related to why some individuals may have worked better together than others, may lead to insights into understanding the underlying dynamics in transactions which require the transfer of novel or creative information.

These ideas remains an area to explore in the future where the conjectures made here can be formed more fully through specific testing. This might take the form of a qualitative study through observation in the workplace or perhaps interviews and a more in-depth and critical analysis of the outcomes of the innovation project.

6.6   Summary

Establishing eternal linkages with outside others in order to source new knowledge and ideas is at the heart of open-innovation (Chesbrough, 2003). With this opening up of a firms boundaries and the search through a network of suppliers and partners, opportunities are created and the quality of the innovation process can be accelerated or upgraded (Powell, 1998), but with the opportunities also come problems and a firm needs particular skills to navigate the uncertain and distributed environment and differences between firms can enhance the difficulties related to issues of motivation, communication and cooperation (Knudsen, 2007).

Recent open-innovation studies suggest that in recent years small businesses have increasingly been exploring the benefits of 'openness' (van de Vrande *et al.*, 2009) with some empirical evidence suggesting that it is beginning to be found as a purposely integrated part of their business strategy (Brunswicker and Vanhaverbeke, 2011), but in choosing to adopt this open-innovation approach, partner choice is seen, for small businesses, as a particularly important issue (Vahter, Love and Roper, 2012) and the debate about whether businesses benefit more from innovation partners who complementary or diversity of new knowledge and information rumbles on.

This study explored innovation partnerships between very small firms and their creative industry suppliers working on largely incremental innovations in new transactional commercial relationships. The analysis framework draws on the conceptual model of cognitive-distance (Nooteboom, 1996) which illustrates a relationship between novelty of information and absorptive capacity where innovation performance improves up to a point but then, as the novelty of the new knowledge goes beyond that point, performance begins to fall away. The optimum level of cognitive-distance is proposed as being somewhere between low levels of novelty and very high levels of novelty. This model was

applied here at two units of analysis – at the organisational level to reflect Nooteboom's

proposition that cognition is embedded in networks of firms, and at the individual level, to

reflect a second level of embedding in individuals in firms. Both levels of analysis used the

same six innovation performance measures but used dependent variables constructed

from different datasets. Organisational level constructs explored features of similarity

around the scale, scope and established innovation processes within the firms and

individual level constructs explored the similarity in six classes of personal values shared,

or not shared, by the individuals who were responsible for spanning the boundaries

between the two firms. These individuals attitudes and values perhaps in the shape of

cooperation or collaboration behaviours can be deemed to have influenced the innovation

project's success.

The degree of similarity was calculated by deducting one similarity score from another and

then an analysis undertaken to investigate for the proposed inverted U-shaped

relationship characteristic of cognitive-distance with the aim to establish evidence of an

upward slope of data as similarity increases and innovation performance improves, then a

downward slope of data as the benefits of similarity moves beyond an optimum point and

performance begins to decline.

The results of the study found evidence of the anticipated inverted U-shaped relationship

between similarity variables and innovation performance measures at the organisational

level for both strategic and search similarity, with statistical significance found for some

innovation performance measures in search similarity, particularly in measures which

indicate the exploitation of current markets. The results present some very early evidence

to suggest that very small firms partnering on these kinds of incremental innovation

projects may benefit from some diversity between themselves and their partner in terms

of their scale and scope, but particularly some medium levels of difference around their

experience and methods for identifying and utilising sources of new knowledge.   At the individual level, the study found similar evidence of the hypothesised inverted U-shaped curve for theoretical similarity, which though the study had not hypothesised which individual similarity measures might emerge as distinct, came as some surprise. So, too, was some evidence of the role of cognitive-*proximity* for the aesthetic range of scores. On this dimension, partners benefited from being very similar. The results of the study might possibly combine to suggest that, within this type of sample group, working on incremental innovations in transactional commercial partnerships, some differences in the scale of the businesses, some differences in the firms experience of seeking out new knowledge for innovation, some differences in the way that the individuals approach and tackle situations that require mental application, and finally, being very similar to each other in creativity and imagination, may yield the best innovation performance and results.   This may be seen as combining Nooteboom's two strands from the Cognitive Theory of the Firm (2003), the competency strand for job-related knowledge and skills where managed distance between parties creates the right conditions for knowledge transfer, and the governance strand closely associated with personal norms and values which leads to quicker, stronger bonding and intentional trust (Nooteboom, 1996, 2000).

7.   CONTRIBUTIONS OF THE RESEARCH

7**.1   Introduction**

This research considers the effect of different dimensions of organisational and individual-level similarity on innovation outcomes.   The data is supplied by a sample of small businesses working with creative industry suppliers on small-scale innovation projects. The research methodology applies the model of cognitive-distance proposed by Nooteboom in his Cognitive Theory of the Firm (2003).

Cognitive distance is defined as the difference between an organisations or individuals mental model of the world and the extent to which their domains of knowledge overlap. The Cognitive Theory of the Firm proposes that in order to learn, particularly in collaborations for innovation, a degree of cognitive-distance is needed to introduce novel information into the firm which can then be combined with current knowledge and converted into new ideas and applications. Too little cognitive-distance and partners have little to learn from each other. Too great a cognitive- distance and partners may fail to understand each other or find difficulties working together. A trade-off is proposed where parties have sufficient overlap of knowledge to allow them some commonalities for communication and developing a relationship, but complemented with a range of diverse knowledge and experience so that parties have something new to draw upon and learn from each other. The model of cognitive-distance implies an upward slope of beneficial interaction where performance is enhanced to a threshold, beyond which there is a downward slope of increasingly diminishing returns as information becomes too novel and too difficult to relate to and absorb. This changing dynamic within the knowledge exchange is represented by an inverted U-shaped curve where optimal cognitive-distance lies somewhere in between high levels of similarity and high levels of difference.

The research develops and applies an analytical framework to explore the effects of different levels of cognitive-distance on performance, applying the concept to the organisation and the individual level in the innovation partnerships.

The section begins with an argument for the theoretical and methodological contributions of the work, particularly around the empirically original use of the *AVL* Study of Values 4th edition (2003) questionnaire as a method of measuring similarity between innovation dyads and how applying this new method has advanced the Cognitive Theory of the Firm. The empirical findings of the research are compared to a 'perfect' cognitive distance model and also to the curve plot created from Nooteboom's (2006-33) own empirical cognitive-distance work. The practical implications of the research are highlighted and their robustness and generalisability assessed in the light of the small sample size, and the specific industrial context, leading to a general review of the limitations of the research.

7.2 Contributions of the Research

This research makes three contributions

1.   The empirical domain for cognitive-distance (Nooteboom, 1996) is extended to

     the small and micro-business sector.

2.   The analysis identifies a component of the Cognitive Theory of the Firm – dynamic

     capabilities (Teece *et al.,* 1997) as operationalised through the *search-similarity*

     measure – as a potential primary driver of the cognitive-distance relationship in

     this type of sample group.

3.   The methodology for measuring similarity and difference for innovation is

     extended from the organisational level to the individual level. The scope of a

     personal values scale is broadened from measuring similarity and difference for an

     individual to a measurement tool for measuring differences between dyads.

7.2.1. Contribution to Theory

This research contributes to the research framework built around the Cognitive Theory of

the Firm (2006), a field of study which highlights and positions at centre-stage the role and

extent of one's collective and individual knowledge range and domain in influencing

dynamics within a firm and between firms, particularly for innovation.

The Cognitive Theory of the Firm is operationalised through the concept of cognitive-

distance – a model which uses the notion of a 'trade-off' between the novelty of

information that is transferred and the level of absorptive capacity required in the

receiving party in order to understand and utilise the information.

The work done here extends the Cognitive Theory of the Firm in two ways.

First, it deconstructs the original theory into its component parts and uses a variety of input similarity variables, related to each component part, to see if the inverted U-shaped relationship proposed as 'cognitive-distance' is a feature only of the combined theoretical base or, whether each contributing factor of the theory shows the same trade-off between distance and performance. What we find is that the main components of Nooteboom's theoretical construct seem to be instrumental in providing some degree of contribution to the overall notion of the increasing and then decreasing benefits of cognitive distance. For example, at the organisational-level the strategic-similarity measure reflects the issues emphasised in Penrose's Theory of the Firm which is the cornerstone of the Cognitive Theory of the Firm. Also at the organisational-level the search-similarity measure reflects the dynamic capabilities (Teece *et al*., 1997; Dosi *et al*. 2000) element of the theory. At the individual level theoretic-similarity taps into the activity theory (Blackler, 1995) component, and aesthetic-similarity links to the theories TCE strand (Williams, 1975). The research here finds evidence of an inverted U–shaped relationship for some dependent variables in strategic, search and theoretic-similarity. This finding is consistent with the conceptual basis of the Cognitive Theory of the Firm and may help to allay some of the criticisms made against it. Furthermore, the aesthetic-similarity dimension appears to be supplying some early empirical evidence of the influence of cognitive-*proximity* on innovation performance for this particular type of sample group.

The research conducted here, in the shape of search-similarity, may have identified one component element of the Cognitive Theory of the Firm which plays a disproportionately powerful role. At least within the context of the sample group here, search-similarity at the organisational level is found to reflect both the expected inverted U-shaped relationship between cognitive-distance and innovation outcomes, but also has statistical

significance. This may begin to help us unravel a single underlying dynamic which may be influencing these small business innovation partnerships.

This work makes a further contribution to theory in terms of the setting for the research. Previous empirical tests of cognitive-distance (2005; 2006) have explored inter-firm relationships in technology-led organisations operating in industries which tend to have established R&D programmes and more formal innovation agendas, such as pharma, bio-tech and ICT. The results here extend the range of the assessment of cognitive-distance into the sphere of interfirm relationships between very small businesses in transactional associations and which are likely to have more informal and ad hoc innovation practices.

And finally, this research makes an empirical contribution to the hypothesis of cognitive-*proximity* which the Cognitive Theory of the Firm identifies as a key condition for successful governance in interfirm and interpersonal relationships. The work here finds some evidence to support the hypothesis at the individual level of analysis and provides an illustrative model in figure 5.8 on page 140 of what the relationship between cognitive-proximity and absorptive capacity appears to look like for this sample.

Page 172 provides a comparison of the hypothesised model of cognitive-distance, with the results of Nooteboom's empirical work (2006-33), and the results of the work here, in the three organisational dimensions.
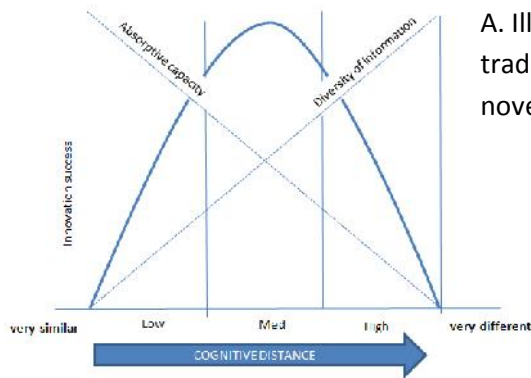
A. Illustration of Nooteboom's proposed trade-off between absorptive capacity and novelty of information.

B. Nooteboom's curve plot produced from his empirical data (2006-33)
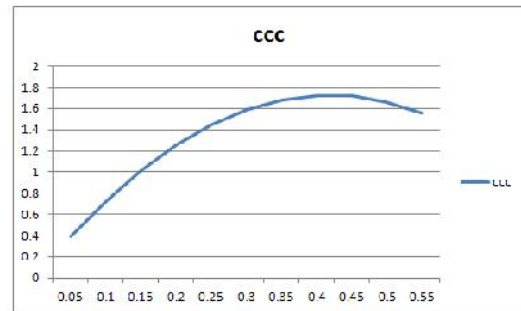
Nooteboom et al. (2006)
Empirical test of cognitive distance and technological capital on absorptive capacity of an innovating firm

Strategic similarity and sales to new clients in existing markets

| Sig | 0.031 |
| Invert | 0.033 |
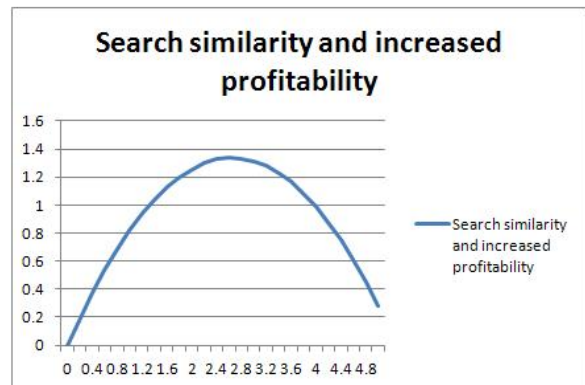
Knowledge similarity and sales to new clients in existing markets

| Sig | 0.367 |
| Invert | 0.392 |

Search similarity and increased profitability

| Sig | 0.029 |
| Invert | 0.029 |

C., D., E. Results of the empirical work here for organisational-level strategic, search and knowledge application similarity

7.2.2.   Contribution to Method

Previous empirical tests of Nooteboom's (1996) hypothesis of cognitive-distance have

been confined to the organisational-level of analysis. This research, too, explores this

organisational-level domain, but extends it into the niche of the small and micro-business

sector.

Where the current study on cognitive-distance diverges from and extends that gone

before, is the method devised to explore similarity at the individual-level.

The method begins with a scale developed to uncover the deeply-rooted personal values

that drive individuals' beliefs, attitudes and behaviours and evolves it into a technique for

gathering data across a dyadic partnership and in the process establishing a routine for

calculating the difference in values between the pair. The Allport-Vernon-Lindzey Study of

Values 4th edition (2003) is a validated, ipsative, psychometric scale used previously only in

values studies whose objective was to establish an individual's values profile. These

profiles were produced either for the purpose of better understanding one's own personal

values and how they might drive behaviour, or for the purpose of producing profiles for

comparing individual work groups,

 The new method developed here offers a systemised-tool which helps to identify how

similarities or differences affect the dynamics of the innovation relationships at a more

nuanced level and potentially opens up the way for new studies where specific dimensions

and combinations of similarity and difference and their impact on performance, either for

innovation or other collaborative objectives, could be explored.

Further, by quantifying the differences between individuals across six different classes of

values, the data produced by the new method could be used both to initiate and support

qualitative face-to-face discussions around similarity or difference for partnerships or, as it has been here, as a data-compiler for running statistical tests.

7.2.3 Contribution to Practice

The starting point for this research is the idea of open-innovation in which firms combine, seek out and acquire externally available knowledge inputs to generate new innovations for their business. There are suggestions that by adopting an open-innovation approach, firms can improve their innovation performance (DIUS, 2008). In the early evolution of the concept of 'open-innovation' (Chesbrough, 2003a) much emphasis has been placed on the importance of knowledge flows across company boundaries. However, open-innovation appears to pose particular challenges for SMEs because of the relative lack of capacity to both seek and absorb external knowledge (Chesbrough, 2010). It is seen as reasonable to expect that small firms will be less open (Vahter, Love and Roper, 2012) and so establishing the conditions to improve the chances of successful open-innovation relationships could be considered to be important. Early successes in open-innovation partnerships may provide a positive perception of partnering for small businesses, and so stimulate further linkages and openness.

This piece of research has taken place in quite a specific context (very small firms working on transactional innovation projects with a creative industry partner) and within a small sample (organisation level: n = 121; individual level: n = 39). If results found here proved valid with other sample groups and within other contexts too, we might at this stage cautiously suggest there may be some implications in the future for how firms may go about selecting their innovation partners. The following propositions are made on this basis.

The research found evidence of the benefits of some diversity on measures related to the competency side of the business and some evidence of the benefits of similarity on a measure related to the governance side of the business. Whilst the findings are far from conclusive and have several limitations, this section explores some possible implications of those findings for three main constraints around which issues appear to pivot for small businesses attempting open-innovation:

A. Innovating versus Business-as-Usual

A view from the literature: managing the imbalance between pursing open-innovation activities and maintaining daily business can be difficult for small businesses (Hewitt-Dundas, 2006)

By understanding the areas where similarity or diversity may aid the transfer of knowledge and information and enhance their innovation performance, small businesses may be able to improve their chances of success in innovation projects which may, in turn, allow them to compete more effectively in their market or industry sector.   By providing them with some insights into the role of the different similarity mechanisms, firms may be able to upgrade and strengthen their innovation processes leading to more successes than failures in their efforts, embedding a more organised and formalised internal innovation process which offers sufficient value to the organisation to justify the trade-off between innovation activities and business-as-usual.

Firms who begin to learn to manage and then optimise the similarity/diversity model of innovation partnerships might improve their ability to gather and process the types of distributed information and knowledge associated with emerging best practice innovation, make new connections and networks and potentially yield new sources of value, increasing their absorptive capacity in the process.

This implication predicates around the more recent writings associated with the Resource Based View of the Firm which have emphasised that irrespective of the uniqueness of the firm's resources and capabilities these cannot *sustain* a competitive advantage. 'Both the skills/resources and the way organisations use them must constantly change, leading to the creation of continuously changing temporary advantages (Fiol, 2001, p. 692) The ability to continuously reconfigure resource, capabilities and competencies is defined as 'dynamic capabilities' (Teece *et al.*, 1997).

Whilst in this research we find some relationship between medium-levels of strategic similarity and innovation performance, the measure which has the greatest implication and potential for making us think about how we might adjust the organisational focus to create equal space and resource allocation for innovation is *search similarity*. Managing, and potentially, optimising *search similarity* in innovation partnerships could allow small businesses to develop their ability through learning economies of scale. Getting the right level of diversity and overlap between partner firms search approaches may provide the right condition for prioritising innovation in small businesses and establishing a more formal internal innovation agenda.

B. Overcoming Behavioural Constraints which create Barriers to Innovation in Small Businesses

A view from the literature: people factors are found to have more importance for small businesses in creating a successful open-innovation mindset (Lin and Zhang, 2005). High levels of commitment, communication and trust between parties are key to open-innovation relationship success (Tidd and Bessant, 2005).

We learned here that there may be personal values which, when closely aligned, aid communication and help develop 'fast trust'. Making this connection at the level of personal values may help establish positive early interactions and personal behaviours which fit well with the perception of each party about how business 'should be done'. This may help develop the levels of commitment required to achieve objectives on both sides of the transaction and to subordinate actions such as self-interest or opportunism which can suppress willing knowledge transfer and sharing and be the foundation for conflict and relationship disharmony and breakdown.

In this work *aesthetic cognitive-proximity,* though emerging from a small sample (n = 39), provided some early signs that matching innovation partners on this dimension may help innovation performance and that firms which were very different to each other in terms of their aesthetic perception of the world, might be less likely to work successfully together, at least on short transactional innovation projects which involve a creative services partner.

This implies that there may benefits to getting partnerships to test the aesthetic dimensions of their personality and character and to experiment with how different levels of *aesthetic proximity* and *aesthetic diversity* impact their innovation attempts.

It may also mean that by combining medium levels of *search diversity* and close levels of *aesthetic proximity* could lead to the foundations, in small businesses, for possible enhanced innovation performance.

C. Finding the Right Partners for Innovation

A view from the literature: having the skills and experience to find the right partners for

innovation is important. (Enkel *et al. 2009).*

Partnering for innovation involves two parties and small businesses may often be

unattractive or un-noticed co-operation partners for other enterprises, especially for large

ones (Chesbrough, 2010).   But even in transactional innovation relationships with

suppliers, such as the sample group we have here, evidence suggests that small firms

struggle to search through a universe of potential knowledge sources which may help them

in their innovation efforts, particularly where those sources are outside the firm's

boundaries (Darr and Kurtzberg, 2000). Due to resources and capabilities shortages, this

may mean that the opportunity cost involved in seeking and selecting a suitable partner

could be very high and even beyond the means of many small firms. There is also relatively

little known about the costs involved in developing external knowledge-based relationships

and so developing these kind of linkages with any kind of strategy is seen as very much a

minority sport among small firms (Vahter, Love and Roper, 2012). Nevertheless, the

potential benefits which increased breadth of linkages can offer is significant with

increased external boundary-spanning linkages formed as part of a small business strategy

boosting markedly their level of innovation behaviour (Vahter, Love and Roper, 2012).

Because of those fewer internal resources, small firms are often forced to turn to external

networks to plug the resource and knowledge gaps, and form informal transactional

innovation relationships stimulated by necessity and geared towards incremental

innovation. In this way contemporary small firms have tended to side-step the formalities

involved in early innovation models and moved instead directly into boundary-spanning

activities linking them directly with outside others (Tidd, 2006). Those first boundary-

spanning linkages often begin by seeking out sources and directions for open-innovation

through interactions along the value chain, among customers and suppliers. Suppliers, particularly may be a very relevant partners for small businesses because they concentrate on solutions and commercial value in the short-term (Dyer and Singh, 1998), they may help consolidate and enhance an SMEs core competencies, reduce its development time and cost for projects, shorten innovation and market cycles, and improve the efficiency and the performance of the SMEs innovation overall (Praest, Knudsen and Mortensen, 2011).

But, where small businesses get as far as establishing an open-innovation relationship, the business owners seem to be particularly prone to initiating a sequence of behavioural biases which affect them as they attempt to innovate (Morrison and Potts, 2008). As the new relationship is established and begins to develop, as the SME experiences conditions which are less familiar, particularly for those businesses who have less experience working with an external innovation partner, and where there is the necessity for the transfer of novel or creative information, an individual's rationality or 'working rules' can fail, leading to a dysfunctional response (Conlisk, 1996). This domain of 'bounded rationality', where one is not sure which alternative is best, where preferences may be inconsistent and payoffs unknown, trust, not only in judgement and competence, but in unselfish values, play a determining role in the relationship (Rosanas, 2004).

But if they perhaps have more to gain than their larger counterparts when drawing on external links, their internal resources are restricted, which makes appropriate partner choice a particularly important issues (Vahter, Love and Roper, 2012). However, the approach to partner selection and the criteria that small firms use to select for partner selection is found to vary, reflecting, Joen *et al*. (2011) believe, the internal capabilities available in the firm and their innovation ambitions.

What we may have found here, in this research study, is the rudimentary beginnings of an innovation partner selection approach. Whilst the findings are quite specific to a

partnership context (value-chain and industry specific) it may be the foundation for a mechanism for helping small businesses to shorten and potentially strengthen their partner search activities and process. The implications of this are several.

Firstly, it provides a framework, particularly for very small businesses which are not innovation savvy, to begin to understand the differing benefits of cognitive-diversity and cognitive-proximity in innovation partnerships.

Secondly, it establishes a transparency to a selection process which may simplify and speed up the identification of a suitable partner.

Thirdly, with fuller testing of the model and more refinement of our understanding of how the measures work it could be that it is possible to create a small business partnering tool that provides a trajectory along which firms progress from working with similar partners to more diverse partners as their skills and experience and absorptive capacity improves. This might facilitate among small business a supported journey along the innovation process trajectory developing, in a more systematic manner from more straight-forward, small, new-to-firm incremental innovations with value-chain parties such as suppliers, towards more complex relationships working with long-term orientation and aimed at achieving joint value creation (Goffin and Mitchell, 2005). At this end of the scale, small businesses could potentially be working with organisations with greater levels of diverse knowledge who exist at medium to high levels of cognitive-distance and whom may offer the opportunity to explore more radical ideas which may lead to the creation of innovations which offer greater differentiation for the firm and a stronger market position.

By creating a steady evolution of innovation partnerships along the learning trajectory in a more controlled manner, small businesses may learn to trust the innovation process and to begin to shift it from an ad-hoc activity driven by opportunity or interest (Hewitt-Dundas,

2006) towards a more strategic approach as the firm begins to realise its importance for long-term sustainable competitive advantage.

7.3   Limitations of the Research

7.3.1   Research Strategy – the narrow industrial context

This research used organisations which had applied to be part of a B2B innovation voucher scheme for businesses based in the North-West of England. Though the programme was open to all businesses in the area which met the definition of 'SME', predominantly those who applied were very small and micro-firms. Secondly, the innovation voucher programme was designed to encourage linkages between SMEs and businesses in the creative industries. As such, all the innovation partnerships which took place here involved one non-creative business and one business from the creative industries.

7.3.2   Sample size

The sample size for dyads at the organisational level provided 121 observations on which we were able to apply regression analysis. However, the sample group of pairings at the individual level was much smaller, with, in the end, just 39 matched from the 82questionnaires returned. As such it was necessary to use a more practical approach to analyse differences. Whilst the approach remains robust, the size of the sample group potentially impacts on the quality of the findings and the ability to effectively answer the individual-level research question.

7.3.3   The nature of the limitations

This research took place in a very specific context where small businesses were encouraged to use a supplier in the creative industries to work on an innovation project. Research shows that creative innovation services can help overcome behavioural failures

associated with innovation (Potts and Morrison, 2009), particularly around working with

novelty. Firms in the creative industries have long been practiced at working in

environments which create and appropriate returns from that novelty on a routine basis.

These innovation capabilities are not easily codified or packaged and therefore often

require one-to-one engagement to be successfully transferred (Potts and Morrison, 2009).

Part of the innovation services that creative industries can provide is in the provision of

models and tools to aid imagination and creativity which help customers imagine new

possibilities and opportunities. They do this by using simulation and visualisation

techniques. This helps firms and consumers to more clearly imagine different futures,

while the creative firm carefully calibrates acceptable differences (Nooteboom *et al*, 2006).

Creative firms further aid their customers or users by displaying, in the form of business

models and working practices, new models of different behaviours and practices which

through customer imitation trigger reflection that may lead to changed behaviours (Earl

and Potts, 2004; Lanham, 2006). Businesses in the creative industries are much closer to

the 5G innovation model than earlier innovation generations; the work is often modular

and project-driven and more naturally based on open-innovation and flexible business

models (Caves, 2000; Von Hippel, 2005; Eikhof and Haunschild, 2006). This is highlighted

as a limitation of the research as these creative industry core- competencies may have

combined to create the right conditions which more readily support the hypothesis of

cognitive-distance. This means, until further studies are conducted using small business

partnerships in other industries, the findings here may be consequential of this type of

very particular innovation partnership.

In terms of the sample size, at the individual level of analysis it was only possible to create

39 pairings of data out of the 82 *SOV* questionnaires that were returned. This is a

recognised difficulty in similarity studies – the necessity to gather sufficient number of

responses from both parties in the dyad. This limited the ability to fully test the concept of cognitive-distance at the individual level and also restricted the type of analysis that could be conducted. An independent *t*-test allowed us to compare the difference in means between the low, med and high-similarity groups, but not to look at relationships between variables as a regression analysis would have allowed. However, the method allowed the research to at least investigate if the expected signs on the coefficients for each group were produced.

7.3.4   How the limitations might be overcome

The key to overcoming the first limitation would be to extend this methodology to small business partnerships which did not involve firms from the creative industries. This would allow us to retest the similarity measures at both levels of analysis and particularly to investigate whether the aesthetic dimension produced a similar result or whether this was, indeed, a factor specific to the creative-industry context. In terms of increasing the sample size, I would recommend that a more careful positioning of the value of the approach and content of the Study of Values and a stronger argument for the link to innovation may encourage a larger number of participants.

Though a positivist approach is less likely to suffer from the subjectivity that can be found in the interpretive methods associated with qualitative research, it cannot be fully ruled out that bias and preconceptions are factors which inevitably influence a researchers work at least to some degree, but being aware of that vagary at least allows one to be on guard against one's own epistemological and ontological idiosyncrasies. Although techniques were used to avoid bias and preconceptions, it cannot be guaranteed that another researcher using the same methodology would report exactly the same observations.

7.4 **Further Research**

7.4.1 Examining the conceptual framework using similar measures in a new context

One of the questions raised here was whether context-specific conditions contributed to the results that have been reported. This could be investigated by applying a similar methodology to small businesses working with a non-creative industries supplier on product development e.g. small high-value-manufacturing firms working together.

7.4.2 Building on a particular finding that was not anticipated

The individual level analysis suggests that cognitive-proximity on the aesthetic dimension may play some role in innovation partnership performance. Further research could investigate whether aesthetic similarity also features in small business innovation partnerships within industries which are typically less innovative e.g. construction or retail.

7.4.3 Address unanswered aspects of the research questions

The size of the sample group at the individual level of analysis precludes this research from reporting more than a starting-point for evidence of the effects of cognitive-distance between individual boundary-spanners in innovation partnerships. A more robust result could be produced by repeating the same research methodology at the individual level with a similar cohort of businesses, but with a sample size which would enable the researcher to conduct a more extensive test of the concept of cognitive-distance and/or cognitive-proximity.

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Appendix I: Part I – Study of Values (20 minutes)

DIRECTIONS: A number of controversial statements or questions with two alterative answers are given below. Indicate your personal preferences by writing appropriate figures in the boxes to the right of each question. Some of the alternatives may appear equally attractive or unattractive to you. Nevertheless, please attempt to choose the alternative that is *relatively* more acceptable to you. For each question you have three points that you may distribute in any of the following combinations.

There is no time limit, but please do not linger over any one question or statement, and do not leave out any of the questions unless you find it really impossible to make a decision.

1.   The main objective of scientific research should be the discovery of truth rather than it's practical applications. (a) Yes; (b) No.

2.   Taking the Bible or the Koran as a whole, one should regard it from the point of view of it's beautiful mythology and literature style rather than as a spiritual revelation. (a) Yes; (b) No.

3.   Which of the following individuals do you think should be judged as contributing more to the progress of the human race? (a) Aristotle; (b) Abraham Lincoln.

4.   Assuming that you have sufficient ability, would you prefer to be: (a) a banker; (b) a politician?

5.   Do you think it is justifiable for great artists, such as Beethoven, Wagner and Byron to be selfish   and negligent of the feelings of others? (a) Yes; (b) No.

6.   Which of the following branches of study do you expect ultimately will prove more important for the human race? (a) mathematics; (b) theology.

7.   Which would you consider the more important function of modern leaders? (a) to bring about   the accomplishment of practical goals; (b) to encourage followers to take a greater interest in the rights of others.

8.   When witnessing a gorgeous ceremony (ecclesiastical or academic, induction into office, etc.), are you more impressed: (a) by the colour and pageantry of the occasion itself; (b) by the influence and strength of the group?

9.   Which of these character traits do you consider the more desirable? (a) high ideals and reverence; (b) unselfishness and sympathy.

10.   If you were a university professor and had the necessary ability, would you prefer to teach: (a) poetry; (b) chemistry and physics?

11.   If you should see the following news items with headlines of equal size in your morning paper,   which would you read more attentively? (a) Leaders of different religions to consult on reconciliation; (b) Great improvement in market conditions.

12.   Under circumstances similar to those of Question 11?

        (a) Supreme Court renders decision; (b) New scientific theory announced.

13.   When you visit a cathedral, synagogue or mosque are you more impressed by a pervading sense of reverence and worship than by the architectural features and beauty? (a) Yes; (b) No.

14.   Assuming that you have sufficient leisure time, would you prefer to use it: (a) developing your mastery of a favourite skill; (b) doing volunteer social or public service work?

15.   At an exposition, do you chiefly like to go to the buildings where you can see: (a) new manufactured products; (b) scientific (e.g. chemical) apparatus?

16:     If you had the opportunity, and if nothing of the kind existed in the community where you
live,   would you prefer to found: a) a debating society or forum; (b) a classical orchestra?

17.   The aim of religious institutions at the present time should be: (a) to bring out altruistic and charitable tendencies; (b) to encourage spiritual worship and a sense of communication with the highest.

18.   If you had some time to spend in a waiting room and there were only two magazines to choose from, would you prefer: (a) SCIENTIFIC AGE; (b) ARTS AND DECORATIONS?

19.   Would you prefer to hear a series of lectures on: (a) the comparative merits of the forms of government in Britain and in the United States; (b) the comparative development of the great religious faiths?

20.   Which of the following would you consider the more important function of education? (a) it's preparation for practical achievement and financial reward: (b) it's preparation for participation in community activities and aiding less fortunate persons.

21.   Are you more interested in reading accounts of the lives and works of individuals such as (a) Indira Gandhi, Theodore Roosevelt and Winston Churchill; (b) Ayn Rand, Jean-Paul Sartre, and Immanuel Kant?

22.   Are our modern industrial and scientific developments signs of a greater degree of civilization than those attained by any previous society, the Greek, for example?

23.   If you were engaged in an industrial organisation (and assume salaries to be equal), would you prefer to work: (a) as a counsellor for employees; (b) in an administrative position?

24.   Given your choice between two books to read, are you more likely to select: (a) THE STORY OF RELIGION IN AMERICA; (b) THE STORY OF INDUSTRY IN AMERICA

25.   Would modern society benefit more from: (a) more concern for the rights and welfare of citizens: (b) greater knowledge of the fundamental laws of human behaviour?

26.   Suppose you were in a position to help raise standards of living, or to mould public opinion. Would you prefer to influence: (a) standards of living; (b) public opinion?

27.   Would you prefer to hear a series of popular lectures on: (a) the progress of social service work in your part of the country; (b) contemporary painters?

28.   All the evidence that has been impartially accumulated goes to show that the universe has evolved to its present state in accordance with natural principles, so that there is no

necessity to assume a first cause, cosmic purpose, or God behind it. (a) I agree with this statement; (b) I disagree.

29.   In a paper, such as the Sunday Times, are you more likely to read: (a) the property sections and the account of the stock market; (b) the section on picture galleries and exhibitions?

30.   Would you consider it more important for your child to secure training in: (a) religion; (b) athletics?

Part II – Study of Values

DIRECTIONS: Each of the following situations or questions is followed by four possible attitudes or answers. Arrange these answers in the order of your personal preference by writing, in the appropriate box at the right, a score of 4, 3, 2, or 1. To the statement you prefer most give 4, to the statement that is second most attractive give 3, and so on.

 You may think of answers which would be preferable from your point of view to any of those listed. It is necessary however, that you make your selection from the alternatives presented, and arrange all four in order of their desirability, guessing when your preferences are not distinct. If you find it really impossible to state your preference, you may omit the question. Be sure not to assign more than *one* 4, *one* 3, etc., for each question.

1.   Do you think that a good government should aim chiefly at:

        a. more aid for the poor, sick and old
        b. the development of manufacturing and trade
        c. introducing highest ethical principles into its policies and diplomacy
        d establishing a position of prestige and respect among nations

2.   In your opinion, can a person who works in business all the week best spend Sunday in:

        a. educating himself/herself by reading serious books
        b. trying to win at competitive sports
        c. going to an orchestral concert
        d. hearing a really good sermon

3.   If you could influence the educational policies of the public schools of some city, would you undertake:

        a. to promote the study and participation in music and the fine arts
        b. to stimulate the study of social problems
        c. to provide additional laboratory facilities
        d. to increase the practical value of courses

4.   Do you prefer to develop friendships with people who:

        a. are efficient, industrious and of a practical turn of mind
        b. are seriously interested in thinking out their attitude toward life as a whole
        c. possess qualities of leadership and organizing ability
        d. show artistic and emotional sensitivity

5.   If you lived in a small town and had more than enough income for your needs, would you prefer to:

        a. apply it productively to assist commercial and industrial development

b. help to advance the activities of local religious groups

c. give it for the development of scientific research in your locality

d. give it to The Family Welfare Society

6.   When you go to the theatre, do you, as a rule, enjoy mostly:

a. plays that treat the lives of great individuals

b. ballets, operas, or similar artistic performances

c. plays that have a theme of human suffering and love

d. dramas that highlight the dilemmas and paradoxes of life

7.   Assuming that you possess the necessary ability, and that the salary for each of the following occupations is the same, would you prefer to be a:

a. mathematician

b. sales manager

c. member of the clergy (priest/minister/rabbi, etc.)

d. politician

8.   If you had sufficient leisure and money, would you prefer to:

a. make a collection of fine sculptures or paintings

b. establish a centre for the care and training of the disabled

c. aim at a peerage, or a seat in the Cabinet

d. establish a business or financial enterprise of your own

9.   At an evening discussion with close friends, are you more interested when the conversation concern:

a. the meaning of life

b. developments in science

c. literature

d. poverty and social amelioration

10.   Which of the following would you prefer to do during part of your next summer vacation (if your ability and other conditions would permit):

a. write and publish an original biological essay or article

b. stay in some secluded part of the country where you can appreciate fine scenery

c. enter a local or other athletic tournament

d. get experience in some new line of business

11.   Do great exploits and adventures of discovery such as those by Columbus, Magellan and Earhart seem to you significant because:

a. they demonstrate the ability of human beings to overcome the difficult forces of nature

b. they add to our knowledge of geography, meteorology, oceanography, etc.

c. they weld human interests and international feelings throughout the world

d. they contribute each in a small way to an ultimate understanding of the universe

12.   Should one guide one's conduct according to, or develop one's chief loyalties toward:

a. one's religious faith

b. ideals of beauty

c. one's occupational organisation and associates

d. ideals of charity

13.   To what extent do the following famous persons interest you:

(a) Mother Theresa
(b) General Colin Powell
(c) Bill Gates
 (d) Marie Curie

14.   In choosing a spouse/life-time companion, would you prefer someone who:

        a. is successful in his/her profession, commanding admiration from others
        b. likes to help people
        c. is fundamentally spiritual in his/her attitudes toward life
        d. is gifted along artistic lines

15.   Viewing Leonardo da Vinci's picture "The Last Supper", would you tend to think of it:

        a. as expressing the highest spiritual aspirations and emotions
        b. as one of the most priceless and irreplaceable pictures every painted
        c. in relation to Leonardo's versatility and its place in history
        d. the quintessence of harmony and design

Part III – demographic data (5 minutes)

Gender:	Male, female
Age:	X
Marital status:	Married, single, divorced, separated, widowed
Children:	Yes, no
Ethnic group:	White
	Mixed/multiple ethnic groups
	Asian/Asian British
	Black/African/Caribbean/Black British
	Other ethnic group, e.g. Arab
Where do you live?	Urban/inner City, suburbs, rural
Height:	X
Highest educational achievement:	No formal qualifications
	CSEs; less than 5 GCSE; NVQ level 1
	6 or more GCSE or O levels; NVQ level 2
	A levels; OND
	Undergraduate degree; HND
	Masters degree
	PhD
	Other professional qualification
Length of time in current business:	X
Seniority of role in business:	Most senior; 2nd most senior; junior managerial; other
Salary:	X
Current interests outside of work:	Team sports
	Individual sports
	CPD
	Additional academic or educational qualifications
	Creative pursuits
English as a first language?	Yes; no
Member of any clubs, societies or associations?	Yes; no.

Appendix II

Creative No.	SME uniref	Study of Values similarity scores calculated as the difference between the creative business and its SME partner using total scores for each pair on each						SME uniref	Ranked Similarity Scores																				
		T	E	A	S	P	R		THEORETICAL		LMH	ECONOMIC		LMH	AESTHETIC		LMH	SOCIAL		LMH	POLITICAL		LMH	RELIGIOUS		LMH
C29	9215	3	7	3	4	2	1		9024 SME1	0	L	9277 SME1	0	L	9034 SME2	0	L	9255 SME3	0	L	9218 SME3	0	L	9066 SME1	0	L
	9239	6	10	11	9	9	5		9060 SME2	1	L	9036 SME1	0	L	9046 SME2	0	L	9236 SME1	0	L	9038 SME1	1	L	9268 SME1	0	L
	9255	2	8	11	0	5	4		9200 SME1	1	L	9261 SME4	1	L	9009 SME2	0	L	9268 SME1	0	L	9249 SME1	1	L	9215 SME1	1	L
	9261	7	1	4	5	5	2		9255 SME3	2	L	9217 SME2	1	L	9236 SME1	0	L	9058 SME1	1	L	9036 SME1	1	L	9028 SME1	1	L
C23	9209	7	22	2	18	2	11		9217 SME2	2	L	9018 SME1	1	L	9066 SME1	1	L	9249 SME1	1	L	9235 SME1	1	L	9027 SME2	1	L
	9217	2	1	3	9	4	15		9257 SME5	2	L	9257 SME5	2	L	9209 SME2	2	L	9009 SME2	1	L	9215 SME1	2	L	9261 SME4	2	L
	9218	3	4	7	6	0	14		9058 SME1	2	L	9274 SME1	2	L	9277 SME1	2	L	9018 SME1	2	L	9209 SME1	2	L	9039 SME4	3	L
	9039	6	19	7	6	3	3		9234 SME2	2	L	9010 SME1	2	L	9215 SME1	3	L	9274 SME1	2	L	9257 SME5	2	L	9024 SME1	3	L
	9257	2	2	3	10	2	9		9249 SME1	2	L	9058 SME1	3	L	9217 SME2	3	L	9034 SME2	3	L	9047 SME1	2	L	9255 SME3	4	L
	9048	16	7	11	5	7	18		9215 SME1	3	L	9064 SME1	3	L	9257 SME5	3	L	9234 SME2	3	L	9039 SME4	3	L	9239 SME2	5	L
	9043	5	4	10	11	7	9		9218 SME3	3	L	9218 SME3	4	M	9211 SME1	3	L	9028 SME1	3	L	9018 SME1	3	L	9230 SME2	5	L
C11	9277	13	0	2	8	7	10		9268 SME1	3	L	9043 SME7	4	M	9261 SME4	4	L	9215 SME1	4	L	9058 SME1	3	L	9047 SME1	5	L
	9034	8	10	0	3	10	9		9043 SME7	5	M	9230 SME2	4	M	9230 SME2	4	M	9066 SME1	4	M	9217 SME2	4	M	9274 SME1	7	M
C14	9018	22	1	14	2	3	8		9015 SME1	5	M	9015 SME1	4	M	9235 SME1	4	M	9029 SME1	4	M	9029 SME1	4	M	9249 SME1	7	M
	9230	10	4	6	6	11	5		9274 SME1	5	M	9046 SME2	4	M	9203 SME4	4	M	9261 SME4	5	M	9234 SME2	4.5	M	9064 SME1	7	M
C12	9058	2	3	19	1	3	18		9036 SME1	5	M	9066 SME1	4	M	9024 SME1	6.5	M	9048 SME6	5	M	9255 SME3	5	M	9018 SME1	8	M
	9060	1	14	16	5	12	36		9239 SME2	6	M	9027 SME2	4	M	9218 SME3	7	M	9060 SME2	5	M	9261 SME4	5	M	9015 SME1	8	M
C13	9200	1	11	21	9	8	14		9039 SME4	6	M	9024 SME1	5	M	9039 SME4	7	M	9024 SME1	5	M	9048 SME6	7	M	9257 SME5	9	M
C15	9024	0	5	7	5	10	3		9261 SME4	7	M	9009 SME2	5	M	9015 SME1	8	M	9064 SME1	5	M	9043 SME7	7	M	9043 SME7	9	M
	9234	2	12	13	3	5	9		9209 SME1	7	M	9211 SME1	6	M	9038 SME3	8	M	9218 SME3	6	M	9277 SME1	7	M	9034 SME2	9	M
C16	9015	5	4	8	12	11	8		9028 SME1	7	M	9215 SME1	7	M	9268 SME1	8	M	9039 SME4	6	M	9274 SME1	7	M	9234 SME2	9	M
C17	9274	5	2	9	2	7	7		9236 SME1	7	M	9048 SME6	7	M	9274 SME1	9	M	9230 SME2	6	M	9028 SME1	7	M	9038 SME1	9	M
C18	9038	15	13	8	10	1	9		9203 SME1	7	M	9255 SME3	8	M	9043 SME7	10	M	9027 SME2	7	M	9236 SME1	7	M	9277 SME1	10	M
C19	9249	2	15	10	1	1	7		9034 SME2	8	M	9047 SME1	8	M	9249 SME1	10	M	9277 SME1	8	M	9200 SME1	8	M	9209 SME1	11	M
C22	9036	5	0	10	8	1	22		9235 SME1	8	M	9029 SME1	9	M	9036 SME1	10	M	9064 SME1	8	M	9064 SME1	8	M	9236 SME1	11	M
	9046	10	4	0	8	9	23		9230 SME2	10	H	9239 SME2	10	H	9239 SME2	11	H	9046 SME2	8	M	9239 SME2	9	M	9218 SME3	14	H
C24	9010	16	2	21	8	17	22		9046 SME2	10	H	9034 SME2	10	H	9255 SME3	11	H	9010 SME1	8	M	9046 SME2	9	M	9200 SME1	14	H
	9009	22	5	0	1	12	38		9066 SME1	11	H	9200 SME1	11	H	9048 SME6	11	H	9239 SME2	9	H	9024 SME1	9.5	M	9211 SME1	14	H
C25	9066	11	4	1	4	20	0		9211 SME1	11	H	9236 SME1	11	H	9029 SME1	11	H	9217 SME2	9	H	9034 SME2	10	H	9217 SME2	15	H
C27	9028	7	20	16	3	7	1		9047 SME1	11	H	9234 SME2	12	H	9234 SME2	12	H	9200 SME1	9	H	9230 SME2	11	H	9203 SME1	17	H
C28	9029	12	9	11	4	4	40		9027 SME2	11	H	9038 SME1	13	H	9200 SME1	12.5	H	9257 SME5	10	H	9015 SME1	11	H	9048 SME6	18	H
C3	9211	11	6	3	19	13	14		9029 SME1	12	H	9060 SME2	14	H	9060 SME2	14	H	9038 SME1	10	H	9268 SME1	11	H	9058 SME1	18	H
C4	9236	7	11	0	0	7	11		9277 SME1	13	H	9203 SME1	14	H	9028 SME1	16	H	9043 SME7	11	H	9027 SME2	11	H	9036 SME1	22	H
C6	9268	3	16	8	0	11	0		9038 SME1	15	H	9249 SME1	15	H	9058 SME1	16	H	9015 SME1	12	H	9060 SME2	12	H	9010 SME1	22	H
C7	9235	8	21	6	13	1	23		9048 SME6	16	H	9268 SME1	16	H	9027 SME2	20	H	9235 SME1	13	H	9009 SME2	12	H	9046 SME2	23	H
C8	9047	11	8	29	13	2	5		9010 SME1	16	H	9039 SME4	19	H	9200 SME1	21	H	9047 SME1	13	H	9211 SME1	13	H	9235 SME1	23	H
	9027	11	4	20	7	11	1		9064 SME1	19	H	9028 SME1	20	H	9010 SME1	21	H	9209 SME1	18	H	9203 SME1	14	H	9060 SME2	36	H
C9	9203	7	14	6	24	14	17		9018 SME1	22	H	9235 SME1	22	H	9064 SME1	22	H	9211 SME1	19	H	9010 SME1	17	H	9009 SME2	38	H
C21	9064	19	3	22	5	8	7		9009 SME2	22	H	9209 SME1	22	H	9047 SME1	29	H	9203 SME1	24	H	9066 SME1	20	H	9029 SME1	40	H