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The Impact Of Organisational Factors On Knowledge Sharing Performance

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THE IMPACT OF ORGANISATIONAL FACTORS ON KNOWLEDGE SHARING PERFORMANCE

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Author's declaration

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award without prior agreement of the Graduate Sub-Committee.

Work submitted for this research degree at the Plymouth University has not formed part of any other degree either at Plymouth University or at another establishment.

Papers have been published and presented by the author based on the PhD work, and the full list of publications has been included in the next page.

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Publications

Journal article

- Oluwafemi Oyemomi, Shaofeng Liu, Irina Neaga and Ali Alkhuraiji (2016). "How knowledge sharing and business process contribute to organisational performance: using the fsQCA approach". Journal of Business Research 69(11): 5222-5227. Doi: 10.1016/j.jbusres.2016.04.116.

Book chapter

- Oluwafemi Oyemomi, Shaofeng Liu and Irina Neaga (2015). The Contribution of Knowledge Sharing to Organizational Performance: An Integrative Knowledge Sharing Performance Framework for Organizational Decision Making, In book: Decision Support Systems IV – Information and Knowledge Management in Decision Process, (Editors: I Linden, S Liu, F Dargam, JE Hernández), vol. 221, pp.1-12. Publisher: Springer.

Conference papers

- Oluwafemi Oyemomi, Shaofeng Liu and Irina Neaga (2016). Measuring knowledge sharing performance with DEA efficiency scores: Efficiency model. In Proceedings of the EWG-DSS 2016 International Conference on Decision Support System Technology (ICDSST 2016): Decision Support Systems Addressing Sustainability and Societal Challenges. ISBN: 978-18-4102-409-7. 23-25 May 2016, Plymouth, UK. (Won the Best Paper Award)

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- Irina Neaga, Shaofeng Liu, Lai Xu and Oyemomi Oluwafemi, (2015). "Cloud Enabled Big Data Business Platform for Logistics Services: A Research and Development Agenda", Euro Working Group on Decision Support Systems (EWG-DSS) ICDSST 2015, Belgrade, Serbia, 27-29 May 2015.

- Oluwafemi Oyemomi, Shaofeng Liu and Irina Neaga, (2014). "Effective Knowledge Sharing for Intelligent Supply Chain Decision Support", Euro Working Group on Decision Support Systems (EWG-DSS) IFORS 2014, Barcelona, Spain, 13-18 July 2014.

Abstract

Facing global challenges in the knowledge economy, the competitiveness of business organisations has transformed dramatically in recent years. With the increase in the significance of knowledge sharing to organisational growth, a lot of resources have been invested to the management of knowledge via technological applications. In the same line of argument, a wide range of literature has argued for the contribution of employees in the sharing of knowledge. However, there are few literature that discussed the impact of organisational factors on the integration of business processes and knowledge sharing. Given the amount of research on the importance of knowledge management to improve business processes and organisational knowledge, it becomes imperative to develop a clear understanding of the impact of organisational factors on knowledge sharing performance. Therefore, the primary aim of this research is develop and validate a functional knowledge sharing model which can facilitate and enhance organisational performance considering the impact of organisational factors for business-knowledge implementation.

A conceptual framework is built based on thorough literature review of knowledge management, organisational factors, performance and in-depth discussion with knowledge experts. The proposed conceptual framework is empirically tested adopting a quantitative method with survey data using over 300 responses from manufacturing and service industries in seven countries across three continents for a comprehensive and balanced view. The data from the survey are analysed by using integrated techniques of both Fuzzy Set Qualitative Comparative Analysis (fsQCA) and Data Envelopment Analysis (DEA).

The fsQCA phase of this study discussed the comparative impact of organisational factors in the seven countries where survey data were collected and formulated the input and output variables for the measurement of knowledge sharing performance using DEA. With regard to the findings of the empirical research, three main constructs (knowledge sharing, organisational factors and performance) were successfully validated as dimensional constructs. The structural paths support conceptual framework that knowledge sharing has a positive influence on organisational competitive advantage, and organisational factors such as culture has a strong contribution to knowledge sharing performance. However, the direct impact of knowledge sharing on organisational performance is insignificant when key performance indicators are not identified.

Various manufacturing and service organisations will potentially benefit from applying the results of this study to their knowledge sharing practices when seeking greater integration of multi business processes with accrued knowledge. The theoretical contribution of this study includes an integrated framework and model for knowledge transformation processes, knowledge sharing processes and knowledge sharing decision making for organisational performance.

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List of abbreviations

AD: Adaptability

AHP: Analytic Hierarchy Process

BCC: Banker, Chames and Cooper

CCR: Constant Returns to Scale

CT: Culture

D: Decision

DEA: Data Envelopment Analysis

DMU: Decision Making Unit

EF: Effectiveness

ELECTRE: ELimination Et Choix Traduisant la REalité

fsQCA: Fuzzy Set Qualitative Comparative Analysis

IE: Input Efficiency

INUS conditions: Cause and Effect

KA: Knowledge Asset

KAD: Knowledge Asset Decision

KM: Knowledge Management

KPI: Key Performance Indicator

KS: Knowledge Sharing

KSP: Knowledge Sharing Performance

LP: Leadership

OA: Overall Performance Proxy

OE: Output Efficiency

OF: Organisational Factors

OL: Organisational Learning

OP: Operation

OS: Organisational Structure

PERF: Performance

SCP: Structure Conduct Performance

SECI: Socialisation Externalisation Combination Internalisation

SFA: Stochastic Frontier Analysis

SWE: Sweden

SWOT: Strength Weakness Opportunities Threats

URL: Uniform Resource Locator

VRS: Variable Returns to Scale

Chapter one: Introduction

1.1 Research context

Business process in an organisation is constantly seeking to out-compete others by developing its competitive advantage in order to achieve outstanding performance. There are two methods relating to how to achieve this goal: integrating knowledge with the business process to best match the objectives of the organisation and advance in the competitive environment (Nonaka et al., 1996); or building knowledge capacity to enhance the productivity of the firm's resources in order to be more effective and efficient than others (Polanyi, 1966).

Knowledge is one of the most valuable assets that organisations pursue to sustain a competitive edge (Owrang and Grupe,1996). This is supported by the widespread integration of numerous knowledge acquisition solutions. Whilst knowledge management systems have been acquired in many organisations, some organisations struggle to exist over organisational knowledge and organisational factors (OF) as a result of differing performance results.

Research has shown that organisational factors have a profound impact on knowledge sharing (KS) intentions (Constant, 1994; Jarvenpaa and Staples, 2001; Navon and Ramsey, 1989; Saetang et al., 2010) and organisational performance (Furby, 1980). The decisions and motivations lying behind knowledge sharing are based on social context of interactions between employees and team members to build a sustainable knowledge-business processes. Sustainable knowledge-business processes refers to business processes within any organisation that considering the impact of organisational factors, perceive that employees' knowledge assets are the key to winning the competitive market challenges. Therefore, sharing knowledge is the organisation's asset and creating more

enablers to share knowledge that leads to benefits for the organisation (Dulipovici and Baskerville, 2007).

While a debate and conflicts are still taking place over the difficulty to enforce the laws, understanding ownership perception will help to reflect individual beliefs related to their belongings (in this case, their knowledge) and their intentions to share. Hence, knowledge ownership should be considered to advance researches in the area of knowledge management.

The work of (Constant, 1994; Jarvenpaa and Staples, 2001; Navon and Ramsey, 1989; Saetang et al., 2010) outlines the motivating factors (i.e competitive advantages and profitability) that have focused on knowledge sharing, organisational factors and performance. Hence, this study investigates current studies in knowledge sharing, organisational factors and performance, and collects empirical data to measure knowledge sharing efficiency by data envelopement analysis (DEA) and fuzzy set qualitative comparative analysis (fsQCA). Knowledge sharing performance will contribute to effective management of knowledge assets in an organisation, provided key organisational factors are considered (Jayawickrama et al., 2013). The conditions of the social context in which employees interact determine the level of the organisational performance (Wiig et al., 1997).

1.2 Research aim and objectives

The aim of this study is to develop and validate a functional knowledge sharing model which can facilitate and enhance organisational performance considering the impact of organisational factors. Three research questions have been formulated:

[1] What are the key components of knowledge sharing in an organisation?

[2] What are the main organisational factors that potentially facilitate effective knowledge sharing in an organisation?

[3] How can DEA and fsQCA be used to measure the impact of organisational factors on organisational knowledge sharing efficiency?

In order to achieve the research aim, this study has detailed research objectives emerging through innovative approaches in addressing the interdisciplinary research questions across knowledge sharing (KS), organisation studies and performance management:

[1] To define key knowledge sharing components required to improve organisational performance.

[2] To identify key organisational factors that impact on knowledge sharing performance.

[3] To develop a knowledge sharing performance framework.

[4] To evaluate the extent to which a knowledge sharing performance model is of operational value to organisations.

A comprehensive understanding of the relationships between KS and organisational factors (OF) that can be measured by using DEA and fsQCA, this study will provide answers to the research questions with guidance on what the benefits of KS practices are, what the impact of OF on knowledge sharing, and how KS, OF and performance are related to each other.

1.3 Research justification

The importance of this study lies in its contribution to theory and practice, and the robustness of the data analysis, findings and discussion. The study examines the influence of OFs on KS by measuring the components of their relationships with DEA and fsQCA,

and the differences knowledge efficiency across seven countries where data collection was carried out. From a theoretical perspective, this study advances and provides insight into the links between KS, OFs, and PERF. These relations have not, to date, been studied in any organisation with DEA and fsQCA, particularly in understanding how to measure the performance of the entities in this relationship.

Two aspects are important for sustaining competitive advantage and continuous increase in performance: the first is the relationships between KS and OFs. OFs are known to initiate and stimulate strong effects via a variety of organisational initiatives that encourage employees to contribute to the organisation's performance (Laudon and Laudon, 2002). Such as leadership, which enables the creation of a suitable climate, sets of values and, norms, and create a culture of change. Thus, it will be useful to provide a better understanding of the linkages between KS, OFs, and PERF.

The second important aspect is the measurement of the contribution of KS in the competitiveness of an organisation and innovation. KS is known to be a key issue in enhancing innovation and performance (Hislop, 2013). Hence, this study contributes to the KS, OFs, and PERF literature by utilising DEA and fsQCA as analysis techniques to implement the practicality of the theoretical relationships.

1.4 Key contributions

This study examines the impact of KS on PERF through an integrating role of OFs, and the differences between focused countries in this regard. From a theoretical perspective, the study advances and provides insights into the links between KS, OFs, and PERF. These relations have not, to date, been studied in an organisational perspective environment.

- Specifically, in terms of the theoretical issue, rather than arguing whether KS or OFs better contributes to performance, this study proposes that neither is universally better causal factor. Rather, both are essential and thus it is better to consider them jointly because each offers a different perspective to explain performance. KS (Drew, 1999; Heijst et al., 1997; Hendriks and Vriens, 1999) draws on an external perspective (intellectual capital) while OFs (Despres and Chauvel 1999; Johannessen, Olsen et al., 1999) take an internal perspective.

Therefore, this study proposes that there are associations or circumstances in which "doing more of one thing increases the returns to doing more of another" (Liebowitz, 2001; Liebowitz and Wright, 1999; Nonaka et al., 1996) between KS and OFs and anticipates that, as a result of a reciprocal and mutually reinforcing effect, consistency between KS and OFs in terms of similar practices will provide a better explanation of performance than the pursuit of incompatible alternatives. According to complementarity theory, this situation called "supermodularity" stems from similarity or practices "of the same kind" (Liao, 2002). For example, the performance of a business process aiming for a low-cost strategy is expected to be better if it belongs to an organisation that has a strong operations capability rather than a strong marketing capability. With the flexibility to adapt to a new and more cost- efficient operations system, such a business process may reduce its costs further and maintain its cost leadership status, which will be reflected in better performance. On the other hand, strength in the marketing function will not help reduce its costs; rather, it will actually require the business process to spend more on marketing campaigns, which in turn will increase the overall cost and go against its configurational objectives (although this may impact positively on differentiation). This mismatch between KS and OFs will be reflected in unfavourable performance.

- By using DEA and fsQCA, a combination of two research techniques based on efficiency modelling and causal asymmetry assumption, both techniques aim at improving organisational performance, this thesis could demonstrate the existence of associations, which would help mitigate criticisms of the theoretical weakness of integrating KS and OFs, research and support its progress by improving its predictive ability and bridging the gap between these two well-established research streams. It is also expected that improved performance exists in this research context. When different KS or OFs or a combination of the two lead to the same level of performance, and when different combinations of KS and OFs as well as different performance dimensions lead to the same level of overall performance proxy.

- With regard to empirical concerns, this study builds on the ideas that performance dimensions cannot all be achieved simultaneously because doing well on one dimension usually entails trade-offs with performance on another (Donaldson, 1984) and that business processes should perform well on the performance dimensions most relevant to the type of strategy they are implementing. This study seeks to prove that the integration of KS and OFs configuration typologies have different appropriate performance measurements. Thus, using DEA and fsQCA will demonstrate the equivocal empirical performance dimensions to organisational configurations.

In addition, by providing a better understanding of past management actions, this research will enable managers to predict the likely consequences of decisions and competitive actions. This research may also help develop a clearer understanding of the impact of various KS and OFs on different performance dimensions. A better understanding of these relationships will result in improved strategy formation and implementation of decisions,

especially in adjusting strategies and organisational resources to match changing environments and achieve performance goals.

1.5 Structure of the thesis

This section briefly explains the structure of the thesis. The thesis comprises seven chapters excluding references and appendices. Figure 1.1 illustrates the overall thesis structure and key segments associated with each chapter.

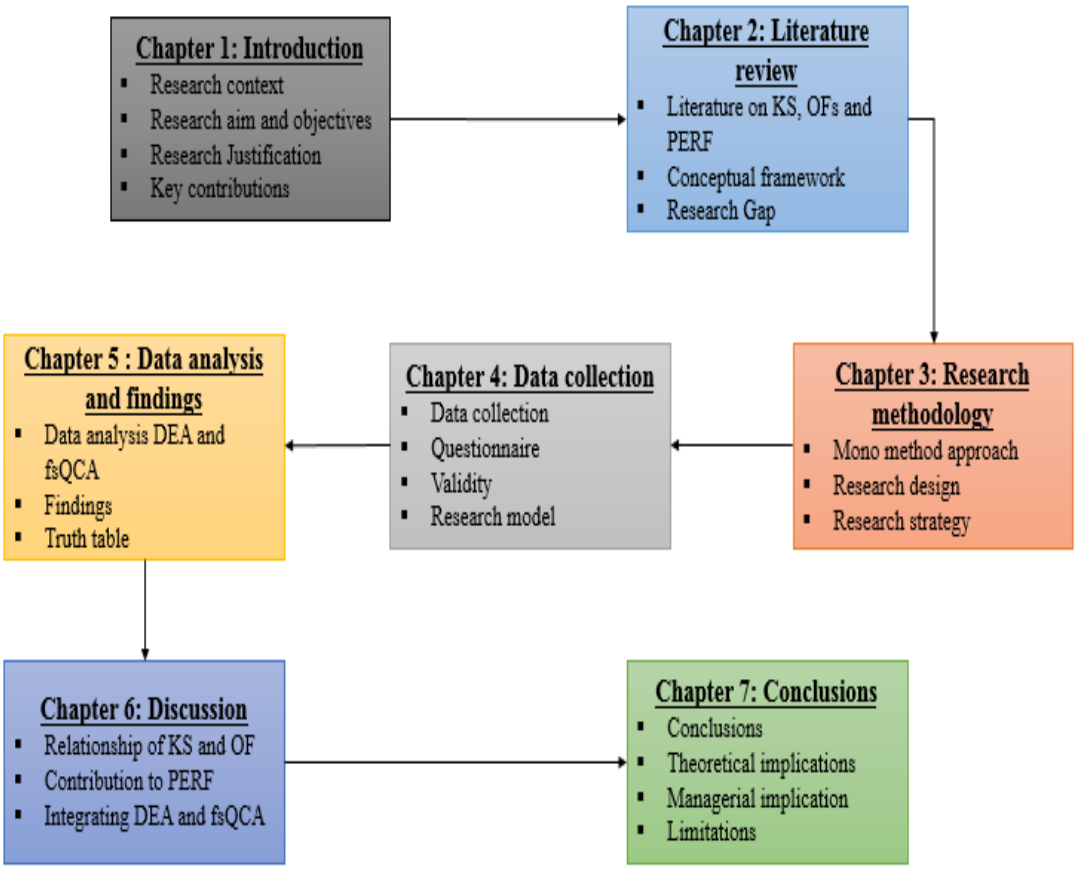


Figure 1.1 Structure of the thesis

Chapter one presents the research context, aim and objectives, and research questions. The structure of the thesis is introduced.

Chapter two outlines the extant literature in regard to knowledge sharing and its key components, organisational factors and performance management in order to provide detailed knowledge regarding knowledge sharing efficiency, impact of organisational factors and performance measurement. It demonstrates a conceptual framework by developing associations. In addition, the scales for each construct are conceptualised and operationalised to underpin questionnaires deployed in this study.

Chapter three examines the research methodology used to answer the research questions and to achieve the research objectives. The chapter discusses the details of methodology, including the research design process.

Chapter four provides rthe details of data collection by discussing the data collection protocol, questionnaire design, sampling strategy and pilot study.

Chapter five is dedicated to data analysis using DEA and fsQCA and reporting findings. This chapter also discusses how the conceptual framework has been refined and improved to develop the integrated knowledge sharing performance KSP model.

Chapter six discusses relevant issues in relation to the operationalisation of all research constructs used to test the research model, describing the measurement approach, the unit of analysis, and the calibration criteria required by DEA and fsQCA, which are the techniques adopted in this research.

Chapter seven summarises this study by linking each research question to relevant findings of each node of the model. Theoretical implications and managerial implications of the findings are highlighted. It also identifies the limitations of the study and makes suggestions for further research.

1.6 Summary

This chapter provided an overview of the content of this thesis. This chapter also included research context, research aim and objectives, and the structure of the thesis. The next chapter presents the literature review on knowledge sharing, organisational factors, organisational performance and the conceptual framework developed based on the critical analysis of the literature.

Chapter two: Literature review

2.1 Introduction

This chapter reviews relevant literature on knowledge sharing (concept of knowledge sharing and knowledge sharing environment), organisational factors (culture, learning, leadership and structure) and organisational performance, focusing on organisational factors implication for knowledge sharing performance. This review will aim to show that, while the conceptual framework is supported by some previous research studies, it has been challenged by others; and that, despite adjustments in response to the challenges, which to a certain extent prove that there is room to develop the level of performance predictability because literature covers only a review of knowledge sharing and other components. Subsequently, this chapter identifies research gaps in the literature of knowledge sharing, organisational factors and performance management, exploring the wide available resources on the measurement of knowledge sharing performance. Finally, this chapter proposes a conceptual framework based on the relevant literature with potential contribution to the field of research.

2.2 Knowledge sharing

Knowledge sharing can be achieved through people and technology, once created and identified or captured the next stage is to circulate knowledge around the organisation (Rubenstein-Montano et al., 2001; Wiig, 1997; Wiig et al., 1997; Wegen et al., 1997). Kim et al. (2000) and Kalling and Styhre (2003, p. 57) highlight that it is perhaps the single most important knowledge management practice because it embodies all of the opportunities and challenges associated with managing intangible invisible assets. While technology may help in the capture and mainly distribution of knowledge, emphasis should be placed on the organisation. Liebowitz (1999) suggests that for an organisation

to succeed in knowledge management, it is imperative for it to have a supporting corporate environment, which is given by Lemken et al (2000) as the norms and values that bind an organisation together. With regards to knowledge, Oliver and Kandandi (2006) propose that organisations create and share knowledge to remain competitive.

Meier (2011, p. 2) also comments on the challenges organisations face due to a rapidly changing business environment, identifying knowledge assets as crucial for achieving competitive advantage. However, Goodman (2006, p. 54-56) points out that promoting and integrating knowledge sharing within an organisation can be a lengthy process. The author recalls Ernst and Young's introduction of a knowledge sharing concept in (Johannessen et al., 1999); according to them whilst it made improvements, concluded that knowledge management work is never done and setting the knowledge agenda is a constant challenge (Liebowitz and Wright, 1999; Wilkins et al., 1997).

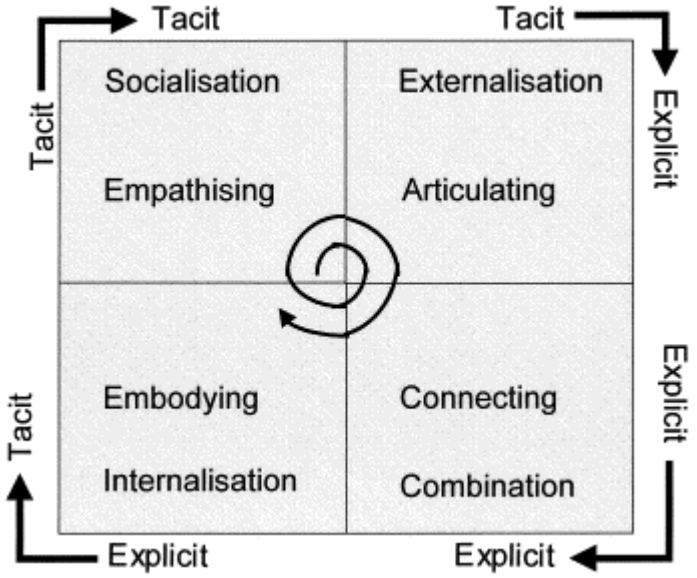


Figure 2.1 The SECI process
Source: (Nonaka et al., 2000, p. 12)

The preceding sections suggest that knowledge is an intangible resource with potential which organisations need to manage effectively. Exploring the SECI model in Figure 2.1 from top left, knowledge creation begins in tacit form; in the head of an individual, and is converted to either tacit or explicit knowledge by means of socialisation or externalisation respectively. The SECI model depicts knowledge creation as a spiral, the knowledge lifecycle, also a common framework, depicts knowledge creation as a continuous cycle. Several other authors including (Fleurat-Lessard, 2002; Kang et al., 1998; Kim et al., 2000; Knight and Ma, 1997; Liao, 2000, 2001; Lee and Lee, 1999) present work associated with the knowledge lifecycle, although having varying explanations, they all share a few similarities in what they highlight as the stages which knowledge moves through in its lifecycle.

2.2.1 Data, information and knowledge

The real emphasis should be made on the difference between data, information and knowledge, as the mistake of interchanging these terms has resulted in organisations spending enormous amount of resources on technological, and other initiatives which did not deliver what they thought they would be getting (Feelders et al., 2000; Bae et al., 2002; Hui and Jha, 2000; Jiang et al, 1999). Cauvin (1996) and Kim et al. (2000) support this, suggesting that if organisations do not develop a working definition of knowledge, utilisation of knowledge resource will be difficult, and organisations will substitute terms such as data warehousing plans or advanced IT programs for knowledge management initiatives.

The implications for a researcher would therefore be one of making distinctions between the definitions of data, information and knowledge; this ultimately clarifies the initiatives which concern each individual term. Data therefore are “a set of discrete, objective facts about events; in an organisational context data is most usefully described as structured

records of transactions" (Laudon and Laudon, 2002). "The amount of data stored in the world's databases doubles every 20 months" and McMeekin and Ross (2002) explain that this volume makes it difficult to identify which single instance is most important within. Data when processed within a given context however, helps to inform decisions. According to Tian et al., (2002) data is the essential raw material for the creation of information, but it has little meaning to an organisation on its own.

The terms information and knowledge have been used interchangeably which may result in ineffective management initiatives. Information is data endowed with meaning, reliance and purpose (Abidi, 2001; Cannataro et al., 2002). (Ha et al., 2002; Hui and Jha, 2000; Lin and McClean, 2001; Shaw et al., 2001) defines information, simply as data that is put into context; both definitions highlight a movement in stages from one form to the other suggested in Figures 2.2. The definitions given reflect understanding continuum in Figure 2.2, as it presents information as a connection of parts that is "absorbed" and needed for "doing" something. Ramesh and Tiwana (1999) and Caraynnnis (1999) explain that information needs to be understood by the recipient for the transformation to be valid. Ramesh and Tiwana (1999) and Robey et al. (2000) highlight that information simply implies transfer (i.e. the process of informing), and Sokolov and Wulff (1999), Huang et al. (2000), Wilkins and Barrett (2000), and Shafer and Agrawal (2000) argue that the most current information in an organisation resides in the minds of trusted colleagues; this definition however, clashes with the business processes being attempted within the understanding continuum and the knowledge pyramid, but its logic is presented to the reader in the section addressing the types of knowledge.

Knowledge has diverse definitions because of its interdisciplinary nature, but the scope has been given to include information management, sense making, and tools and techniques that facilitate socialisation and sharing of expertise, skills, or experiences.

Using the knowledge pyramid, knowledge results from processed information, Zhong and Ohsuga (1996a, b) and Owrang and Grupe (1996) state that it is information in action; actionable information which allows us to make better decisions" (AI-Tabtabai, 1998; Hooper et al., 1998; Liang and Gao, 1999; Mohan and Arumugam, 1997; Tu and Hsiang, 2000).

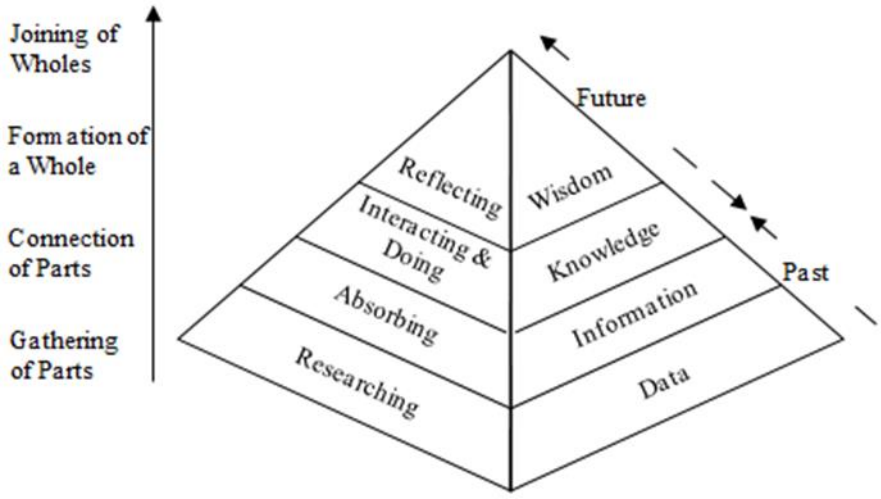


Figure 2.2 Understanding continuum of the knowledge pyramid
Source: (Hey 2004, p. 3)

It can only be referred to as knowledge when people take information and use it, hence while information in itself maybe actionable, it must be deployed for problem solving or value generation for it to transform to knowledge; Figure 2.2 further highlights the Business Processes by classing information and knowledge as terms occurring in the past and present respectively. The knowledge stairs presented in (Zhong and Ohsuga, 1996a) and the understanding continuum proposed by Zhong and Ohsuga (1996b) also show how adding context to information creates knowledge (formation of a whole) that can be used for a purpose. A useful explanation is found in (Huang et al., 2000; Koschel and Lockemann, 1998; Shafer and Agrawal, 2000; Sokolov and Wulff, 1999; Wilkins and Barrett, 2000), who defines knowledge as an intellectual concept, referring to the

condition of knowing or understanding something. Knowledge management needs to be concerned with creating an environment within an organisation that facilitates the creation, transfer and sharing of knowledge (Caraynnnis, 1999; Chen et al., 2002; Harun, 2002; Hicks, Culley et al., 2002; McCown, 2002; Ramesh and Tiwana, 1999; Robey et al., 2000; Yoo and Kim, 2002). This statement, while accurately presenting the scope of knowledge, also highlights the concept of knowledge sharing which is an important component of this research. In order to manage knowledge an understanding of the different types of knowledge is required.

The types of knowledge that are most commonly used in the literature are tacit and explicit knowledge, which are the focus of this study. These types of knowledge were first used by Polanyi (1967) but have since been applied to the context of organisations by Nonaka (1994). Tacit knowledge describes the personal, the subjective, and the intangible (Nonaka, 1994, Nonaka, 1995, Hislop, 2009). It is embedded in the minds of people, is accumulated through study, learning, and experiences, and developed through conversations, workshops, job training, and social interaction (Nonaka and Takeuchi, 1995, Nonaka and Toyama, 2005, Polanyi, 1967, von Krogh et al., 2012). Nonaka et al. (2006) explained that tacit knowledge consists of two elements: the technical and the cognitive. The technical element refers to informal personal skills that apply to a specific context, such as know-how and crafts, while the cognitive component includes beliefs, paradigms, values and a person's mental model. Tacit knowledge is difficult to communicate, articulate and transmit (Hislop, 2005). It is argued that this type of knowledge is less familiar and unconventional. This includes their problem-solving ability, and their capability to conduct research. Tacit knowledge can be a source of competitive advantage in an organisation (Bryant, 2003, Chen and Edginbton, 2005). It is crucial to getting things done and is the key to organisational tasks, such as creating

new knowledge, generating new products, and improving procedures, that lead to innovation.

In contrast to tacit knowledge, explicit knowledge denotes knowledge that is articulated, objective, externalised and captured, and has a more tangible format (Yahya and Goh, 2002). This type of knowledge is saved in documents and found in books, databases, models, procedures, rules, policies, and regulations, making it easily shared between individuals and organisations. Therefore it is more common in the workplace (Nonaka, 2005, Ichijo and Nonaka, 2007, Uriarte, 2008, Birasnav et al., 2011, von Krogh et al., 2012). Nonaka et al. (2006) argued that explicit knowledge includes object-based and rule-based knowledge. Object-based knowledge refers to intangible knowledge such as words, numbers, and, formulas, and tangible knowledge such as equipment, and documents, while rule-based knowledge refers to knowledge that is translated into the rules, routines, and procedures of the organisation. Therefore, it is referred to as know-what. Kumar et al. (2013) explained that the advantage of this type of knowledge is that it is easy to share and can be reused to solve similar problems.

2.2.2 Understanding knowledge sharing

The literature on KM has adopted various terms to describe KS, such as knowledge exchange (Calantone et al, 2002; Hertzum, 2002; Kidwell et al, 1997; Lang et al, 2002; Walsham, 2002), knowledge diffusion or dissemination (Huang et al., 2000; Koschel and Lockemann, 1998; Shafer and Agrawal, 2000; Sokolov and Wulff, 1999; Wilkins and Barrett, 2000), conversion (Dekker and Hoog, 2000; Hinton, 2002; Kitts, Edvinsson and Beding, 2001; Maddouri et al., 1998; Muller and Wiederhold, 2002; Wirtz, 2001; Wong, 2001), knowledge sharing (Calantone et al., 2002; Hertzum, 2002; Kidwell et al., 1997; Lang et al., 2002; Walsham, 2002), and knowledge flows (Allsopp et al., 2002; Sugumaran and Storey, 2002). The term knowledge transfer has been used frequently in

the recent literature on KM to described KS (Huang et al., 2000; Koschel and Lockemann, 1998; Shafer and Agrawal, 2000; Sokolov and Wulff, 1999; Wilkins and Barrett, 2000). In this regard, some researchers, such as Maddouri et al. (1998) and Wong (2001), have distinguished between the transfer and sharing of knowledge by arguing that knowledge transfer refers to the application of existing knowledge from one context to another. This assumes that the owner is the main source of knowledge and the transfer of knowledge occurs in one direction, from owner to recipient. KS, meanwhile, is a broader concept that includes the interaction, absorption, and creation of new knowledge, which means that KS occurs in two directions, and between two or more participants (see Figure 2.3).

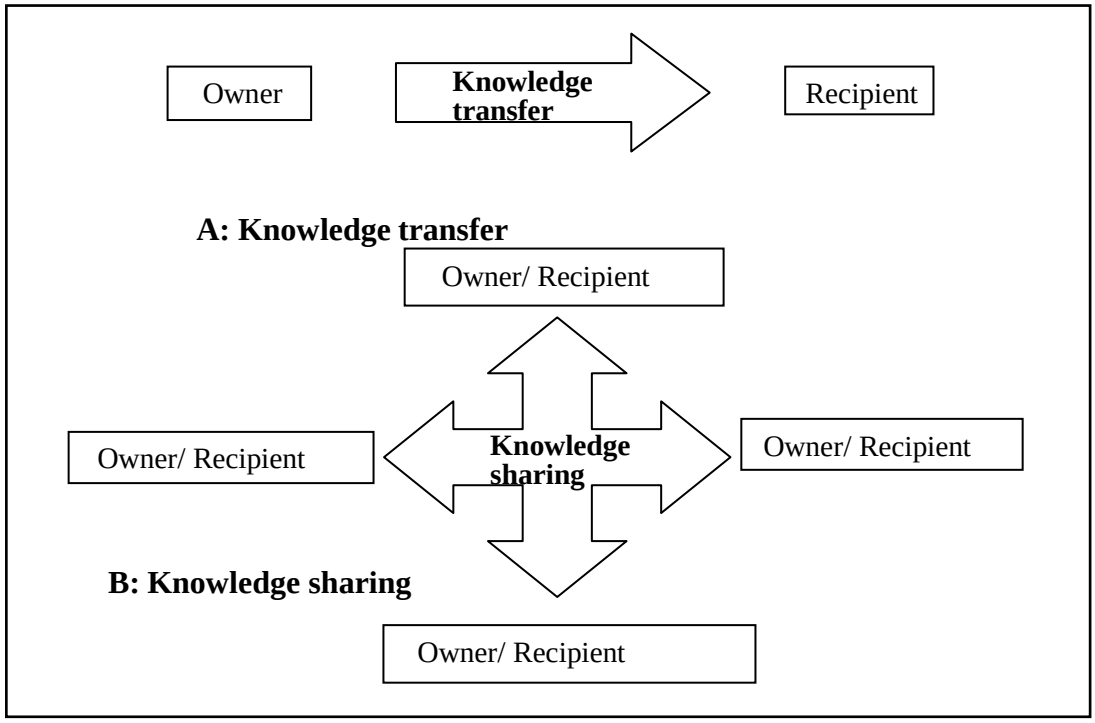


Figure 2.3 Difference between knowledge sharing and transfer
Source: (Owrang and Grupe,1996)

However, many definitions and ideas have been posited by researchers and philosophers, leading to the wide variety of concepts of KS given in Table 2.1. For instance, some of the definitions assume that KS as activity (Calantone et al, 2002; Hertzum, 2002; Kidwell et al., 1997; Lang et al., 2002; Walsham, 2002), others see it as a process from one person,

group or firm to another (McFadden et al, 2000), while others found KS is a culture or behaviour may occur formally among colleagues in a workplace or informally among friends and social networks (Lee and Lee, 1999; Liao, 2000).

Table 2.1 Definitions of KS

Author/s	Definition
(Dyer and Nobeoka, 2000)	KS is the activity of working to exchange knowledge among people and enable them to achieve their individual aims.
(Darr and Kurtzbery, 2000)	KS is the process of helping people to acquire knowledge by learning from others' experiences.
(Bartol and Srivastava, 2002)	KS is the activity of helping organisational members to share their data, information, ideas, experiences, and suggestions within the organisation.
(Argote et al., 2003)	Is the process by which one unit is affected by the experience of another.
(Ipe, 2003)	KS is the process of converting knowledge from individuals who possess it into individuals who accept the knowledge and absorb it.
(Hooff and Ridder, 2004)	KS is the process by which knowledge is exchanged and created at the same time.
(Bock et al., 2005)	KS refers to the behaviour of individuals in sharing their knowledge with each other within an organisation.
(Lin, 2007)	KS is a culture of social interaction that includes the exchange of knowledge, experiences, and skills among employees.
(Xiong and Deng, 2008)	KS refers to the exchange and communication of knowledge and information between members.
(Sohail and Daud, 2009)	KS represents the exchange and sharing of the events, thoughts, and experiences of people.
(Islam et al., 2010)	KS is the process of social exchange that occurs between individuals, from individuals to organisations, and from organisation to organisation.
(Lee et al., 2010)	KS refers to the interaction of tacit and explicit knowledge that is relevant to the task in hand.
(Masrek et al., 2011)	KS is described as a process by which individuals mutually exchange their tacit and explicit knowledge and jointly generate new knowledge.
(Jahani et al., 2011)	KS includes the activities by which knowledge is transferred from one person, group, or organisation to another.
(Hitam and Mahamad, 2012)	KS is the exchange of knowledge, experiences, and skills among members through various departments in the organisation.

(Kim et al., 2013)	KS is the activity by which information, skills, and insights are exchanged among organisational members.

Prior literature has reported different types of KS processes. For instance, Hendriks (1999) distinguished between the knowledge owners who have the knowledge and also called externalisation, and the knowledge receivers who receive the knowledge. Ardichili et al. (2003) proposed that KS includes a supply of new knowledge and a demand for new knowledge. Lin (2007) discussed KS as involving the carrier and the requester of knowledge.

From Kankanhalli et al., (2005) point of view, KS processes consist of knowledge seekers and knowledge contributors. Weiss (1999) indicated that KS involves two processes: knowledge collection, which includes the accumulation, storage and recording of knowledge, and the connection of knowledge, which, consists of the knowledge seeker accessing a knowledge source and identifying the needed knowledge.

Additionally, Wei et al. (2009) divided KS processes into knowledge seeking and knowledge contribution. Similarly, Chen and Hung (2010) pointed out that KS consists of knowledge contributing, collecting, and utilising. Others, such as Ipe (2003), found that KS processes involve the transmission and absorption of knowledge. Kuo and Young (2008) noted that the transmission of knowledge includes sending knowledge to the recipients, while the absorption of knowledge reflects the effectiveness of knowledge use. Davenport and Prusak (2000) and Hussain et al. (2004) differentiate between the possession and acquisition of knowledge. Gupta and Govindarajan (2000) explained that KS includes the sourcing of knowledge, its transmission, receiving knowledge, and absorbing knowledge. Other researchers, such as Tong and Song (2011), have distinguished between voluntary and solicited knowledge. In the case of voluntary

knowledge, individuals initiate the sharing (giving) of knowledge, while solicited KS occurs when individuals are asked by others or by an organisation to share their knowledge (receiving). Reid (2003), meanwhile, saw KS as encompassing a knowledge seller and a knowledge buyer.

However, this study agrees with Hooff and Weenen (2004), who divided KS processes into donating and collecting knowledge. These two processes have been studied by several researchers and tested empirically in different environments (De Vries et al., 2006, Lin, 2007, Kamasak and Bulutlar, 2010, Lin et al., 2009, Sandhu et al., 2011, Kim et al., 2013, Alhady et al., 2011, Chen and Hung, 2010, Tong et al., 2013). The donating of knowledge refers to the exchange process and communicating to others what one's personal intellectual capital is (Hooff and Ridder, 2004, De Vries et al., 2006). It represents the willingness and eagerness of individuals in organisations to give and share their knowledge with others (Kim et al., 2013). It is argued that without willingness it is impossible for knowledge to be donated and transferred to others (Islam et al., 2010). This refers to the capacity of individuals to share what they know and to use what they learn (Lin, 2007).

Knowledge collecting, on the other hand, refers to the recipient of knowledge who must consult colleagues through observation, listening or practising so as to encourage them to share their intellectual capital (Hooff and Weenen 2004, De Vries et al., 2006). It reflects the person's willingness to ask for, accept, and adopt new intellectual capital and know-how (Kim et al., 2013). Lin (2007) indicated that this process represents the acquisition of information and knowledge from internal and external sources. Knowledge collecting is a key aspect of organisations' success because the organisation with proficiency in gathering knowledge is more likely to be unique and rare (Lin, 2007). Knowledge collecting occurs when organisational members are willing to learn from others (De Vries

et al., 2006). Senge (1998) stated that collecting knowledge means learning, absorbing, and applying it.

These two processes of KS promote trust and mutual respect as well as facilitate the flow of people's knowledge assets to be capitalised for performance development (Kamasak and Bulutlar, 2010). It is clear that the processes of knowledge donating and knowledge collecting have drawn the attention of some researchers but perhaps not enough and not in all contexts. Hence, for the purpose of this study and according to the objectives of the research, this thesis defines KS as a two-dimensional process, as described by Hooff and Weenen (2004) with members of staff sharing and exchanging their tacit and explicit knowledge. Interaction creates new knowledge through the process of knowledge exchange, donation, and collection.

2.2.3 Knowledge sharing environment

Nonaka's concept of knowledge creation was re-conceptualised in 1996 through the idea of 'ba'. The organisational 'ba' or 'shared space' (i.e. physical, mental or virtual) provides a basis for knowledge creation. The physical space (e.g. room, office or workplace), mental space (e.g. idea, concept, or experience sharing) and virtual space (e.g. IT platform, Internet or intranet) works as an incubator in which an individual and collective knowledge creation transpires (Nonaka and Konno, 2005). For instance, Nonaka and Konno (2005) noted that originating 'ba' plays its prime and incisive role in knowledge creation by sharing tacit knowledge among individuals through the first SECI mode of socialization as shown in Figure 2.4. The doctrine of originating 'ba' derived from 'existentialism' which asserts that shared space provides a basis for knowledge creation through face to face interaction. It is related to human existence in which individuals are overwhelmingly involved in interaction and their emotions, thoughts and experiences (Nonaka et al., 2001). Therefore, the exchange of information, knowledge, ideas, data,

collaboration and mobilisation helps organisations to countenance requirements and convey shared space (Choudhary et al., 2013). The interacting ‘ba’ created by the reflection when ‘individual skills, knowledge and mental models are changed in general terms and concepts’ (Nonaka et al., 2000). It is argued that during externalisation in which tacit knowledge is converted into explicit knowledge, the primary role of interactive ‘ba’ is to facilitate dialogue within teams and groups in which they engage in a new idea creation and value addition (Nonaka and Konno, 2005). The cyber (or systematising) ‘ba’ represents a combination mode in which virtual or non-physical elements (e.g. software, database, repositories and online communication systems) are particularly involved in converting one type of explicit knowledge to another explicit knowledge in order to create a new explicit knowledge (Nonaka et al., 2006).

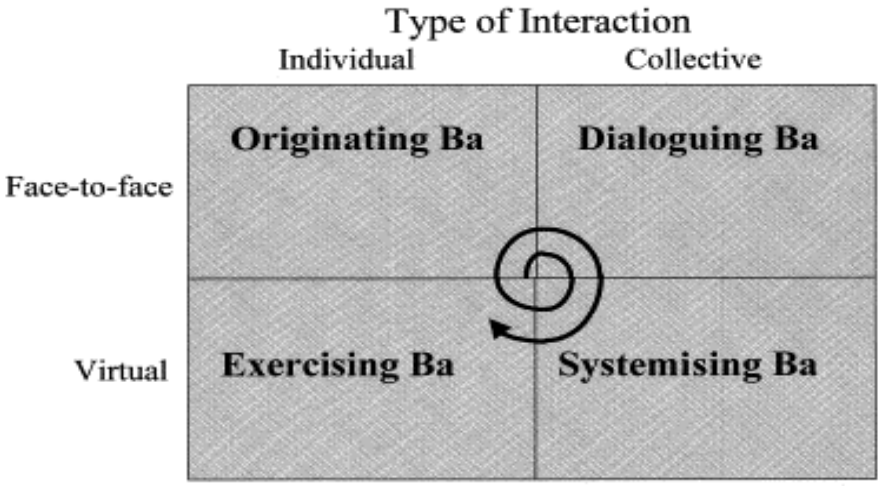


Figure 2.4 The four types of Ba
Source: (Nonaka et al., 1994)

According to Nonaka and Toyama (2005), the SECI combination mode is efficiently operating in information technology supported by the environment because explicit knowledge can only be articulated, codified, stored in databases and transferred, shared and managed by knowledge sharing tools. However, the exercising ‘ba’ is purely personal or subjective which relies on one's attitude or belief. Internalisation facilitates continuous

learning and self-improvement through workplace training, mentoring and individual participation (Nonaka et al., 2006). Nonaka and Toyama (2005) reported that internalisation can be helpful in converting explicit (e.g. codified) knowledge into tacit (e.g. real life) knowledge and during this process exercising 'ba' play its role of mental modelling and thought refinement.

More specifically, knowledge embedded in the 'ba' which is intangible can be acquired through one's own experience when organisational members share and exchange in this 'shared space'. In a recent quantitative research project conducted in twenty-three high tech international firms, Alvarenga Neto (2010, p. 209) found that "management of 'ba' and the enabling conditions rather than 'management of knowledge' supports 'innovation, sharing, learning, collaborative problem solving and tolerance to honest mistake". In other words, managing knowledge through 'managing an enabling context' in terms of 'ba' or 'shared space' supports knowledge sharing and use (Alvarenga Neto and Choo, 2011).

In spite of the evidence that knowledge sharing through managing the context or enabling conditions, the striking challenge within knowledge management is cultural and behavioural (Choo and Alvarenga Neto, 2010). For example, organisational culture provides a specified state that the constructs bond between employees and configures their attitudes and behaviours (Schein, 2006). Lundvall and Johnson (1994) also cited that the culture and behaviour are dominant over the liveliness of the relationships and the likelihood of knowledge creation, sharing and transfer. Nevertheless, an organisational context in which people work is characterised by numerous artefacts (e.g. leadership, communication, structure, technology, values, norms and stories) counted under the general concept of organisational climate and culture (Schein, 2006). In addition to this, it is argued that the cultural artefacts facilitate employees relationships through their

interaction and communication (Weick, 1995). However, 'ba' can only provide a 'mental or virtual space' rather than a 'cultural artefact of space' that also contains objects and physical environment (Lamproulis, 2007). Therefore, it is argued here that both 'mental or virtual space' and 'cultural artefact of space' provide a basis for knowledge sharing within the specified time and space (Nonaka et al., 2000).

2.3 Organisational factors

This section discusses the relevant literature in terms of organisational factors and their influence on knowledge sharing performance in an organisation. There are numerous factors to consider when implementing knowledge sharing within an organisation, however, this section will consider four critical organisational factors to support research findings in this study. According to (Oyemomi et al., 2015), culture, learning, leadership and structure are core organisational factors to that impact knowledge sharing performance.

2.3.1 Culture

An often mentioned vital element of the concept of knowledge sharing is culture. Goodman (2007, p. 7) identifies culture as an element that enhance an organisation's knowledge sharing. The knowledge culture needs to be embedded within the daily processes of the organisation, meaning that it has to be incorporated into every part of the business. There are many proposed benefits to engendering a knowledge sharing culture; the two common viewpoints presented in literature are focused on the tangible and intangible elements associated with it. The benefits proposed by Huysman and Wit (2002) include the value of saving time resources, contingency plans for crises and financial and people-oriented rewards. According to Kelleher and Levene (2001) the benefits include values obtained from enhancing the organisation's knowledge searching activities, the

organisation's ability to remain up-to-date with quick and constant environmental changes, increasing effective integration, and the ability to simplify complex processes. Bowman (2002, p. 32) adds that for organisations which are becoming more geographically dispersed, knowledge sharing is of great importance to operate in a dynamic business environment.

In the knowledge creation theory, organisational culture as an antecedent is not assumed, although, it is generally claimed that culture (i.e. in a different context) is a function of knowledge sharing (Haag et al., 2010). In order to make the assumption that culture can be a primary antecedent of knowledge sharing; there is a need to look at the nature of both culture and knowledge sharing process. Despite the recognition of the influence of culture on effective knowledge management implementation (Janz and Prasarnphanich, 2003); knowledge management practices (Alavi et al., 2006); and knowledge sharing, management and transfer (Schumann and Tittmann, 2010), the relationship between organisational culture and specific knowledge sharing processes is not investigated (Mueller, 2012).

Nonaka and Takeuchi (1996) theorise that knowledge is created when both tacit and explicit knowledge are complementing and interfacing each other through four switching modes; socialisation, externalisation, combination, and internalisation. It is suggested that the basic cognitive process of knowledge conversion between tacit and explicit knowledge is a natural process that is highly dependent on culture and the supporting environment. It can be argued that knowledge is intensely embedded in different organisational routines and practices including organisational culture, values, practices, policies, repositories, documents, systems, and memories. It resides in individual assumptions and requires an appropriate state that provides inter-subjectivity in order to be conclusive. Therefore, the importance of organisational culture in the knowledge

sharing processes is widely acknowledged. Ponis et al., (2010, p. 15) argued that culture is made up of values, assumptions and beliefs of organisational members that strongly influence how organisational strategies are implemented. It implies that values, assumptions and beliefs facilitate organisational members to invent, discover, or develop their external adaptation and internal integration so as to deal with the problems. For scholars, it is always a primary concern to grasp specific ways (or cultural context) in which creation has taken place. The cultural difference may have an influence on the knowledge (or the way people perceive events and objects). It implies that the act of perceiving any objects is subject to culture or cultural values and assumptions.

In an organisational context, cultural difference and similarities may prevent the act of perceiving any objects on the one side and expedite the entire process on the other. For instance, the social interaction may be the main source in deploying tacit knowledge because the continuous process of sharing and observing life or work experiences through social interaction and replicating these interactions with learning by doing so may be the source of creating new knowledge (Nickols, 2000). Moreover, organisational culture offers a mutual system of learning in which people can share and exchange life or work experiences through social interaction. Kitayama et al. (1997, p. 1247) found that people's cognitive capacities can be changed if they are exposed to a new host culture. In other words, culture either pacifies the environment in which knowledge sharing takes place or it tends to regulate individual behaviour which is important for knowledge sharing. Thus, organisations should provide an environment in which people utilise their cognitive capacities during workplace socialisation for knowledge sharing and use.

The concept of knowledge creation also discussed in terms of individual behavior as shown in Figure 2.5. For example, Delong and Fahey (2000) argued that knowledge creation is a behavioural phenomenon as behaviours are playing a mediating role in the

knowledge creation process. According to Hagg et al. (2010), culture determines an individual's behaviour whereas behaviour is a result of different sociological forces which has the capability to influence people. It implies that the culture regulates individual behaviour and this regulated behaviour has a tendency to create new knowledge in terms of new ideas, concept, and know-how (Ribiere and Sitar, 2003).

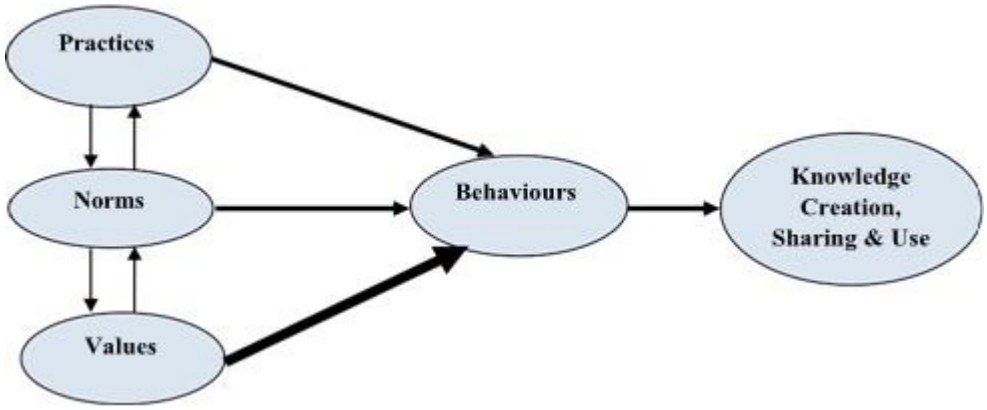


Figure 2.5 Elements of culture
Source: (Delong and Fahey, 2000)

More specifically, Delong and Fahey (2000) identified three primary elements of organisational culture; namely, values, norms and practices that directly impact behaviours which, in turn, keep influencing knowledge sharing and its utilization as illustrated in Figure 2.5. It is argued that values, norms and practices are fundamentally interconnected at multiple levels. Values are deeply rooted and may not be easily expressed, but it would impact on knowledge creation capability because it manipulates individual behaviour that could be the source of useful knowledge creation. Therefore, it suggested that the interplay between norms and values support the desired behaviour which is necessary to create and sustain knowledge creation and sharing capability. It further indicated that, culture demonstrates a specific set of practices which are required in daily routines. Thus, practices symbolically provide a direct lever for change that may be needed to support knowledge creation, sharing, and use.

Moreover, it is strongly conceived that the knowledge creation process not only is 'culturally situated' but stems from a specific cultural context. Also, four SECI knowledge creation modes (socialisation, externalisation, combination, and internalisation) are robustly influenced and created by culture and cultural attributes (Nisbett et al., 2001). Due to the scarcity of literature, an attempt has been made to link up some elements of organisational culture and the four knowledge creation processes at an organisational level for which it was originally intended.

2.3.2 Learning

Beyond the widely-accepted proposition that learning constitutes a pivotal aspect of the competitive advantage of organisations (Argyris and Schön, 1996; Senge, 1990), learning in general has received attention throughout the last century owing to its explicit recognition as a necessity of human life (Dewey, 2014) and its ubiquitous presence wherever activities occur (Lave, 2009; Wenger, 2009). It has however, passed through many different phases, which may explain that it is nowadays frequently perceived as a "vogue term" (Contu et al., 2003, p. 932) but also a generally "good thing" (Contu et al., 2003, p. 932).

Organisational learning is generally attributed to changes in the behaviour of people, leading to better results in comparison to a previous point in time (Spender, 2008). Within traditional perspectives there also resides the claim that these changes are to occur in spite of continuity of those stimuli that generate action; assuming the possibility that environmental factors could remain static (Weick, 1991). However, learning may also happen without any observable changes in conduct, when it only leads to a better understanding of the respective phenomenon (Elkjaer, 2009). Organisational learning is linked, and sometimes reduced to, learning curves, which provide evidence that performance of mechanical activities improves by repeatedly executing them, which can

be called learning by doing (Argote et al., 1990; Darr et al., 1995; Epple et al., 1991; Reagans et al., 2005).

Traditional learning theories are often based on behaviourism, focusing on stimulus-response relations and selective reinforcement, minimising pain and maximising pleasure (Piaget and Inhelder, 1969). This is argued to change behaviour or cognitive structure as suggested within cognitive learning theories (Wenger, 2009). These treat environmental factors as independent variables of learning (Kolb, 1984). Moving beyond the traditional theories of learning, the American philosopher and psychologist John Dewey was among the first who advanced a theory of learning based on experience, which is converted into knowledge. In contrast to traditional theories of learning, author emphasised its process. The understanding that learning is a process, generating knowledge has indeed found broad acceptance among scholars and practitioners (Duncan and Weiss, 1979 as cited in Weick, 1991).

It may be regarded as a widely accepted fact that experience plays a central role in the learning process. According to Weick (1991, p. 121) experience is manifested through perception and interpretation of events. Elkjaer (2009, p. 74) argues that "experience is the relation between the individual and environments, 'subject' and 'worlds', which are the terms I use to connote a socialised individual and the interpreted world". The central role of experience on learning is depicted by Kolb (1984), who defines learning as "the process whereby knowledge is created through the transformation of experience".

Kolb and Kolb (2005) point out the six propositions of their learning theory, which has been very influential, and are based on experience:

[1] Learning should be understood as a process not as an outcome.

[2] Learning builds upon prior knowledge, termed relearning.

[3] Learning is about the resolution of dialectical conflicts of adaption to the world.

[4] Learning is an holistic process of adaptation to the world.

[5] Learning involves the interaction between the person and the environment.

[6] Learning is about the creation of knowledge.

Within this theory as illustrated in Figure 2.6, the learning process is triggered by a concrete experience, which initiates reflective observation, followed by an abstract conceptualisation to then start an active experiment.

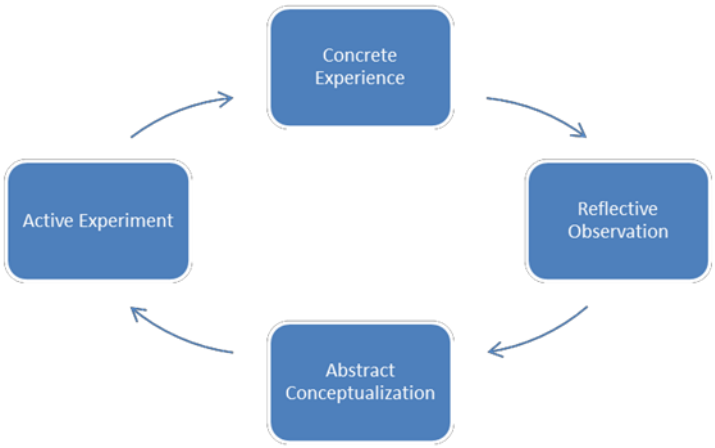


Figure 2.6 Experiential learning
Source: (Kolb and Kolb, 2005).

Whilst the model of experiential learning may be regarded as simplistic, as pointed out by Mezirow (2009), it has had a big influence on contemporary learning theory, highlighting the role of experience and connecting it with learning. It has been suggested that some learners have different preferences in their learning and thus focus more on one dimension or the other. However, the role of experience is pivotal either way, causing reflection, rejection, emotional response of action as Mezirow (2009) points out.

However, experience may also lead to no learning at all as Elkjaer (2009, p. 81) argues: Some experience never enters consciousness and communication, but remains emotional and subconscious. Accordingly, and in line with Dewey (2014), Elkjaer (2009, p. 81) highlights the role of discourse, which may be in the form of language or other forms of communication, such as pictures, to elevate experience to consciousness. Notwithstanding this, it may be argued that even emotional or subconscious experiences lead to learning, even though the learner may not be explicitly aware of them. Still, in line with Elkjaer (2009), this research will indeed emphasise the role of willingness to learn, as it will become evident in this dissertation.

Teece et al (1997) differentiate between learning as a process in which recurring execution and experimentation improve performance, and learning as the identification of new opportunities. From an organisational perspective this may be described as either exploitation, which is to be understood as improved performance and efficiency gains, or exploration, the creation of something new (O'Reilly and Tushman, 2008). March (1991) argues that the adequate balance between exploration and exploitation capabilities within a firm represents a critical component for company survival and well-being (Gibson and Birkinshaw, 2004; Lavie et al, 2010). Those organisations that are able to efficiently manage this balance, by answering the dynamic business requirements of today, while also assuring survival in the long term, can be coined ambidextrous (Levinthal and March, 1993). While there seems to be a general agreement that KS between exploitation and exploration is important for organisations, the proposals on how to reach this balance are different. Knowledge sharing has been associated with all of these learning outcomes.

2.3.3 Leadership

Leadership is one of the fields that is most discussed around the world. It has gained importance in every walk of life, from business and education to social organisations.

Although administrative leadership has long been a subject of interest, the scientific research on leadership began in the early 20th century. Researchers have found leadership behaviours to be important determinants of organisational success (Bass, 1990, Saenz, 2011, DuBrin, 2012). Organisations today need people with leadership ability they are believed to bring assets and success to their organisations (Northouse, 2007). Good leadership has the ability to bring change in relation to environmental demands (Schermerhorn, 2008). It is considered the solution to most organisational problems (Yukl, 2013). Riaz and Haider (2010) noted that effective leaders have the ability to lead organisations to success by paying more attention to expected future events and environmental change.

Leadership plays a vital role in establishing high-performing teams and is one of the critical elements in enhancing organisational performance (Northouse, 2007, Betroci, 2009, DuBrin, 2012). It has been identified as one of the key factors in promoting innovation (Jung et al., 2003). According to Yukl (2010), there is no general agreement on the definition of leadership. Some of the definitions that have appeared in the past include the following:

[1] Leadership includes directing and coordinating the work of group members (Fiedler, 1967).

[2] Leadership is exercised when a group of individuals mobilises political, and other resources to arouse, engage and satisfy the motives of followers (Burns, 1978, p. 18).

[3] Leadership comprises influential processes that affect the actions of subordinates (Yukl, 1981).

[4] Leadership is the ability to motivate confidence, encouragement and support among the organisational members who are required to reach the goals of the organisation (House et al., 1991).

[5] Daft (1999) defined leadership as the influential relationship that occurs between leader and followers who aim to make changes that reflect their shared purposes.

[6] Leadership is described as a process that encourages others to work hard to accomplish tasks (Schermerhorn, 2008).

[7] Leadership is a process that includes the effects of individuals and the group towards the accomplishment of goals (Robbins and Coultar, 2005).

[8] Oke et al. (2010) found leadership to be a social process that takes place in a group context in which the leaders influence their followers' behaviours to achieve desired organisational goals.

[9] Leadership is a process in which an individual influences a group of individuals to achieve certain goals (Northouse, 2007, 2012).

[10] Dubrin (2007, 2012) defined leadership as the ability of the leaders to motivate confidence, encouragement, and support among their followers, who are needed to achieve the goals of the organisation.

[11] Leadership is defined as a trait, behaviour, influence, or relation between leader and followers, or the role relationships of an administrative position (Yukl, 2006, 2010, 2013).

Although different definitions listed above, most cover the following: leadership is a "process" by which a leader can affect and be affected by their subordinates. The leader's "influence" on the followers, is considered a necessary condition without which leadership cannot exist. Leadership occurs in a "group" and influences the individuals in that group to have the same goals as the leader. It involves the "accomplishment" of set of goals through the direction of a group of people.

Others, such as Daft (1999), have added another element to the idea of leadership, describing it as including the influence that occurs between leaders and their followers, that produces the outcomes the leader wants, so that both leader and followers are actively involved in the pursuit of a change aimed at reaching the required goals. Daft argued that these elements are connected and cannot be separated from the success of the process of leadership (see Figure 2.7)

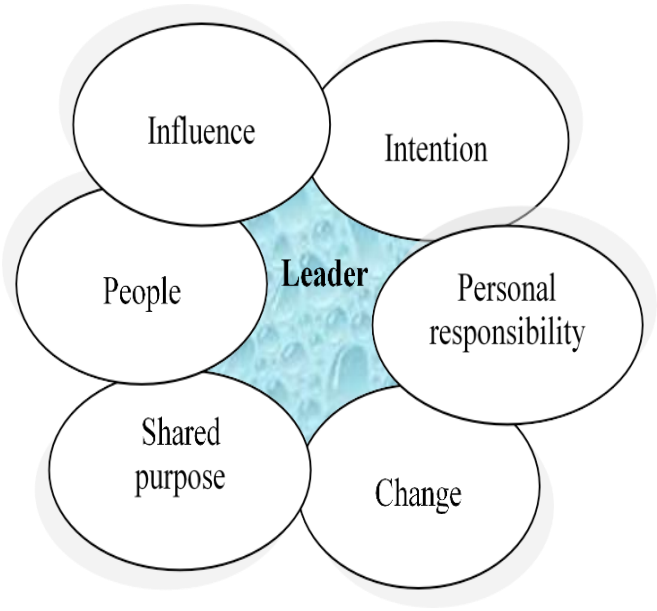


Figure 2.7: Elements of leadership
Source: (Daft, 1999, p. 6)

It is clear that the people who can affect others are called leaders, while the people towards whom the leadership is directed are called followers, and that both leaders and followers are connected in the leadership process (Northouse, 2007).

There is a consensus among leadership researchers that leadership centres on the same issues as management. Therefore, it is useful to differentiate it from this term. According to Bennis and Nanus (1985), management means the achievement of activities, actions and main routines, while leadership focuses on creating a vision for change and influence. Kotter (1990) further clarified the distinction between management and leadership: Management produces order and consistency through planning and budgeting, organising and staffing, controlling and problem solving. Meanwhile, leadership produces change and movement by establishing direction, aligning people, motivating and inspiring them.

Although management and leadership deal with different activities, it is argued that both are essential to the success of organisations (Northouse, 2007). Thus, the two terms are complementary and overlapping, while managers who are concerned with affecting a group so as to achieve their goals, practice leadership, leaders who engage in planning, organising, and controlling are involved in management. Several studies of leadership have been produced over the years (Burns, 1978, Bass, 1985, Northouse, 2007, Yukl, 2010). As a result, different schools of thought have emerged regarding such aspects as traits, styles, behaviour, situational, transactional and transformational leadership.

2.3.4 Structure

According to Huczynski and Buchanan (2010), the rationale for an organisational structure itself is to divide and allocate the activities of organisations, then control and co-ordinate these activities in pursuit of the organisational purpose. They highlight

specialisation, hierarchy, span-of-control, chain-of-command, departmentalisation, formalisation, specialisation and centralisation as the building key variables of structure.

Hatch and Cunliffe (2006) identified the characteristics of five structural types: functional, multidivisional, matrix, hybrid and network. A functional structure divides the organisation by specialist departments such as culture, accounts and operations. Responsibilities are clearly defined and within the functions there can be close relationships. However, co-ordination between functional groupings can sometimes be problematical, and Lam (1996) was in no doubt that a structure separated into different functions inhibits knowledge sharing. Multidivisional structures consist of a collection of separate functional structures. This is typical of larger organisations and groupings can be created on the basis of products groups or geographical territories. Coordination between groups is provided by the headquarters (Hatch and Cunliffe, 2006). Johnson et al (2011) pointed out the dangers of fragmentation with this structure and again consider that this impedes knowledge sharing.

In contrast the matrix structure is a combination of functional and divisional structures and employees may report to two managers in different sections, typically a functional manager and project manager. Although this can lead to conflict due to competing demands (Hatch and Cunliffe, 2006) there is an increase in accessibility to different social networks for employees and this will serve to improve horizontal knowledge sharing (Cummings, 2004).

The network structure is relatively new and accentuates lateral rather than horizontal communication. Groupings within the company are characterised by partnership and collaboration and on the whole knowledge sharing and innovation are encouraged (Hatch and Cunliffe, 2006). The dominant form of organisational form for the majority of the

twentieth century has been the bureaucracy. Bureaucracies typically exhibit functional specialism, a hierarchy of authority and normally possess a formal set of rules that employees are compelled to follow Morris and Farrell (2007).

Clearly, characteristics such as the focus on trust, the sharing of strategic information, the network of relationships and open boundaries are favourable to knowledge sharing and management in the post-bureaucratic model whereas the hoarding of information at the apex of the organisation coupled with the consequence of trust can only be a disincentive to sharing knowledge. In addition, the bureaucratic form was also no longer considered to be fit for the purpose due to the development of fast-moving markets and an intensification of competition due to its rigidity and lack of responsiveness (Morris and Farrell, 2007). Post bureaucracies are also credited with the ability to engender high performance flexible workforces able to adapt to change, and more importantly for knowledge sharing establish lateral rather than top down communication (Applebaum et al., 2000; Tucker, 1999).

2.4 Knowledge sharing performance

This section defines performance in general, discussing use of the term in the literature, the growing body of research specifically on performance and research using similar terms. In using words such as ‘fulfilment’ and ‘achievement’, the definition alludes to some sort of attainment or reaching a standard in the output of a process. They suggest that a wide range of things may perform, including processes, actors or products.

2.4.1 Performance

The term ‘performance’ is widely used across a range of bodies of knowledge in the literature, including strategy, operations management and innovation. As Lebas, (1995) argued, few people agree on what performance really means: it can mean anything from

efficiency, to robustness or resistance or return on investment, or plenty of other definitions never fully specified.

Table 2.2 Examples of use of the term 'performance' in recent publications

Journal	No. Publications with Performance in Title)	Examples of Publications and their Use of 'Performance'
International Journal of Operations and Production Management	106	• Millington *et al.* (2006): Performance of suppliers, in particular global suppliers • Narasimhan *et al.* (2005): Performance of manufacturing plants • Kennerley and Neely (2003): Measuring performance • Fynes and Voss (2002): Quality, manufacturing and business performance
Journal of Operations Management	78	• Kaufmann and Carter (2006): Supply management performance, performance outcomes of sourcing • Melnyk *et al.* (2003): Corporate and environmental performance • Hendricks and Singhal (2003): Financial performance of the organisation
Journal of Purchasing and Supply Management	11	• Paulraj *et al.* (2006): Supply chain performance • Day and Lichtenstein (2006): Organisational performance • O'Toole and Donaldson (2002): Relationship performance dimensions
Harvard Business Review	30	• Kaplan and Norton (2005): Performance measures • Kirby (2005): High performance company • Augustine *et al.* (2001): Performance of individuals
Journal of Product Innovation Management	41	• Leenders *et al.* (2007): Performance of new product teams • Frishammar and Sven (2005): Innovation performance • Langerak *et al.* (2004): New product performance, organisational performance • Morgan and Vorhies (2001): Business unit performance • Hultink and Atuahene-Gima (2000): New product selling performance • Cooper *et al.* (1999): New product portfolio performance

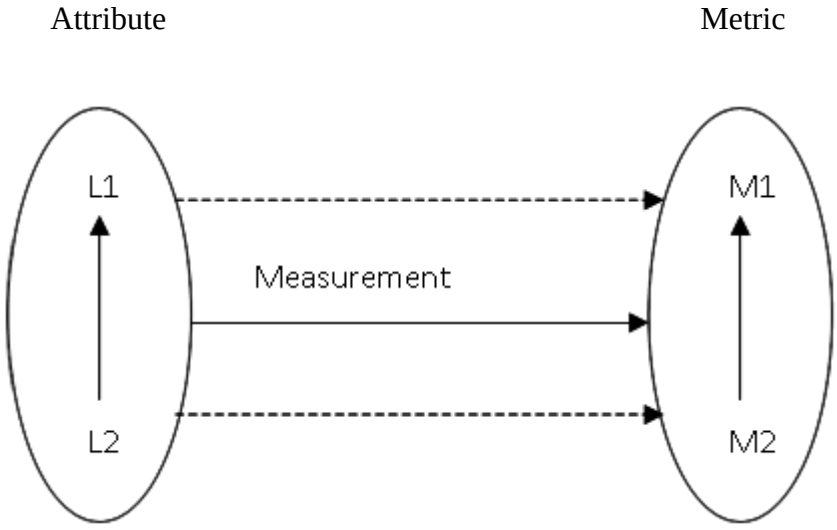
Further, other existing research has studied performance in a less specific way. For example, Carter and Ellram, (2003) reviewed the most common research topics in the Journal of Supply Management. Papers on inventory and production management including forecasting, purchasing organisation and contracting including contract management and cost analysis all attempt to build theories about how organisations manage their processes or other organisations towards improving or maintaining performance in some form.

So far the literature suggests that performance is a commonly used term, indeed other similar terms also appear such as 'success', 'value' and 'effectiveness'. Ritter and Gemunden, (2004) built a concept of product innovation success based upon measures including an organisation having better market response to innovations compared with others. 'Success' is thus used in a very similar conceptual sense to performance as analyzed above, however Ritter and Gemunden, (ibid.) give a success scale that is reverse scored: "Our competitors have more success with their product innovations", demonstrating that success is a positive concept that is either present or absent, whereas performance may be positive or negative. Success has had limited use in the literature whereas performance has been used extensively in the concepts of performance measurement and performance management for example. In addition to success and the opposite concept of failure, Cooper and Kleinschmidt, (1987) refer to new product winners and losers in the same publication, again suggesting that terminology is relatively common in the field.

2.4.2 Performance measurement

A performance measure is defined by Neely et al., (2005) as: "a metric used to quantify the efficiency and/or effectiveness of an action". Although this definition was produced on the basis of a review of the performance measurement literature,

it is limited when viewed in the context of the broader performance literature reviewed in this research. Efficiency and effectiveness are broad descriptions of performance, but the literature also includes research on softer aspects of performance such as quality of life (Skevington, 1999) and more qualitative aspects of performance in general (Teece, 1992), that are not viewed from such a mechanistic, operational viewpoint. The definition presents measures as objective, though the human element involved in using a measure suggests that there is some subjectivity involved (Johnson and Kaplan, 1987 pp. 253-262). The discussion of quantification is not inclusive of softer, qualitative measures and the term 'metric' is a narrower term that is often used to replace 'measure', alluding to quantitative, decimal scales. Expressing the concept of measurement, Farbey et al., (1993 pp. 75-94) described how a measurement procedure maps and preserves the difference in a set of symbols and the difference in attributes of a collection of entities. This expresses the same basic phenomena as Neely et al., (ibid.), yet reflects the broader concepts in the literature. It is shown in Figure 2.8.



Where L=Attribute

M = Metric

Figure 2.8 Diagrammatic view of measurement
Source: (Farbey et al., 1993)

As suggested by the Neely et al., (2005) definition and criticism of it, views of measures and the process of measurement in the literature come from a variety of philosophical viewpoints from natural science to social science. The different perspectives of measures cover both objective natural science and subjective social science measures and measurement processes. The latter tend to be more qualitative, taking far more account of the role of humans in the measurement process, than quantitative natural science views. Literature on the background to performance measures also discusses issues of validity of measures and whether to use nominal, ordinal, interval or ratio scales for example (Bryman 2004, pp. 65-75, 225-227).

Being a prominent part of the performance literature, discussion of performance measurement reflects themes in the development of the performance literature as a whole. For example, financial performance measures are often used in the accounting based literature (Biddle et al., 1997, Ferguson and Leistikow, 1997), the early literature (Ridgway, 1956) and often where a sole performance measure is used (Hendricks and Singhal, 2003). However operational measures have received increasing attention, as they lead or drive future financial performance, whereas financial measures follow performance, showing the results of management action already taken (Kaplan and Norton, 1992, Ittner and Larcker, 1998a). Also there is an emphasis on using measures taking a view external to the organisation, focusing on customer satisfaction. Johnson and Kaplan (1987 pp. 253-262) also promote a broader description of organisational performance than the traditional financial measures, which they describe as rooted in nineteenth century cost accounting and

inappropriate for the increased dynamism and competition in the contemporary business setting as illustrated in Table 2.3.

The range of performance measures is not only becoming broader, but more diverse and specialised. Further specialist types of performance measures include those of innovation, discussed when defining performance of innovation (Tidd et al., 2005 pp. 561-569, Chiesa et al., 1996). However, Coombs and Bierly (2006) emphasise that performance measures in the technology field usually have shortcomings. The broad range of performance measures reflect the broad conceptualisations of performance found in the literature. Having described a range of types of measures, the literature also discusses their appropriate selection and implementation (Hammer, 2007; Purbey et al., 2007; Ridgway, 1956), including a summary of existing work in the area (Neely, 1997). Table 2.3 summarises the literature concerned.

Table 2.3 Advice for effective performance measures based on the literature

Publication	Recommendations for Effective Performance Measures	Description of Research Principles
Hammer (2007)	• Decide what to measure • Measure the right way • Use metrics systematically • Create a measurement friendly culture	Guidance to avoid 'the 7 deadly sins of performance measurement', enabling performance improvement

Purbey *et al.* (2007)	• Sensitivity to changes in internal and external environment of organisation • Reviewing and reprioritising internal objectives when environmental changes are significant • Deploying changes to internal objectives and priorities to critical parts of the organisation • Ensuring that gains achieved through improvement programs are maintained	Guidance for characteristics of a performance measurement system for healthcare processes
Robson (2005)	• Measurement system must provide relevant graphical information at local level • Performance measurement information must be in form that assists people in perceiving their control of performance as part of their job • Measurement system designed from the outset with psychological consequences in mind	Examines how to implement a performance measurement system that creates a high performance culture
Bititci *et al.* (1997)	• System deploys corporate and stakeholder objectives throughout organisation • System defines key competitive factors, position of business within competitive environment • Focus on key business processes to manage performance • A measurement methodology differentiating between actuality, capability and potentiality • Use of proactive rather than reactive measures	Presents reference model for a performance measurement system, as a critical system embedded within performance management as a key business process

Kaplan and Norton (1992)	• Use a broad based set of measures • Measures should have an associated goal • The opinions of a range of stakeholders should be taken into account	Develops a practical tool consisting of a range of measures intended to avoid maximising performance in one area at the expense of another. Both financial and operational measures should be used, operational measures are the drivers of future financial performance
Lea and (1989)	• Simple to understand • Ensure visual impact • Improvement focused rather than on variance	Japanese operations management based work using lean principles.
Fortuin (1988)	• Enable fast feedback • Provide information • Be exact and precise about what is being measured • Be objective not subjective	Development of effective indicators, operations research numerical, objective bias.
Johnson and Kaplan (1987 pp253-262)	• Use broader range of operational performance measures rather than traditional accounting measures	Describes the inadequacy of traditional management accounting system measures, advocating a broader, operations based approach to measures.
Globerson (1985)	• Be aligned with strategy • Provide timely and accurate feedback • Relate to specific, stretching but achievable goals • Based on quantities that can be influenced or controlled • Clearly defined • Be part of a closed management loop • Have an explicit purpose • Be based on an explicitly defined formula and source of data • Use ratios rather than absolute numbers • Use data which are automatically collected as part of a process where possible	Effective performance measures must be developed as a basis for effective planning and control performance management. Emphasis on operational performance criteria.

Ridgway (1956)	• Both qualitative and quantitative performance measures must be used to avoid dysfunctional consequences • Performance measures must be chosen to determine the right behavioural consequences	Describes and gives suggestions for mitigating the effects of dysfunctional consequences of performance measures.

2.5 Research gaps

The major challenge of measuring the benefits of knowledge sharing to organisational performance is the process of selecting the most suitable approach, improve competitive advantage for the organisation in the market which they operate, particularly when confronted with issues of organisational factors (Yang et al., 2014). Another challenge which focuses on knowledge activities within the organisation is how to retain and retrieve knowledge within the organisation for the purpose of achieving organisational goals (Yassin et al., 2013). These challenges have motivated developing a model for data warehousing of individual and group experiences, providing a resourceful learning organisation for sharing of knowledge, enhancing individual performance in the organisation (Lahoz and Camarotto, 2012). There are existing studies that have provided conceptual solutions to these problems rather than empirical, that organisational learning is the foundation for effective knowledge sharing within the organisation shows that study in this field is under-researched from an international context (Evans, 2010). The development of an empirical knowledge sharing model creates an environment for an organisation to motivate their staff in building an organisational knowledge bank and examine the implemented knowledge processes, by empowering individual members through the transfer of knowledge from the originator to develop positive reinforcement, team building and organisational performance (Yassin et al., 2013).

Researchers have carried out a significant number of studies through which organisations have implemented knowledge management systems to support activities and processes to achieve improve performance. However, for an organisation to implement successful knowledge management systems, an employee's readiness to adjust or adopt to the KS system must be considered and motivated, the extent to which employees hold positive views to modifications within the organisation can also be influenced by the leadership structure of the organisation (Özşahin et al., 2013). therefore, for employees to contribute their know-how to the organisation, there must be an enabling environment for the organisation and the employees, one of the ways to build an enabling environment for employees is to have an organisational structure which provides a sense of ownership of the organisation, hence, employees have the opportunities to invest their resources at the same time, which gives them that feeling of ownership (Markham, 2012). This remains a dearth of literature which shows support for the implementation of knowledge management systems, to improve organisational performance. There are numerous existing knowledge management studies (Al-Khawaldeh et al., 2013, Chang et al., 2009) concerned with organisational factors and different organisation-wide changes in achieving organisational goals.

There is a need to justify the contribution of knowledge sharing to the performance of an organisation and to support organisation-wide goals. Hence, there is a need to measure knowledge contribution as an asset and a process. Therefore, such measurement system should consider OFs set or facilitators which are gaps for the implementation of the knowledge sharing system (Lai et al., 2011). There is indication that such research draws attention to organisational goals with an organisation's adaptive strengths from knowledge sharing system for the purpose of improving organisational performance.

However, there is no study where the performance of knowledge sharing has been measured using specific analysis techniques to assess the impact of OFs.

The potential causal factor in order partially to adopt the suggestions of those who have challenged the validity of organisational knowledge performance (Barney and Hoskisson, 1990) and focus on the performance implications of organisational-specific characteristics without neglecting organisational factors completely. Rather, both parameters will be taken into account simultaneously and it will be suggested that complementarity between them provides a better explanation of performance than considering only a single notion at a time because each provides different perspectives on the source of competitive advantage, increasing the likelihood of complementarity rather than substitution.

Knowledge power explanation, focuses on the impact of components of knowledge sharing on an organisation's ability to raise prices above a competitive level. This explanation is rooted in the structure-conduct-performance (S-C-P) paradigm of industrial organisation economics (Bain, 1956) in that, if the industry structure (e.g. number of competitors, product heterogeneity, and entry and exit costs) and the particular firm's conduct or actions (e.g. price taking, product differentiation, tacit knowledge, and exploiting market power) restrict the entry of newcomers into the industry by raising various barriers, then that firm will achieve above normal performance, while firms that cannot take advantage of knowledge power will achieve only normal or below normal performance. This concept is built on a review of opportunities and threats in the environment (external appraisal) under the SWOT analysis model. It is reflected in the KS of this research in that its proponents, with an "outside-in" view, focus firstly on analyzing the external or industry environment and then positioning business processes by developing unique strategies as well as related surrounding contexts (combination of

technology, structure and process), collectively called configurations, to best match the organisation.

Efficiency explanation, focuses on the impact of disparity between organisations' ability to respond to customer needs, as some firms are more effective and efficient than others (Demsetz, 1973), resulting in superior performance (Rumelt, 1984). This explanation is rooted in neoclassical price theory (Foss and Knudsen, 2003) in that it is costlier for less efficient organisations to mimic more efficient firms, perpetuating differences in their performance levels. Likewise, this notion is developed in a review of organisational strengths and weaknesses (internal appraisal). This included an attempt to develop typologies of these tangible and intangible assets in order to suggest that different types of factors of production may have different effects for organisations (Barney and Clark, 2007). These assets were first called simply "resources" (Wernerfelt, 1984; Barney, 1991b) with no more detailed categories. When building on Selznick (1957), they developed their core competencies concept of a diversified firm and added the term "competence" to this research stream. Stalk, Evans and Shulman (1992), argue that competencies and capabilities are different, then added the term "capabilities". Moreover, as resource-based theory continues to develop, other parallel research streams have emerged to explain the same phenomenon from different perspectives. Although it is helpful to understand the full range of an organisation's factors, Barney and Clark (2007: 249) argue that "the essential predictions of resource-based theory did not change with the introduction of these [resource] typologies". In other words, whether the knowledge is called resources, capabilities, competencies or whatever, the theoretical prediction will be exactly the same in that these organisational factors are likely to be a source of sustained competitive advantage only if they enable the organisation to implement a strategy that increases customers' willingness to pay and/or reduces its costs. At the same

time, such strategies must be path dependent, causally ambiguous or socially complex. This research stream is at the root of OFs, another construct used in this research, advocates of which, taking an "inside-out" view, primarily emphasise the characteristics of internal resources and capabilities within organisations derived from collective and learning processes. This, in turn, creates efficiency, resulting in above average performance and sustainable competitive advantage.

2.6 Conceptual framework

As seen from the previous section, a large amount of existing research on KS, OF and PERF has been published relating to the literature of this study. The main purpose of this study is not just to explore past studies, but to provide an overall picture of the body of knowledge, and more importantly to elicit KSP conceptual framework. Hence, it is important to demonstrate the links between KS, OF and PERF as illustrated in Figure 2.9. In addition, the KSP conceptual framework is developed in order to fill the research gaps identified in the literature by contributing new knowledge to the field of this study.

Knowledge sharing is the platform where employees directly/indirectly mutually exchange individual 'know-how', 'know-what' and 'know-why' (Liu et al., 2012, 2014). Based on (Abidi, 2001; Anand et al., 1996; Anand et al., 1998; Cannataro et al., 2002; Nemati et al., 2002; Park et al., 2001; Sforna, 2000; Shaw et al., 2001), SECI model has been developed. In categorising the SECI model, internalisation and socialisation as knowledge sharing process converts organisational knowledge to individual knowledge, while combination and externalisation as knowledge sharing process is the transfer of individual knowledge to organisational knowledge (Bock et al., 2005, Cui et al., 2005, Ling and Nasurdin, 2010, Andreeva and Kianto, 2011, Ferraresi et al., 2012). Organisations position knowledge sharing activities as a means to tackle unresolved

problems, innovation and reduce cost. Furthermore, implementation of successful knowledge sharing practices has benefits to organisation, such as improved performance and decision making. Tacit and explicit knowledge are the foundations of socialisation and combination respectively, while for externalisation and internalisation, it will be classified as an equal share of contribution by Sokolov and Wulff (1999), Huang et al. (2000), Wilkins and Barrett (2000), and Shafer and Agrawal (2000). The KSP conceptual framework as shown in Figure 2.9 defines knowledge sharing modules, organisational factors and knowledge sharing performance feature, as well as the links between them.

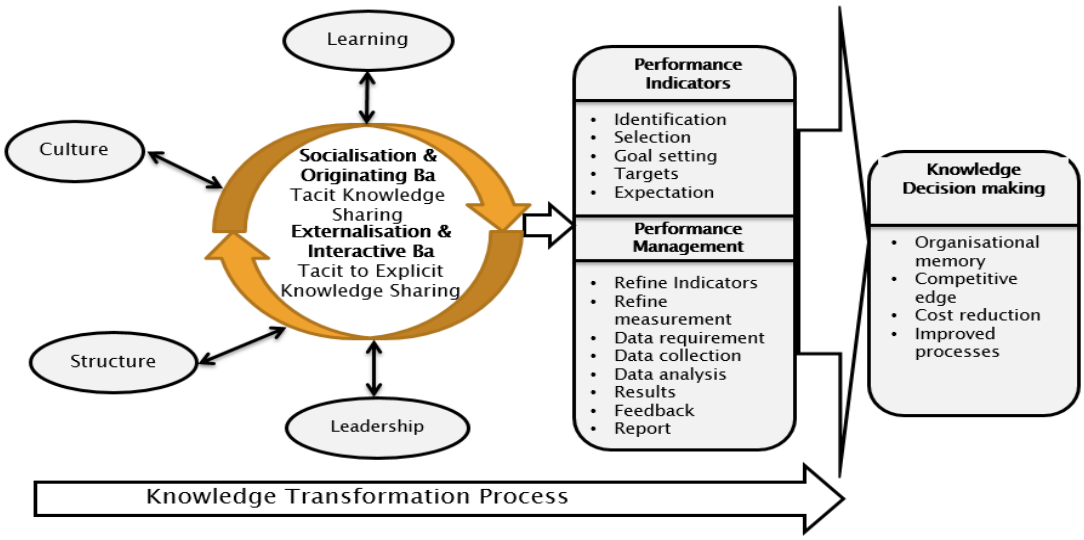


Figure 2.9 KSP conceptual framework

Source: (Oyemomi et al., 2015)

Knowledge transformation process has incorporated the significant of SECI model and Japanese Ba theory to business activities. The advantages of knowledge sharing has propelled an environment in the organisation for knowledge generation, also supporting decision making, key knowledge indicators measure the performance of knowledge sharing by comparing the outcome of the organisational process before the implementation of knowledge sharing and after. Knowledge transformation process combine organisational activities with knowledge to achieve optimal performance.

2.6.1 Knowledge sharing modules

It is important to consider main limitations to the integration of knowledge sharing with organisational factors. The role of knowledge sharing for future research needs to support decision making through its impact on organisational performance. Therefore, the foundation of knowledge has to be embedded in the processes of the organisation, starting with the types of knowledge; tacit knowledge as a type of knowledge is context specific, therefore it is very difficult to document, codify and communicate (Laudon and Laudon, 2002). However, tacit knowledge is understood to be the hub where new knowledge is initiated. On the other hand, explicit knowledge is knowledge which can be codify, documented and easily communicated. Hence, the transfer of explicit knowledge is more easily carried out through a channel while tacit knowledge requires enabling environment for transfer (Oyemomi et al., 2015, 2016). The KSP conceptual framework presents the combination of tacit knowledge from the SECI model and the social context for interaction, the nature of tacit knowledge requires an organisational environment where shared mental model exist. Although for knowledge sharing to be effectively productive, the following organisation factors; culture, leadership, structure and learning needs to be favorable for employees to actively share their experiences and 'know-how' (Liu et al., 2014; Oyemomi et al., 2016). In order to avoid the complexity of knowledge sharing at group, sectorial and departmental level will ensure documentation of specialised knowledge sharing, this procedure promotes the association of knowledge sharing activities with processes within this domain. Therefore, the summation of knowledge sharing activities in all departments forms the organisational knowledge sharing process.

This feature sets out the knowledge domains which is in existence and focus on sharing that knowledge from individuals to groups, from groups to departments and from departments to the entire organisation as a whole. In terms of strategic decision support, the contribution of knowledge sharing is an orientation towards attaining efficiency in organisational processes as well as improving competitive advantage (Lee and Lee, 1999; Liao, 2000). Knowledge sharing strategy ensures that organisations are capable of developing organisational memory by integrating existing knowledge from employees' knowledge domains. Ultimately, considering the fact that organisational memory is built on experiences of employees which are gained over a period of time, therefore the interaction of employees with organisational processes over time deposits new knowledge which improves performance.

2.6.2 Knowledge sharing performance

Organisational performance is classified into three main levels; financial, non-financial, and operational level (Kennerley and Neely, 2003, Kaplan and Norton, 2005). The financial level of an organisational performance is the net profit derived after sales. Almost all companies focus more on finance performance (Lindgreen and Wynstra, 2005, Eriksson and Lofmarck-Vaghult, 2000). The non-financial level is considered as the employees' satisfaction, the outcome of finance performance most often dependent on the non-financial performance, while operational level is the performance of the market share, quality of products and services (Kaplan and Norton, 1992). However, financial and operational performance is directly influence by the efficiency of non-financial performance.

During the last two decades, there is a shift from measuring only financial performance to financial and non-financial performance of assets and liabilities. The annual report of

the organisation reflects the relationship between financial and non-financial entities (Johnson and Kaplan, 1987 pp. 253-262). Therefore, the contribution of either hampers the performance of the other. Most financial performance measurements have national and international report standards. There are guide-lines which are supervised by financial governing institutions, hence, the measurement of financial performance of the organisation is easy to quantify. On the other hand, there exist little or no non-financial governing institutions to design a uniform measuring guide-line for the organisations (Johnson and Kaplan, 1987 pp. 253-262). Therefore, the measurement of non-financial performance activities such as knowledge sharing is developed within organisations. Hence, this study is looking into the non-financial performance of the organisation, specifically on the contribution of knowledge sharing. Performance measurement provides a comprehensive view of the organisation's achievement over a given period of time, this achievement varies when comparing time periods, and performance is subjected to factors such as; government policy, environmental conditions and other external influences. Owing the limited research in this area of study, it is difficult to measure the performance of knowledge sharing in the organisation, however, organisation relies on internal planning and monitoring to evaluate key impacts of knowledge sharing activities in the organisation. Internal planning and monitoring uses strategic performance indicators such as; internal target setting and feedback to evaluate the knowledge non-financial achievements.

2.6.3 Links between KS, OF and PERF

As identified in literature and research gaps, there is existing research on KS, OF and PERF. However, the relationships between the components of KS and OF have not been measured in the past. Therefore, the need to measure knowledge contribution against cost investment encourages effective organisational decision making. Research on knowledge

performance has taken tremendous steps in finding how knowledge sharing contributes to improve organisational performance for better decision making. Investment in knowledge assets primarily shows knowledge output when decisions are based on customers' satisfaction from products and services of the organisation. Intra and inter organisational knowledge activities improves the creation of new knowledge, during this process, employees improve their knowledge base and this knowledge base enhances employees' performance (Teece, 1992). KPIs are set values or figures which are tools used to measure against targets, goals, and objectives. KPIs provide the platform to compare both internal and external targeted performance milestones. KPIs are characterised by;

[1] The fewer the number of indicators, the better the performance.

[2] Knowledge impacted processes should be measured against real factors.

[3] Comparing of indicators should reflect past, present, and future.

[4] The interest of stakeholders should come first when designing indicators.

[5] To achieve a more comprehensive performance, complex indicators should be simplified. KPIs represent organisational key success factors.

This concept of performance management as some sort of planning and controlling action in addition to performance measurement is found widely.

2.7 Summary

This chapter discussed the relevant literature in the field of knowledge sharing, organisational factors and performance context. This study is the first study that explores the possibilities of measuring knowledge sharing performance by studying the impact of

organisational factors on knowledge sharing. Knowledge sharing performance is useful to gain more understandings about key factors to influence knowledge sharing. Despite the importance of the topic, there is a lack of knowledge and empirical work in the area of knowledge sharing performance. Thus, this study explores the knowledge sharing concepts and proposes a conceptual framework on knowledge sharing performance in organisational context arguing that knowledge sharing is affected by organisational factors. This research seeks to assess the contribution of knowledge sharing to organisational performance and maintaining long-term performance.

Chapter three: Research methodology

3.1 Introduction

This chapter discusses the design of the research strategy and methodology. Since the aim of this study is to measure the impact of organisational factors on knowledge sharing, the methodology adopted in this study is primarily quantitative seen as a suitable methodology to answer research questions and achieve research objectives. It outlines the research philosophy, approach, design and methods chosen for this study along with the justifications behind selecting them. Furthermore, it discusses research ethnics.

3.2 Research philosophy

The choice of methodology should be guided by fundamental principles. The term research philosophy is concerned with the development and nature of knowledge (Saunders et al., 2012). Research philosophy affects the quality of management research, so it is viewed as an important notion in research design (Easterby-Smith et al., 2012). Moreover, the specific research philosophy which a researcher adopts can be considered as his or her assumptions in regards to the way in which he or she views the world, so this assumption will underpin the research strategy and methods (Saunders et al., 2012). Easterby-Smith et al. (2012) argued that this is why the research philosophy is useful because it leads researchers to clarify research designs. Further, researchers can not only identify and create research designs beyond their previous experience, but also can adapt designs in accordance with the constraints of different knowledge structures. The belief that one research philosophy is superior to another may be wrong as each philosophy suits different aims (Saunders et al., 2012).

A research design is a framework that guides how research should be conducted, based on people's philosophies and their assumptions about the world and the nature of knowledge (Collis and Hussey, 2009, p. 55). The philosophical paradigms reflect specific ontologies and

epistemologies. Ontological assumptions concern the nature of reality whilst epistemology is concerned with valid knowledge (Collis and Hussey, 2009). The ontological perspective looks for not only objectivism, which contends that social phenomena have an existence that is a reality external to social actors, but also constructionism (constructivism), which argues that social phenomena are generated by social interaction in a constant state of revision (Bryman and Bell, 2011). Bryman and Bell (2011) asserted that an epistemological issue is associated with what should be considered as acceptable knowledge in disciplines, and in particular the most central element of epistemology is whether a social world can be investigated in accordance with the same procedures, ethos and principles as natural sciences.

In general, there are two main philosophical paradigms on epistemology: positivism and interpretivism. Positivism supports the application of natural scientific methods to social reality and beyond (Bryman and Bell, 2011). Easterby-Smith et al. (2012) contended that a social world must be evaluated through objective ways rather than subjective methods such as reflection or intuition because positivists assume that the social world exists externally. According to Creswell (1994), positivists assume that investigation of social reality has no impact on that reality since they tend to see reality as independent from them. Positivism is concerned with quantitative research because it assumes that research can measure social phenomena (Collis and Hussey, 2009). Positivists prefer researching causal relationships by collecting observable data and developing associations and using existing theory (Saunders et al., 2012). In addition, positivists are likely to adopt a highly structured methodology so as to ease replication (Gill and Johnson, 2010)

Deductive approach refers to the research in which a theoretical structure is developed and evaluated through empirical observations (Collis and Hussey, 2009), whilst an inductive approach begins with data in hand and creates a theory from the ground up (Saunders et al., 2012). The deductive approach is likely to be employed in positivism whilst the inductive

approach is dominant in interpretivism. As shown in Figure 3.1, this study assumes positivism since the main constructs will be tested by a deductive approach based on extant theories. Given this, the quantitative methodology is employed because it is concerned with a deductive approach focusing on test my theory. Quantitative research is associated with survey research (Saunders et al., 2012), and closed questions are typically employed in quantitative research using large-scale surveys (Hair et al., 2007). Therefore, the survey method including closed questions is selected as the major research strategy. In terms of choosing a time horizon, the 'snapshot' time horizon means cross-sectional whilst longitudinal represents 'diary' perspective (Saunders et al., 2012).

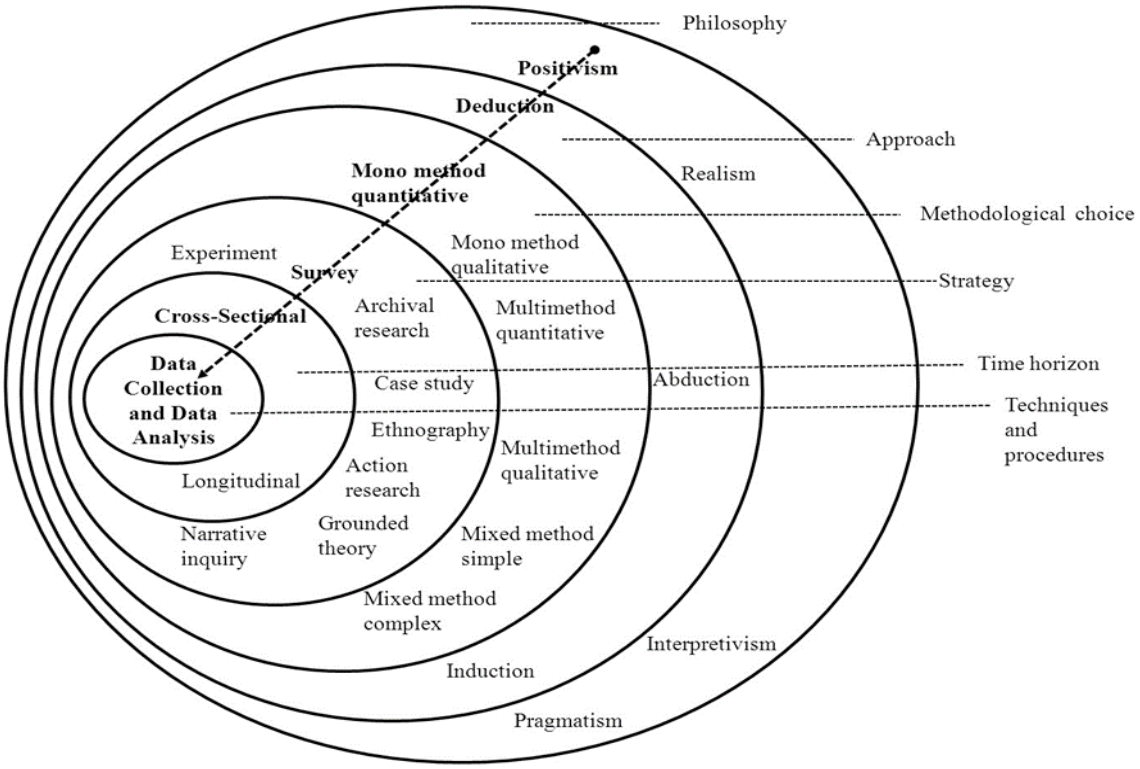


Figure 3.1 The research 'onion' path in this research
Source: (Saunders et al., 2012)

Dess et al (1993: 783) suggest that research on performance is primarily inductive in nature a process of observation and description. Short et al (2008) also assert that the uniqueness of KS research is in pursuing three goals describing organisations by identifying the similarity of

important dimensions; explaining organisational success and failure by arguing about fit within any given circumstance; and predicting which sets of firms will be successful in a particular context. In other words, organisational KS researchers believe that events are determined by antecedents. These causal relationships can be understood from and verified by the empirical evidence (empiricism). The knowledge from observation can then be generalised to the world at large (generality). Clearly, with these scientific assumptions, this research stream appears to be consistent with positivism.

In addition to recognising critical theory, critical realism and the social constructivism concept, the awareness of Feyerabend's (1975) criticism of Lakatos's (1970) assumption that all areas of study must share the basic characteristics of physics. Feyerabend (1975) argues that methodologies and standards for judging physics may not be suitable in other areas. Unlike physics, studies of people and societies cannot proceed by isolating an individual mechanism without affecting the subject under investigation. In other words, a change in theory may bring about a change in the system being studied. Nevertheless, this literature still shows no good examples to support the argument regarding this criticism as illustrated in Table 3.1. Although the "swings of the pendulum" of theory and research in strategic management (Hoskisson et al., 1999) have two main implications for the theoretical focus of source of performance and the dominant method for conducting strategic management research, they have no effect on the organisational KS performance relationship, the phenomenon being studied.

Table 3.1 Fundamental quantitative research strategy

	Quantitative Research
Principal orientation to the role of theory in relation to research	Deductive; testing of theory
Epistemological orientation	Positivism
Ontological orientation	Objectivism
Example of methods	Survey, Laboratory experiments

Source: (Bryman and Bell, 2007, p. 28)

The positivist concept that best fits with this thesis appears to be that of Lakatos (1970) because it conforms to the real situation in this research stream. His suggestion, regarding the way to deflect away from the hard core (negative heuristic) towards model in the protective belt (positive heuristic), has inspired me to propose integrating DEA and fsQCA to explain knowledge sharing performance, the main argument of this dissertation, how to maintain the knowledge sharing performance and reduce the impact of organisational factors by suggesting a favourable conditions as another causal condition that will improve the organisation' competitiveness. The core of the KS-performance, this study answers Dess et al (1993) call for a research philosophy that permits a causality inference to be applied in this literature by using DEA and fsQCA as the research methodology rather than continuing to use a rigid approach like most previous research, which may help improve the match between the research programme's predictions and observation and experiment without relinquishing the core of the KS- performance. A supporting reason for switching from a conventional correlational approach to a set theoretic approach will be covered in detail in Section 3.4.

3.3 Research design

According to Bryman and Bell (2007), research design is a way to define the framework and methods to collect and analyse data to support propositions or to answer research questions. Five well-known research designs are suggested:

[1] Experimental design is a research design that researchers set, control and manipulate independent variables to observe the outcomes from a dependent variable. This design is strong for its internal validity; a way to ensure that there is a relationship between the independent and dependent variable. However, this design is difficult to conduct to study organisational behaviours because in a real situation for example in an organisation, it is difficult to manipulate and control variables and environments.

[2] Cross-sectional design is a design that "entails the collection of data on more than one case (usually quite a lot more than one) and at the single point in time in order to collect a body of quantitative or quantifiable data in connection with two or more variables (usually many more than two), which are then examined to detect patterns of association" (Bryman and Bell, 2007). In this design, researchers cannot manipulate and control any variables so causal relationship can hardly be claimed in the same way as experiment design does.

[3] Longitudinal design is a design that entails time and context which the changes are created. This design involves comprehensive level of analysis of phenomenon through time. Hence, it is time and cost consuming and usually, it is an extension of social survey research to observe phenomenon. Causal relationship can be inferred by this design.

[4] Case study design is an intensive examination and analysis of a case study location such as a workplace and an organisation. This design tends to favour qualitative methods because details and explanations are generated from observation and interviews.

[5] Comparative design is a research design involving comparing and contrasting the identical or different cases or situations in order to gain more understanding. Comparative design is an extension of cross-sectional design to involve two or more cross-sectional studies. One example of comparative design is cross-cultural research or cross-national research which is research conducted in two or more countries (Bryman and Bell, 2007). The main purpose of cross cultural research is to explore significance and meaning of differences and similarities of the chosen cultures.

As shown in Figure 3.2, the research design of this study is divided into four stages. The first section focused on conceptual stage, the second one was created for data collection, the third was designed to reveal the data analysis, findings and discussion, and the final one was constructed to provide a more detailed account of this study's research conclusion and key contribution.

[1] The flow of activities in the first stage were carried out by designing research questions and research objectives, literature review based on the application of the research questions and research objective to focused organisations, developed a conceptual framework from literature review and identifying possible research gaps.

[2] The second stage is the data collection phase of this study. This section consists of the data collection approaches that were used by conducting a survey which followed the following procedures:

- Data collection protocol
- Questionnaire design
- Sampling strategy
- Pilot study

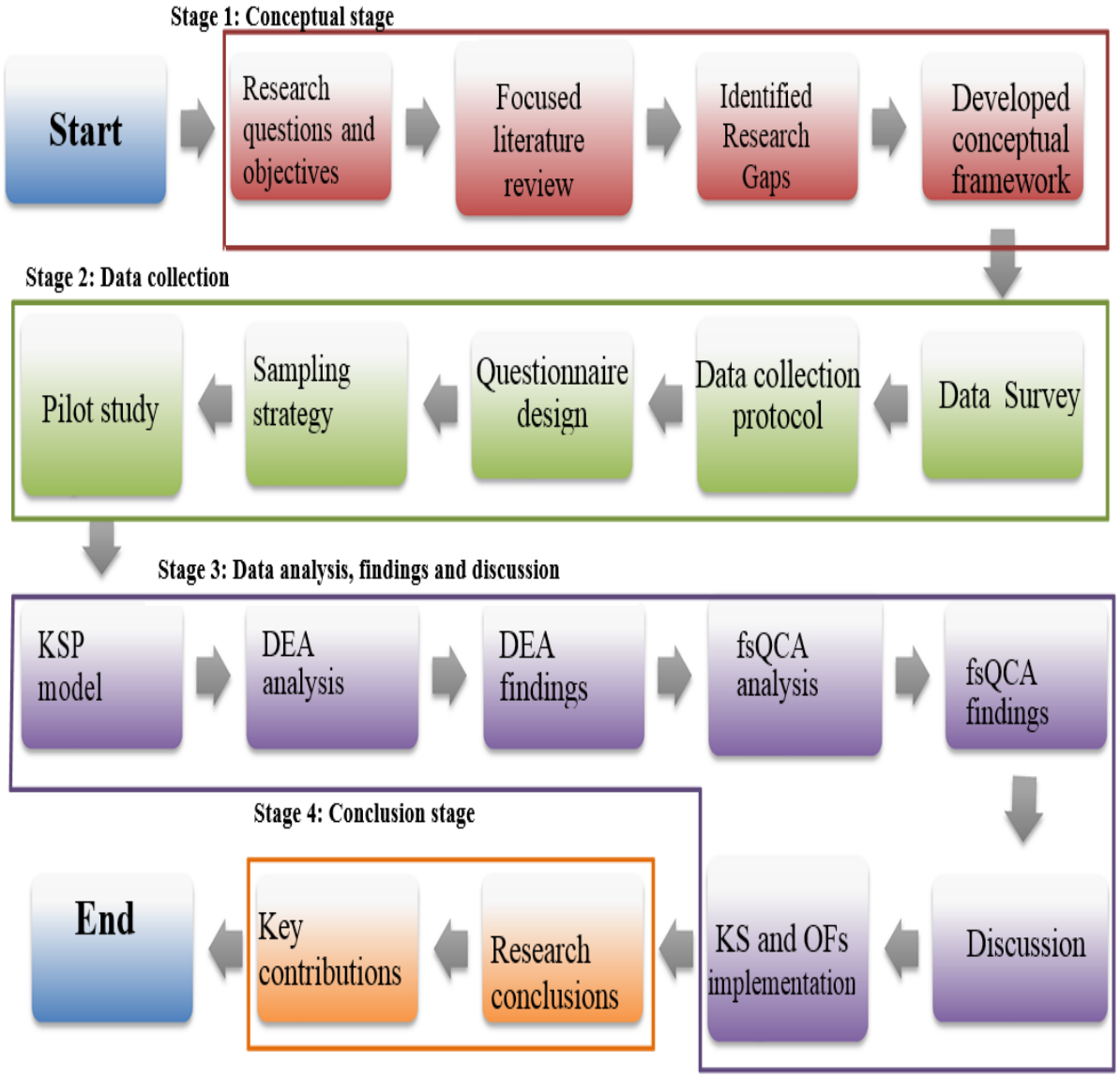


Figure 3.2 Research design

[3] The third stage of the research design implemented the data that were collected at stage two of this study by using DEA and fsQCA methods to analyses the data. The analysis was carried out in two parts i.e the DEA analysis to find the knowledge sharing effieciency and the fsQCA analysis for knowledge performance identifies the relationships of components of KS and OFs. Thereafter, the findings of the analysis were presented and discussed.

[4] The fourth stage explains the conclusions of all the chapters of this study by comparing the existing research work to the concepts derived for KS and OFs relationships for KSP. Furthermore, key contributions to theory and practice were discussed along with future research.

3.4 Research methods

The qualitative method allows the research findings to emerge from significant themes inherent in qualitative raw data and uses several methods to collect these data as illustrated in Table 3.2. Researchers deal with a small sample of subjects and theory is developed as a result of the data analysis. Hence, this approach is exploratory, unlike the explanatory nature of quantitative research. It works well under the interpretivist paradigm (Creswell, 2009). Creswell (2009) explains that this component represents the declaration of forms of data collection, analysis, and interpretation, which the researcher intends to employ in the research.

Table 3.2 Research methods

Quantitative method	Predetermined
	Instrument based questions
	Performance data • Attitude data • Observational data • Census data
	Statistical analysis
Qualitative Method	Emerging methods
	Open-ended questions
	Interview data • Observation data • Document data • Audio-visual data
	Text and image analysis

Mixed Methods	Both predetermined and emerging methods
	Both open-ended and closed-ended questions
	Multiple forms of data drawing all possibilities
	Statistical and text analysis

Source: (Creswell, 2003, p. 17)

The decision over whether to use the deductive or the qualitative method is not an easy one, but it is important to attach these methods to the philosophies of the research as this will help the researcher to determine the types of strategies and methods to be used in the data collection (Saunders et al., 2012). Since this study uses mono-paradigm, quantitative method was used; the first stage is to explain the differences in knowledge sharing efficiency and their effects on PERF and innovation across sectors, and in the second stage to test the association model.

The survey is a method associated with the deductive method. It helps the researcher to collect a large amount of data from a sizeable population using a questionnaire (Saunders et al., 2012). According to Bryman (2012), the data collected by using a survey strategy can provide several possible explanations of the relationships between variables and posit models of these relationships. Gray (2009) noted that there are two types of survey: descriptive and analytical. A descriptive survey is designed to measure the characteristics of a particular population at various times and enable the researcher to identify the variability in different phenomena. An analytical survey, on the other hand, attempts to test a theory and to explore whether there is a relationship between the independent variables (the causes of change) and the dependent variables (the subject of change) (Gray, 2009).

Saunders et al. (2012) explained that the choice over which questionnaire to use will be influenced by several factors related to the questions and objectives of the research, such as the characteristics of the respondents, the size of sample required for the analysis, and the types and number of questions needed to collect the data. Researchers have distinguished between two further types of questionnaire: self-administered and interviewer-administered.

Self-administered surveys are usually completed by the respondents themselves: this type encompasses three sub-types:

[1] the delivery-and-collection questionnaire, where the researcher delivers the questionnaire by hand to each respondent and collects it later (Gray, 2009).

[2] the postal questionnaire, which is sent by post to selected respondents,

[3] internet surveys and email-based surveys administered either via a website or via a word-processed document attached to an e-mail.

(Gray, 2009) stated that the main advantage of the third method is that it can be used to cover a wide geographical area.

On the other hand, with interviewer-administered questionnaires, the respondents' answers are recorded by the interviewer. The researcher can collect the data either by one of two methods:

[1] In the telephone questionnaire, he/she telephones the respondents and completes the questionnaire based on their answers. This method is the most widely used in survey research, because of the high proportion of the population that has access to household telephones.

[2] In the interview questionnaire, sometimes called interview schedules, the interviewers meet the respondents face-to-face and ask them questions directly (Saunders et al., 2012).

3.5 Data envelopment analysis (DEA)

Key performance indictors KPIs are essential to the day to day business operations as they can easily reflect the different aspects of performance and be used as descriptive, diagnostic and predictive measures. Whilst KPIs alone cannot indicate the possible magnitude of

improvements, they can be used in benchmarking studies so as to seek this externally oriented information. However, the external information necessary to the interpretation of the measure itself cannot generally be easily included in the KPI measure itself. For example, vehicle weight cannot be easily incorporated in the miles per gallon measure despite the fact that knowing the vehicle weight is essential to interpret miles per gallon. Furthermore, both methods struggle to reflect all aspects of performance in a single measure. Instead several KPIs have to be used to reflect all aspects of performance. Although weighted averages are often used to address this issue, Laise (2004, p. 624) warns on the risk associated with using simple weighted averages to find best in class performers. Similarly, Cooper et al (2007) explain how problems can arise when arbitrarily choosing weights. This makes finding best in class performers using KPIs or traditional benchmarking hard and potentially impractical task.

On the other hand, literature has shown that outranking methods are better suited to ranking different entities. Analytic hierarchy process AHP, a method first introduced by Saaty (1980), calculates each criterion's weight through matrix calculations based on dominance values given by managers generally on a 1-9 scale although some are known to use different scales. This process has the advantages of appraising each criterion's weight by translating human opinions of dominance to actual weights (a more robust process than arbitrarily choosing the weights). The process also checks on the consistency of the manager's perception of criteria dominance. Nevertheless, the ELimination Et Choix Traduisant la REalité ELECTRE methods do not only weigh each criterion individually but works on a dominance basis instead (although weights can be used to relax the notion of strict dominance) (Buchanan and Vanderpooten, 2007). These two different methods address traditional benchmarking limitations in regards to finding best in class performers for multi-criteria situations. They could consequently both be used to find best performers in terms of multi-criteria benchmarking. However, they do not offer a satisfactory method to include the factors that are necessary to the interpretation of the knowledge measure and thus, do not answer all its

limitations. Consequently, similar conditions could be compared without bias using these outranking methods (which in turn limits the usefulness of these methods).

In contrast, frontier methods provide suitable mechanisms to measure performance against several different criteria. Moreover, these methods offer mechanisms to incorporate the variables necessary to the interpretation of the knowledge measure which cannot be satisfactorily included within traditional or outranking approaches. Stochastic frontier analysis SFA, the production frontier method which looks at efficiency from a statistical perspective, can incorporate these kinds of variables as exogenous variables (Kumbhakar and Knox Lovell, 2000, p. 261). Similarly, DEA offers adequate mechanisms to take into account in the calculations exogenous or undesirable factors.

The literature on the inclusion of exogenous and undesirable factors seems more extensive in DEA than in SFA. Additionally, because SFA relies on a statistical approach, the confidence in the inferences drawn from datasets in which variables are only observed once (these datasets are called single cross section) is severely limited (Kumbhakar and Knox Lovell, 2000, p. 95 and p. 166). Although DEA requires adequate and intelligent data cleansing to ensure that no measurement error is assigned to a Decision Making Unit's (DMU) efficiency, it performs well with single observation datasets. Additionally, DEA provides very efficient and relatively easy ways to analyse the factors affecting efficiency (Cooper et al., 2007), a feature which importance was highlighted by Tingley et al (2005).

Due to its statistical approach, SFA is less robust than DEA at measuring performance when dealing with datasets having a limited number of observations. DEA seems to be a more robust choice in this respect. In light of the previous theory, DEA can also be used as descriptive, diagnostic, and predictive performance measures. Effectively, DEA scores can be used to quantify observed performance (descriptive), weights and slacks are a powerful tool to understand the reasons behind performance (Cooper et al., 2007), and extensive research was

also conducted on measuring performance over time using DEA (Cooper et al., 2007). Similarly, the knowledge sharing efficiency model can encompass all the relevant families of measure (productivity/resource utilisation) into a single model and thus, into a single measure.

Finally, DEA has been widely applied in the banking sector (Cullinane et al., 2006, p. 356) although the literature concentrates mainly on financial performance (Cullinane et al., 2006, SangHyun, 2009), benchmarking (Yoshida and Fujimoto, 2004, Yu, 2004, Pestana Barros and Dieke, 2007), or other important performance indictors rather than directly on knowledge. There is no paper found dealing with the use of DEA to measure knowledge, and despite the potential interest highlighted in the aforementioned literature on knowledge sharing. This lack of research brings originality to this study.

For all the above reasons, this study will use DEA as a means of measuring knowledge sharing efficiency.

Table 3.3 lists the performance measures introduced so far and compares their different characteristics.

Table 3.3 Performance measure comparison table

PM	KPI	benchmark	AHP	ELECTRE	SFA	DEA
Measure can be used as a descriptive measure	✓	✓	✓	✓	✓	✓
Measure can be used as a diagnostic measure	✓		✓		✓	✓
Measure can be used as a predictive measure	✓				✓	✓
Can appropriately include other factors in the measure					✓	✓
Benchmarking		✓	✓	✓	✓	✓
Compare agaainst best performance					✓	✓
Can easily draw inferences from limited observations	✓	✓	✓	✓		✓

Efficiency is commonly measured through the mean of a performance ratio which takes the form illustrated in Formula 3.1 (Cooper et al., 2007):

$$Efficiency = \frac{Output}{Input}$$

Formula 3.1 Efficiency ratio

More generally, efficiency ratios can also be used to reflect productivity such as with the number of jobs per day/vehicle (where the number of jobs is the output and day/vehicle the input). These measures are called 'partial productivity measures' in an effort to differentiate them from 'total productivity measures' (Hayes et al., 1988); the latter attempting to take into account all outputs and all inputs under the same efficiency ratio (Cooper et al., 2007, p.1). A total productivity efficiency ratio can be illustrated as in Formula 3.2.

$$Total\ Productivity\ Ratio = \frac{\sum_{j=1}^{s} output_j \times weight_j}{\sum_{i=1}^{m} input_i \times weight_i}$$

where s is the number of outputs and m the number of inputs,
$weight_j$ is the weight of $output_j$ and
$weight_i$ is the weight of $input_i$.

Formula 3.2 Total factor productivity ratio

The choice of weights in DEA is not arbitrary but is rather the result of an optimisation process completed for each entity. One interesting feature of total productivity measures is that they reduce the risk and increase the chances of attributing gains to one factor which are in fact caused by another factor (or other factors). For instance, if a supermarket's sales increase following an advertising campaign, the ratio 'sales / labour' would also be likely to improve. However, labour's performance could have potentially decreased during that same period and this could go unnoticed (or worse, the sales increase could be attributed to labour). The total

productivity approach used by DEA avoids this problem by directly including all parameters under the same ratio and simultaneously measure the impact of all factors.

3.6 Fuzzy-set qualitative comparative analysis (fsQCA)

In this section, this study will argue for the benefit of a set theoretic approach over a conventional correlational approach in terms of its greater suitability to the objective of this research. Both conceptual and brief analytical procedures regarding fsQCA, a proposed analytical technique grounded in set theory, since this methodology is relatively new to the knowledge management field. Casual condition and equifinality, the two main arguments of this research, share the same underlying assumption as the set theoretic approach that patterns of attributes will exhibit different features and lead to different outcomes depending on how they are arranged (Fiss, 2007: 1181). In other words, contextuality, which is how attributes within a case of concern are arranged (as present or absent conditions) and interacted, rather than the net effect of all attributes (as isolated items), determines the outcome. Casual condition exists when there is a match between causal factors, which leads to a higher level of outcome. By the same token, equifinality takes place when there are at least two different paths (combination of causal factors) that result in the same level of outcome. However, although the discussion of organisational KS stresses causal asymmetry, synergistic effects and equifinality, previous research studies have been conducted mainly using an econometric method, which relies on causal symmetry, additive effects and an assumption of unifinality (Fiss, 2007) because of the lack of the alternative technique supporting causal asymmetry, synergistic effects and equifinality assumption.

This assumption mismatch resulting from methodological gap makes it impossible to capture, not to mention test, combination and equifinality, potentially leading to equivocal results in prior researches. For instance, regression analysis is based on the independent contribution of a particular variable while everything else stays the same, usually called a ceteris paribus

condition (Kogut, 2010). By focusing on the net effect of a variable without taking into account the meaning of the presence or absence of other variables, regression analysis cannot identify in which situations a particular variable has more (or less) influence on the outcome. In other words, correlation-based analysis cannot both detect Casual condition (Fiss, 2007) and consider equifinality (Van de Ven and Drazin, 1985).

The interaction effect, and two and three-way interactions in particular, has been utilised in organisational KS to circumvent the limitations of regression analysis (Baker and Cullen, 1993; Dess et al., 1997; Miller, 1988). Nonetheless, three-way interaction is by and large the current boundary of interpretation (Van de Ven and Drazin, 1985; Dess et al., 1997; Ganzach, 1998). Furthermore, the assumption that its estimated nonlinear relationship applies to all cases under examination stands in direct opposition to the equifinality assumption (Gresov and Drazin, 1997; Fiss, 2007).

This method cannot explain how each of these variables are relevant to the outcome. In fact, it cannot even demonstrated whether a particular variable shown in the identified group is really a part of the cause. Therefore, one of the weaknesses of this technique is that it is possible that cluster analysis may classify two cases with many similar variables in the same group, whereas in fact these variables are irrelevant to the outcome (Fiss, 2007). In addition, cluster analysis relies on the researcher's judgment regarding the choice of sample and variables, scaling of variables, stopping rule, similarity measure and clustering method (Ragin, 2000).

A deductive approach which has also been employed to study knowledge sharing performance is deviation score (Drazin and Van de Ven, 1985; Delery and Doty, 1996). Again, although this method is theoretically more convincing than cluster analysis because it allows modelling regarding the relationship between the level of performance and the level of the profile's fit (deviation score), which is calculated from the difference between a theoretically-

defined ideal type and the empirical profile of the organisation in the dataset, deviation score is still prone to the same criticism as cluster analysis, which is its inability to identify which misfitting profile actually results in low performance (Fiss, 2007). In other words, although deviation score is an improvement on cluster analysis, it still cannot distinguish the more relevant causal factors from the less relevant ones. Thus, the "black box" concern remains unsolved: only a limited peek into the box is achieved (Fiss, 2007). Furthermore, this approach is also based on the researcher's judgment regarding the ideal profile. Hence, the reliability of deviation score is questionable owing to the debatable level of reliability of its original value (Gupta and Govindarajan, 1993).

Key problem remains because the fundamental assumptions of these methodologies have not yet taken the premise of causal complexity into consideration. With a completely symmetrical view, they test equally for a connection between the absence of the cause and the absence of the effect. In other words, they assume that the explanations for both negative and positive outcomes are based on the same mechanisms and conditions, which is not true for the nature of social science causal relationship. Obviously, the reasons causing low performance are not necessarily the reverse of those causing high performance. Similarly, the explanations for extremely high performance can be vastly different from those that result in moderately high performance levels. Consequently, conventional quantitative analysis, especially correlation, is blind to causal asymmetry assumption of set theoretic relationships (Ragin, 2008), resulting in previous inconsistent findings.

Therefore, understanding of casual condition and equifinality cannot be developed further without using a new empirical methodology that takes the concept of causal complexity (set theoretic relationships) into account. This set-theoretic approach is uniquely suitable for analysing the impact of organisational factor knowledge sharing, because it is based on the set

relationship understanding of how causes combine to bring about outcomes, and because it can handle significant levels of causal complexity (Ragin, 2000, 2008; Fiss, 2007).

Furthermore, in contrast to regression analysis, nonparametric, set methods make sample representativeness less of a concern because they do not assume that data are drawn from a given probability distribution. In addition, as part of QCA procedure, which will be explained later, the calibration of sets to measure research constructs reduces sample dependence. This is because set membership is defined relative to substantive knowledge rather than the sample mean, thereby further reducing the importance of sample representativeness (Fiss, 2007, 2011). In summary, these points suggest that a set-theoretic approach will allow for the analysis of small to medium-sized situations, in which the number of cases is too large for traditional quantitative analysis and too small for many conventional statistical analyses, for example between 10 and 50 cases (Ragin, 1994, 2000; Lacey, 2001). However, it should be noted that, although QCA was initially considered to be a small-N approach, more recent works have extended QCA to large-N settings unproblematically (Greckhamer et al., 2008; Ragin and Fiss, 2008).

In summary, one of the main reasons for the prior KS researches' puzzle (equivocal results) is the methodological gap, particularly the mismatch between the underlying assumption of causal relationship of methodologies available for the previous studies and actual social phenomena. Hence, this study proposes using a set-theoretic approach fuzzy set qualitative comparative analysis, or fsQCA to test the model of this research. fsQCA (Ragin, 1987, 2000) is a formal analysis of qualitative evidence to study causal complexity, focusing on what conditions are necessary and/or sufficient for an outcome of interest using Boolean algebra (a set-theoretic method). The fundamental idea of this method is that cases are best understood as combinations of attributes resembling overall types and that a comparison of cases may allow a researcher to strip away attributes that are unrelated to the outcome in question (Fiss,

2011). fsQCA's logic is rooted in the "method of difference" and the "method of agreement" (Mill, 2002), in which one compares instances of the cause and outcome to understand patterns of causation. Unlike previous methods, fsQCA focuses on set-subset relationships to examine causal patterns. For example, to understand which combination of OFs leads to high overall performance, the fsQCA researcher first considers members of the set of "high-overall performing" organisations and then distinguishes the combinations of attributes (OFs) associated with the relevant outcome (high overall performance) using Boolean algebra that allows logical reduction of various complex causal conditions into a reduced set of combinations that lead to the outcome.

In order to gain a clear understanding of the mechanism of the set-theoretic approach, it is better to compare it with the quantitative approach. Therefore, the basic steps of the quantitative approach will be summarised for the purposes of comparison, then the main differences between these approaches will be discussed. After that, the procedure for fsQCA will be explained. The conventional template for the quantitative approach starts by identifying the phenomenon under consideration (dependent variable) believed to vary across cases and/or over time. Then, a literature review of relevant theories and studies must be conducted to list the most important causes (independent variables). The quantitative researcher should develop measurements for both the dependent variable and independent variables and identify a given population that has variation in both variables. Depending on the selected dataset, control variables may be required to include independent variables. After specifying the associations and/or models, multivariate analysis is conducted on the selected variables to estimate the "net effect" of each independent variable based on its intercorrelation with other independent variables and its correlation with the dependent variable. In the final stage, re- specification of the analysis, the most important independent variables are identified. Some independent variables that have weak effects on the dependent variable or are weakly justified by theory may be dropped. The researcher can then report a theory that explains the

greatest variation in the dependent variable (Ragin, 2008). The set-theoretic approach, on the other hand, assumes that "relationships among different variables are often best understood in terms of set membership" (Fiss, 2007: 1183). This fundamental notion has three implications as follows.

First, it uses calibrated sets, instead of measured variables. Rather than using a variable that captures a degree of variation across observations relative to each other based on indicators of sample-specific statistics (e.g. company A has greater operations capability than company B or than average), a set is employed to be more case-oriented because it requires membership criteria based on external, substantive standards, and thus has classificatory consequences (Ragin, 2008). A set is not just a nominal-scale variable with values of 0 (non- membership) and 1 (full membership), also known as a crisp set. Cases may vary in the degree to which they satisfy membership criteria, which is the primary idea of fuzzy sets (Ragin, 1987, 2000). In fuzzy sets, between 0 (non-membership) and 1 (full membership) represent varying degrees of membership in the set. In other words, a fuzzy set allows partial membership of the set. 0.5 is the crossover point between "more in" and "more out". As mentioned previously, the assignment of set membership scores (a process called "calibration" in fsQCA) follows directly from the external standard definition of the set as shown in Table 3.4.

Table 3.4 Crisp set versus fuzzy set

Crisp set	0 fully out					1 fully in
Fuzzy set (6 values)	0 fully out	0.2 mostly but not fully out	0.4 more or less out	0.6 more or less in	0.8 mostly but not fully in	1 fully in
Fuzzy set (continuous)	0 fully out	0<Xi<0.5 more out than in	0.5 (crossover) neither in nor out		0.5<Xi<1 more in than out	1 fully in

Source: (Ragin, 2008)

Accordingly, the processed data consist of set membership scores, which reflect membership of cases in sets. For instance, in the previous example, rather than only measuring the score of

company A and comparing it with other companies' scores or even a mean score, the researcher must also specify the score according to external, agreed standards that would qualify a company for full membership in the set of high operations capability (membership score = 1) and specify the score that would completely exclude it from this set (membership score = 0), meaning it is not in a set of high operations capability (OP).

It should also be noted that the set of firms that are out of a set of high OP is not the same as a set of low OP. It is possible to be a company that is not in a set of high OP but still not in a set of low OP. This is because the criteria for these two sets are not necessarily the reverse of each other. In addition to the benefit of calibration to differentiate between "different kinds of case" as mentioned earlier, the researcher can also calibrate a fuzzy set to "differentiate between different kinds of causal connections" (Ragin, 2008). For example, is it a firm with high OP that is linked to avoiding input inefficiency (formally: ⊂) or is it not a firm with low OP (formally: ⊂ IE)? These two notions, again, are not mirror images, for there are plenty of companies that are not high OP but still not in a group of firms that have input inefficiency. Unlike the conventional research method with the assumption of symmetry, a fuzzy set can easily address these kinds of competing arguments simply by assigning different calibration schemes to the same indicator.

Obviously, a fuzzy set allows the researcher to achieve "fidelity to verbal formulations" by calibrating a membership score that is directly commensurate with theoretical constructs (Ragin, 2008), while variables in the traditional quantitative approach will be taken for granted without calibration. Aiming to explain cross-case and/or variation over time in the dependent variable, conventional quantitative researchers calculate total pools of variation in the dependent variable by adding up the effects of all observed independent variables, but they may still not know which cases (combinations of causal conditions) actually exhibit the outcome that inspired them in the first place (Ragin, 2008).

Assuming that company A achieves the criterion for the set of high OP (let us say, 0.7, which is a membership score greater than 0.5, the crossover point or the most ambiguous point), and hence it is more "in" than "out" in this set, company A is then classified as a firm with high OP. In formal mathematical terms, let A be a company A and OP a set of firms with high operation capability. The previous statement can be restated as A is a member of set OP or A is a subset of OP or formally: A⊂OP. Figure 4.4 shows an example histogram displaying the difference between a set of high operations capability and a set of low operations capability, as well as example company A.

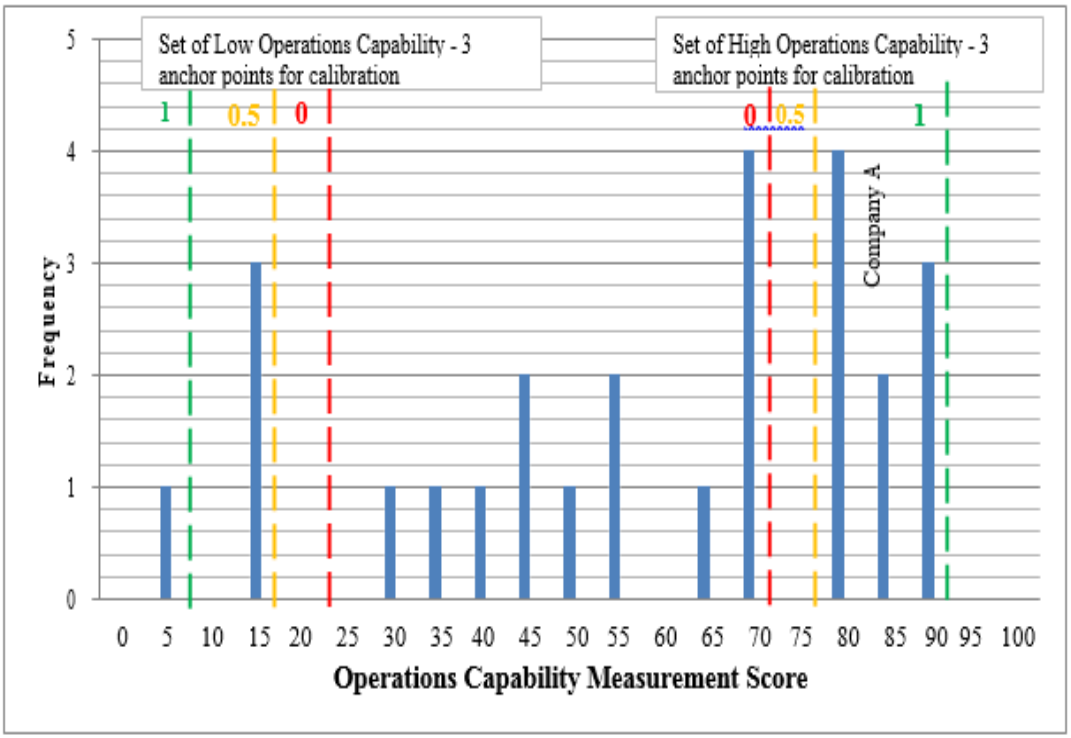


Figure 3.3 Histogram showing difference between high and low operations capabilities
Source: (Ragin, 2008)

Secondly, relationships between social phenomena are perceived and can be modeled in terms of set relations. This is best explained by example. Let OP be a set of firms with high operations capability and OA be a set of firms with high overall performance. Thus, the statement that firms with high operations capability exhibit high overall performance (all firms

with high operations capability are high overall performance firms) may be restated as that such firms form a subset of high overall performance firms (formally: ⊂). This statement can also be mathematically paraphrased as that a set of high overall performance firms is a superset of high operations capability firms (formally: ⊃).

Thirdly, the result emphasises causal complexity. In social phenomena, the overlap between two sets need not be absolute. For instance, from the previous example, consider CT, a set of firms with high culture capability. This characteristic may also lead to high overall performance, thus making firms that do exceptionally well in their culture activities another subset of high overall performance firms (formally: ⊂). Yet there may, in fact, be little overlap between the two subsets OP and CT; one can easily imagine a situation in which a cost reduction-led production system and a high level of advertisement expense may inhibit or preclude each other, thus making both OP and CT non-overlapping subsets of OA. This may be expressed in the following logical statement:

[1] where "+" denotes the logical operator or, which represents the union of two sets, while "→" denotes the logical implication operator, as in "OP or CT implies OA". Both OP and CT therefore present two different but viable ways of achieving high overall performance.

Consider a somewhat more contingent statement: firms that exhibit an efficient production system will be high overall performing if they do not conduct much OL, i.e. if they are not in a set of high product design and OL capability. In logical terms, this statement may be expressed as follows:

[2] where "•" denotes the logical operator and, which represents the intersection of two sets, while " ~" denotes the logical not, which represents non-membership of the referred set (complement set).

In effect, statement 2 shows a contingency in set theory. To better understand the possible complexity of the causal relationship in social phenomena, specifically a concept of contextuality, which suggests that an outcome is determined by how attributes are arranged (case-oriented), rather than the net effect of all attributes as isolated items (variable-oriented), let us introduce another contingency statement: firms with high culture capability (CT) will be high overall performing if they also exhibit a high level of product design and OL capability. Combining this statement with statement 2 from above results in the following statement:

[3] The Boolean statement above thus summarises two contingency statements (causal recipes) about the relationship between organisational factors OFs and a firm's overall performance.

The fact that all of the ingredients in one of these two causal recipes must be present for the outcome to occur demonstrates that this view pays attention to how conditions combine in each case, and thus is much more case-oriented than the net effects understanding of causation, which is variable-oriented (Ragin, 2008). These social phenomena can be viewed in terms of set-subset relationships, which are better interpreted in terms of necessity and sufficiency (Ragin, 1987). These two notions allow researchers to generalise from a limited set of cases to larger populations.

On the one hand, a necessary condition indicates that an outcome can be achieved only if the attribute in question is present. It should be noted that the researcher need not consider the attribute in question for cases in which the outcome has not been achieved, because whether the attribute in question is present or absent in such cases does not violate the statement of necessity. The implication for the set-theoretic approach regarding necessity is that membership of cases in the causal attribute under consideration must be more than or equal to the membership of cases in the outcome of interest. Essentially, a set of the causal conditions

must be a superset of the outcome. In other words, a set of the outcome must be a subset of the causal conditions (Ragin, 1987, 2000).

On the other hand, a sufficient condition suggests that an outcome will always be obtained if the attribute in question is present. It should be noted that the researcher need not consider achievement of the outcome for cases in which the attribute in question is not present, because whether the outcome of interest is present or absent in such cases does not violate the statement of sufficiency. The implication for the set-theoretic approach regarding sufficiency is that membership of cases in the outcome of interest must be more than or equal to the membership of cases in the concerned causal attribute. Essentially, the set of the outcome must be a superset of the causal conditions. In other words, the set of the causal conditions must be a subset of the outcome (Ragin, 1987, 2000).

Necessary and sufficient conditions for fuzzy sets can be presented in visual format by plotting the membership scores of cases in an XY matrix, which has a membership score of causal conditions as the horizontal axis and a membership score of the outcome as the vertical axis. (It may also be a combination of conditions depending on the researcher's focus of concern.) As mentioned above, cases are not allowed to show in the upper left area above the diagonal line in order to achieve a necessary condition because this area represents cases for which the causal attributes concerned are more than or equal to their membership in the outcome of interest. Conversely, cases are not allowed to show in the lower right area below the diagonal line in order to attain a sufficient condition as this area represents cases for which membership in the outcome of interest concerned is more than or equal to their causal attributes.

Conventional steps in understanding a contexuality of solution paths of fsQCA results (Crilly, 2011; Fiss, 2011; Greckhamer, 2011) start with discarding unreliable solution paths using a particular consistency threshold (e.g. 0.65 is used for "usually" sufficiency). Then the residual solution paths will be grouped by their combination of core conditions. Those share the same

combination of core conditions (in term of their presence and absence) will be categorised into the same group. The difference between these unique groups displays first-order equifinality (different across-group) that equally achieve a particular outcome, while the difference within a particular group (a deviation exists only in combination of peripheral conditions.) portrays second-order equifinality (different within group) (Fiss, 2011).

By applying this notion into this research context, both types of equifinality provide evidences supporting this research argument that the prior researches' unifinality assumption in the relationship between KS or OF or their combination and corresponding performance (i.e. one best way) is wrong, rather there are many possible ways leading to the same level of outcome depending on the contexuality or the arrangement of attributes of each case. In other words, they prove causal complexity and causal asymmetry assumption in the concerned relationship, which in turn resolving previous inconsistent findings, at different levels. The presence of first-order equifinality suggests a trade-off (substitution) in a broader sense, which is across different groups based on their unique combination of core conditions, to achieve a same level of desired outcome while the presence of second-order equifinality suggests a trade-off (substitution) in a narrow sense, which is between different combinations of peripheral conditions within a group that shares the same combination of core conditions, to also achieve a same level of desired outcome. Therefore, different constellations of peripheral conditions surrounding core conditions in the same analysis provide a finer-grained understanding of which conditions are substitutes for each other (other peripheral conditions) under second-order (within-group) equifinality. Apart from finding potential substitution relationship mentioned above, a careful consideration of a contexuality of solution paths of fsQCA results may also suggest a potential "true" combination between two attributes present as core conditions within the same solution path because both are required with the same level of importance. Moreover, existence of an empirically dominant combination, which is a solution

path that has the highest unique coverage within a particular analysis, provide insights into understanding which solution path is the most relevant to generate a concerned outcome.

Although fsQCA solves many previous limitations of conventional correlational approach, it still has an unsolved limitation. Like regression and other standard statistical methods, fsQCA identifies associations, not causality. In a typical analysis, fsQCA reveals combinations of attributes associated with an outcome; it is up to the researcher, however, to model any possible causal mechanisms. It is here that the justification for a set theoretical interpretation of the model should be justified. The researcher can then array the possible causal conditions in model chains and claim that it is necessary to conduct separate analysis for each intermediate outcome. fsQCA can also be modified to include temporality in the analysis by explicitly including attributes that include time patterns, such as "X preceded Y," in the analysis (Caren and Panofsky, 2005; Ragin and Strand, 2008).

With regard to a robustness test for fsQCA, Epstein et al. (2008) suggest replicating the analysis with a reduced consistency threshold and comparing the new solution (parsimonious, intermediate and conservative solutions) and its consistency and coverage (raw, unique and solution coverage scores) with those of the previous analysis as illustrated in Figure 3.4. For the robust solution, it is expected that the combinations will be similar among a variety of consistency thresholds but the consistency and coverage may be reduced when applying a lower consistency threshold (Schneider and Wagemann, 2012).

The conventional template for the quantitative approach starts by identifying the phenomenon under consideration (dependent variable) believed to vary across cases and/or over time. Then, a literature review of relevant theories and studies must be conducted to list the most important causes (independent variables). The quantitative researcher should develop measurements for both the dependent variable and independent variables and identify a given population that has variation in both variables. Depending on the selected dataset, control variables may be

required to include independent variables. After specifying the hypotheses and/or models, multivariate analysis is conducted on the selected variables to estimate the "net effect" of each independent variable based on its intercorrelation with other independent variables and its correlation with the dependent variable.21 In the final stage, re- specification of the analysis, the most important independent variables are identified. Some independent variables that have weak effects on the dependent variable or are weakly justified by theory may be dropped. The researcher can then report a theory that explains the greatest variation in the dependent variable (Ragin, 2008). The set-theoretic approach, on the other hand, assumes that "relationships among different variables are often best understood in terms of set membership" (Fiss, 2007: 1183).

Complementarity and equifinality, the two main arguments of this research, share the same underlying assumption as the set theoretic approach that "patterns of attributes will exhibit different features and lead to different outcomes depending on how they are arranged" (Fiss, 2007: 1181). In other words, contextuality, which is how attributes within a case of concern are arranged (as present or absent conditions) and interacted, rather than the net effect of all attributes (as isolated items), determines the outcome. Complementarity exists when there is a match between causal factors, which leads to a higher level of outcome. By the same token, equifinality takes place when there are at least two different paths (combination of causal factors) that result in the same level of outcome. However, although the discussion of organizational configuration stresses causal asymmetry, synergistic effects and equifinality, previous research studies have been conducted mainly using an econometric method, which relies on causal symmetry, additive effects and an assumption of unifinality (Fiss, 2007) because of the lack of the alternative technique supporting causal asymmetry, synergistic effects and equifinality assumption.

This assumption mismatch resulting from methodological gap makes it impossible to capture, not to mention test, complementarity and equifinality, potentially leading to equivocal results in prior researches. For instance, regression analysis is based on the independent contribution of a particular variable while everything else stays the same, usually called a ceteris paribus assumption (Kogut, 2010). By focusing on the net effect of a variable without taking into account the meaning of the presence or absence of other variables, regression analysis cannot identify in which situations a particular variable has more (or less) influence on the outcome. In other words, correlation-based analysis cannot both detect complementarity (Fiss, 2007) and consider equifinality (Van de Ven & Drazin, 1985).

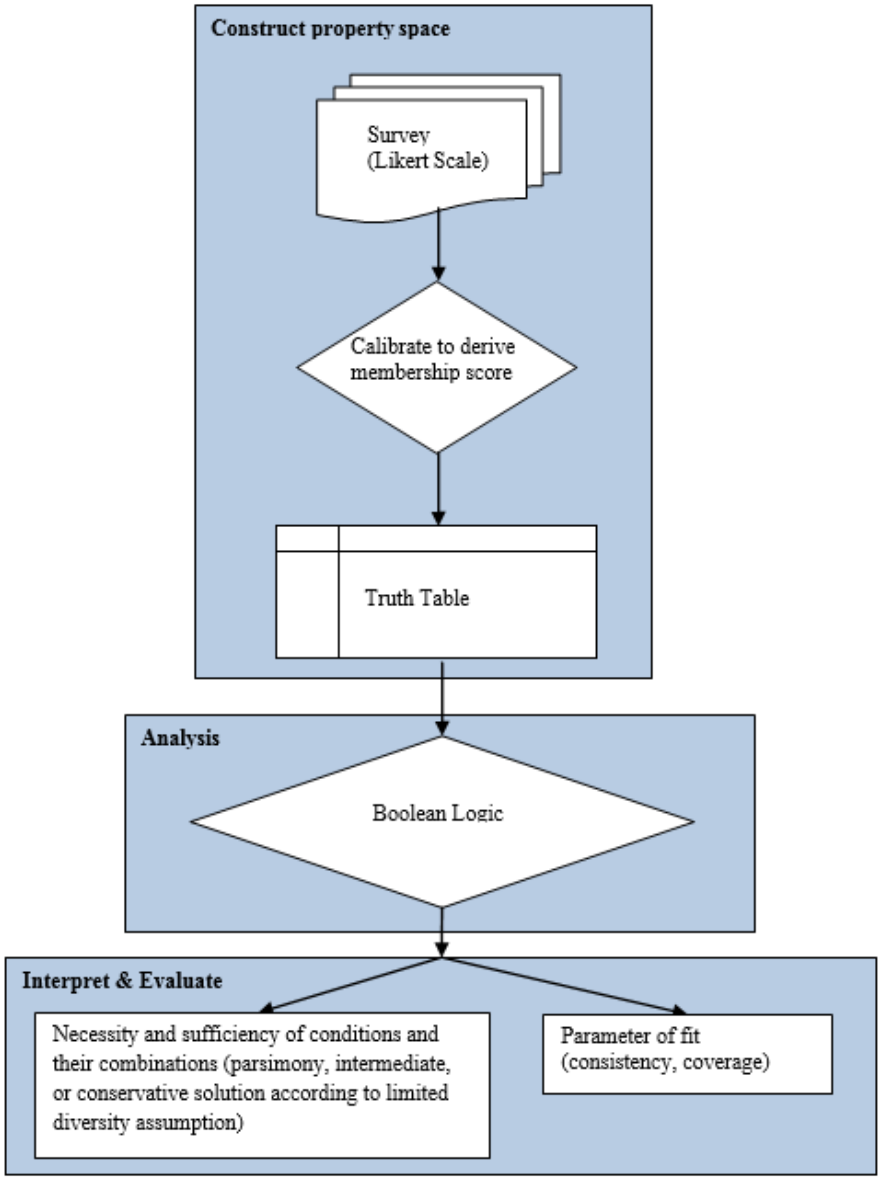


Figure 3.4 Flowchart of fsQCA procedures
Source: (Fiss, 2011)

3.7 Integrating DEA and fsQCA techniques

Integrating DEA and fsQCA is a circumstance in which doing more of one thing increases the returns to doing more of another (Milgrom and Robert, 1995: 181). Setting the integration notion in this research context, this study anticipates that consistency between KS (the components of knowledge sharing) and OF (organisational factors) will result in better performance than pursuing incompatible alternatives, a situation known as "supermodularity" in fsQCA theory (Milgrom and Robert, 1995). The principal aim is not to try to resolve the underlying theoretical tension between the two perspectives, since this study is conscious that they are drawn from two different theoretical traditions. Rather, to improve the explanation of knowledge sharing performance by simultaneously incorporating the impact of both industry and firm-specific organisational factors on knowledge sharing performance, in order to demonstrate whether consistency between them better predicts a higher performance outcome than each individually. In effect, this study will attempt to extend the relevant empirical literature (Schmalensee, 1985; Hansen and Wernerfelt, 1989; Rumelt, 1991; McGahan and Porter, 1997; Mauri and Michaels, 1998; Spanos and Lioukas, 2001) by proposing a composite model in which these two distinct but integrating perspectives explicitly modelled and concurrently tested to find compatible combinations. Although there is no explicit theories that integrate DEA and fsQCA stems from similarity, practices "of the any kind", Milgrom and Roberts (1995) considered the examples of combination of techniques by complementary.

Consequently, the dominant function of organisational performance in this field follows this assumption that combining stems from similarity. For example, Williamson (2004) suggests that the less varied the practices in a particular system, the better. Building on this notion, this

study aims to identify similarities between each integration of KS and each type of OF, which in turn should lead to integration and generate higher levels of performance.

Although it appears that relationship between KS and OF in explaining KSP has only recently been recognised (Conner, 1991; Mahoney and Pandian, 1992; Amit and Schoemaker, 1993; Peteraf, 1993; Henderson and Cockburn, 1994), in fact Wernerfelt (1984) suggested that a competitive advantage framework (the root of KS) and a resource- based view (the root of OF) are two sides of the same coin. Likewise, Hamel and Prahalad (1986) have argued that to be successful (to achieve sustained competitive advantage), a company must reconcile its purpose, which is comparable with the ideal type of organisational performance, with its means, which are comparable with the knowledge resources and OFs underlying its current position, through strategic intent (a corporate challenge to achieve a desired future position).

Similarly, Cool and Schendel (1988: 209) have argued that if a firm's current actions [strategies] are incongruent with its accumulated 'stock' of knowledge assets [resources and skills or competences], then it is likely to be less effective than other firms pursuing a similar strategy but with a good 'fit' between current strategic investments and accumulated assets. Barney (1992) and Barney and Griffin (1992) also argue that value is created not only through internal fit between the resources and capabilities within a firm and its pursued strategy, but also by external fit between the firm's strategy and its competitive environment.

In addition, Barney and Zajac (1994) claim that, unless the content of the firm's strategy and competitive environment are taken into account, strategy implementation (resources and capabilities) cannot be clearly understood. Similarly, Short et al. (2007) assert that to better understand why some firms outperform others, strategic group level, which is an important component of the organisational system, must be added to resource-based logic.

In the same manner, Sirmon et al (2007) propose that contingency theory (the root of KS) should be integrated with resource-based theory (the root of OF) to explain resource management processes, because value created by resource management is at least partly contingent on a firm's external environment. In other words, varying degrees of uncertainty and favourability in the environment affect the potential value of a firm's resources and capabilities (Sirmon et al., 2007).

Perhaps the most logically convincing argument in this regard is that of Spanos and Lioukas (2001), who argue for combination between these two theoretical models and for a composite framework for three reasons. Firstly, by considering their difference in terms of the nature of the organisational performance created by a firm, these two approaches are integrated in providing multi-dimensional explanations for KSP because they offer a balanced view (both internal and external antecedents) of sources of competitive advantage. In other words, it could be argued that a KSP framework and a resource-based view jointly constitute the KSP model (Spanos and Lioukas, 2001). While the focus of the KSP framework on industry analysis to understand the industry's impact on business unit performance provides the "opportunities and threats" dimensions, the resource-based view, which emphasizes a specific firm's attempts to develop and combine resources and capabilities, constitutes the "strengths and weaknesses" dimensions (Foss, 1996). In other words, whereas the KSP framework closely monitors industry structure to ensure that a firm's controlled resources enable it to maintain competitive advantage (gain momentous edge) because factors changes "may change the significance of resources to the firm" (Penrose, 1959: 79), the organisational factors focus on developing and combining resources to gain knowledge sharing efficiency by considering the impact factor of these conditions. Since these two approaches cover different domains of performance analysis (Barney, 1991a; Foss, 1997b), each of which generate different types of value, i.e. comparative analysis vs. efficiency analysis (Barney and Griffin, 1992; Barney, 1992; Sirmon et al., 2007),

they coexist and are integrating DEA and fsQCA in providing a multi-dimensional explanation of knowledge sharing performance (Spanos and Lioukas, 2001).

Secondly, taking into account their shared belief that sustained above-normal returns are possible and can be achieved by an attractive strategic position (Conner, 1991), each perspective attempts to explain the same phenomenon (sustainable competitive advantage) from different points of view, as mentioned previously. Thirdly, taking into consideration the similarity of the unit of analysis, both also focus on the individual firm as a critical unit of analysis (despite their dissimilar perspectives on what is more important as a source of competitive advantage).

3.8 Research ethics

The questionnaires were distributed with an explanation on what the study was about and how the data would be used along with the contact information of the researcher. The questions asked respondents on their opinions about this study, their knowledge sharing perceptions, factors that will influence knowledge interaction and how best to measure key knowledge performance indicators within their organisations. Those answers are sensitive to their status and the relationship with their colleagues and organisations. Furthermore, demographics and contact information are private and important information. To assure respondents on giving their honest answer, the researcher stated in the covered letter that their responses and their private information would be kept confidentially. Therefore, the respondents' information would not be revealed or be made for commercial purposes. Ethical consideration of this study fulfilled the ethical principles for conducting research with Plymouth university ethical approval.

Ethics are a critical aspect for the conduct of research and refer to the appropriateness of research behaviour in relation to the rights of those who become the subject of the work, or

are affected by it (Saunders et al, 2012). The study recognises that the norms of behaviour, which prevail within ethnical consideration, may create a number of ethical positions that will require to be carefully considered, such as reporting relationships and presentation of commercially sensitive information. However, in pursuing the objectives of the research, it was important to proceed with sensitivity and respect for participants.

First, an important dimension to the ethical conduct of this study is the question of the relationship between the researcher and the participant. This required a high degree of sensitivity on the part of the researcher not to use the existence of such a relationship or the nature of a 'power relationship' (Saunders et al, 2012) to compromise the participant in any way. Careful planning of survey rollout was also necessary given the previous position of the researcher and this required the researcher to remain as detached and objective as possible.

Second, absolute assurances about the use of the data collected, coupled with an unqualified confidentiality and anonymity was critical to gain trust, especially from the staff of the organisations. The author sought the assistance of the university IT support team, to assist in the rollout of the questionnaire and importantly, in the almost daily follow up that was required to achieve a high response rate. This provided the participants with sufficient information that the survey was to better the purpose of the organisation as a whole, and that consistent and continuous reinforcement of the confidential treatment of the information given by the respondents, was seen as a critical success factor within the study. Finally, as previously mentioned a letter was sent to all participates seeking participation, notwithstanding an option to decline was a key feature of this correspondence thus ensuring self-determination for all.

3.9 Summary

Research methodology discusses the structure for discovering new knowledge based on theories on how research should be carried out. This thesis was positioned in the positivism

applying deductive approach and mono method quantitative way through the web-based survey. Subsequently, the data collection method and questionnaire design was presented in detail. The questionnaire was designed by Churchill's (2001) procedure and followed Plymouth university research ethics guideline. This study follows the research philosophy procedures by outlining deductive reasoning (abductive reasoning) in order to satistify and response to research questions and accomplish research objectives. The research method adopted for this study is a quantitative approach. The areas described in this chapter construct the research design adopted in this study, and an overview of the same can be seen in Figure 3.2.

Chapter four: Data collection

4.1 Introduction

The data collection section of this study is about explaining data collection protocol, questionnaire design, sampling strategy and pilot study as the prerequisite tools for measuring knowledge sharing performance analysis. This chapter will provide detailed description of the procedures that were followed for pre and post data collection by observing the basic rudimental theories. The procedure for developing questionnaire, how the pilot testing was carried out and types of validity will be extensively discussed in different sections in this chapter. Also in this chapter, the measurement approaches, developed KSP model, knowledge DEA efficiency and fsQCA will be deliberated.

4.2 Data collection protocol

Surveys can be regarded as good methods for collecting data to measure a number of peoples' opinion and behaviour (Easterby-Smith et al., 2012). This study employs a questionnaire survey for data collection because it can be used to identify and discern relationships between variables that might have causal relationships (Saunders et al., 2012). Collis and Hussey (2009,

p. 191) stated that a questionnaire is a list of structured questions, which have been chosen after considerable testing with a view to eliciting reliable responses from a particular group of people.

According to Saunders et al. (2012), the questionnaire design varies according to how it is administered and the amount of contacts for respondents. In general, self-administered questionnaires are undertaken by the respondents. These are conducted by the Internet (Internet-mediated questionnaires), Intranet (Intranet- mediated questionnaires), posted to respondents by mail (postal questionnaire), or delivered in person and collected soon (delivery and collection questionnaire). As a different way, interviewer-administered questionnaires are a way to record a respondent's answer by the interviewer through a telephone or a physical meeting. Figure 4.1 indicates the various types of questionnaires

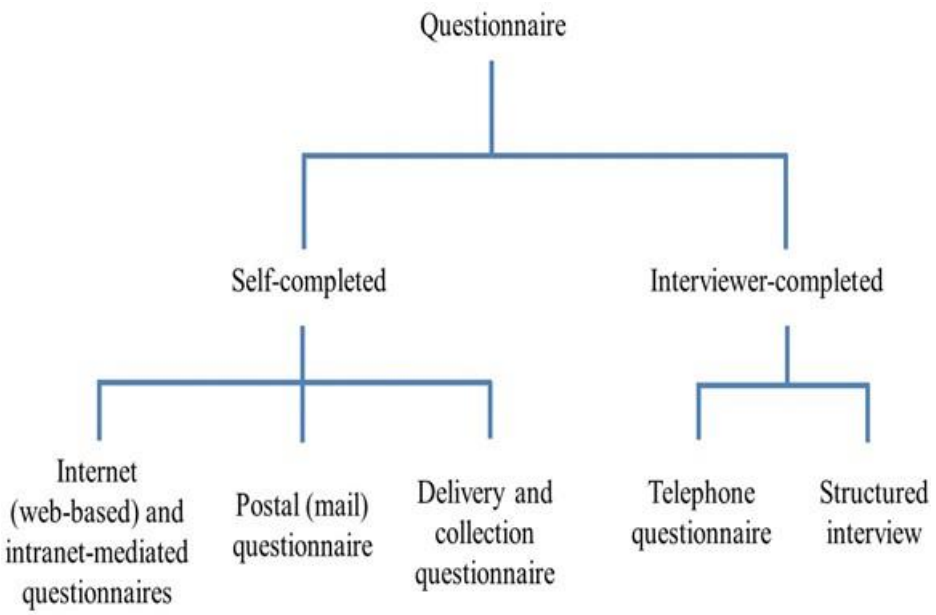


Figure 4.1 Types of questionnaire
Source: (Bryman and Bell, 2011)

A considerable growth in the number of surveys online has been detected for the last decade (Bryman and Bell, 2011). Two categories of online social surveys are email surveys (through emails) and web surveys (through a website). This study employs the web survey as shown in

Appendix B, since it is more advantageous than the email and paper survey in that it can utilise diverse decorations, colour and variety in the format of questions in terms of appearance (Bryman and Bell, 2011). If researchers notify potential respondents of URL (web address) by emails, texts or phone calls or in person, respondents can answer that questionnaire by visiting the website clicking URL via their personal computer. The reason this method is employed for this study is because there are a variety of advantages of it. At first, the Internet-mediated questionnaires by email provide potential respondents with greater flexibility and control (see **Appendix A**), as they can respond to their own email in front of their personal computer (Saunders et al., 2012). Therefore, filling out a questionnaire using this method is more convenient for respondents because they can complete it when they have free time and at the speed they want. Secondly, the cost per respondent for large samples is cheaper than other methods if samples are widely dispersed, so it is possible to cover a widespread geographical area. Thirdly, researchers can sometimes know who or which organisation completes the questionnaire. Fourthly, a researcher is able to send questionnaires regardless of the number of them in one batch without any costs. Fifthly, there will be no interviewer effects causing bias due to characteristics of interviewer's (Bryman and Bell, 2011). Finally, the online questionnaire assists researchers to save much time by automatically coding respondents' answers, so no bias issues via the coding occurs.

In contrast, the disadvantage of an online questionnaire is low response rates. First of all, it is common that a twenty per cent response rate is seen as good, since there is no encouragement for anonymous respondents to demand their cooperation (Easterby-Smith et al., 2012). Secondly, this low response causes sample bias problems because there is a possibility that respondents who filled out a questionnaire might be not representative of the targeted population (Collis and Hussey, 2009). For example, a high proportion of executives might hand an online questionnaire over to their subordinates because they are normally very busy. Thirdly, there is no way to demonstrate whether respondents have a difficulty in completing a

question (Sekaran and Bougie, 2009). Fourthly, researchers cannot ask a number of questions which might not be salient to respondents due to 'respondent fatigue' if questionnaires have a lot of questions (Bryman and Bell, 2011). Lastly, there is the possibility that people decide not to complete a questionnaire if they feel bored or it is irrelevant to them (Bryman and Bell, 2011).

In spite of these disadvantages, there are several ways to improve response rates for the questionnaires. First, closed questions and short questionnaires increase response rate (Collis and Hussey, 2009). Second, some methods such as sending follow-up letters and attaching small monetary incentives can increase the response rates (Sekaran and Bougie, 2009). Third, response rates can be boosted by an attractive layout and clear instructions (Bryman and Bell, 2011). Fourth, accompanying a good cover letter stating the reasons for the study also can increase the response rates (Bryman and Bell, 2011).

4.3 Questionnaire design

The constructs postulated in this study have been extracted explicitly from the literature review, and selected measures which have high reliability and validity. To develop and validate reliable measures of KS, OF and PERF, subjective measures based on DEA and fsQCA technique were canvassed. A questionnaire to capture the extent to which each respondent's organisation performs and perceive KS, OF and PERF were designed to ensure coincidence between researchers' understanding of the meaning of each measurement scale proposed, and practitioners' understanding as suggested by scale development research (Churchill, 2001, Segars and Grover, 1998, Xia and Lee, 2005). This study has invited 12 post-graduate students and knowledge experts who are also currently senior practitioners in manufacturing and service organisations. In particular, they have attempted to ensure content and face validity by scrutinising instruments, drafts of questionnaires and cover letter from the stance of domain representativeness, item specificity and readability. Some instruments were

reworded according to above processes. If a pilot test indicates appropriate content validity of instruments, it will be used. Item purification and development does not halt at any one of these stages, but, rather, is an iterative process. Each variable is evaluated using a five point Likert scale, ranging from "1 = strongly disagree" to "5 = strongly agree". Questionnaire design is a demanding task, so it requires a guideline on drawing appropriate questionnaires. McDaniel and Gates (2013) put forward ten-step questionnaire design process whilst Churchill (2001) proposed nine-step procedure. Due to simplicity and academic focus, this study decides to use Churchill's (2001) procedure for developing a questionnaire as shown in Figure 4.2.

As a first stage in questionnaire design, researchers should have sufficient knowledge regarding research problem and associations to guide the study. The associations guide what information will be pursued since they elaborate what kinds of relationships between the main constructs will be explored. Therefore, the questionnaire was designed to measure answers from respondents for three main constructs: KS, OF and PERF. Besides, the questionnaire includes a cover page illustrating research objectives and author's information. Also, some questions that are related to both respondents' profile and organisational profile in the organisation. The type of questionnaire and method of administration such as an email, postal mail, online survey, telephone and personal interviews. After carefully considering how data is collected and what level of structure and disguise is used, a researcher should decide the method of administration (Churchill, 2001).

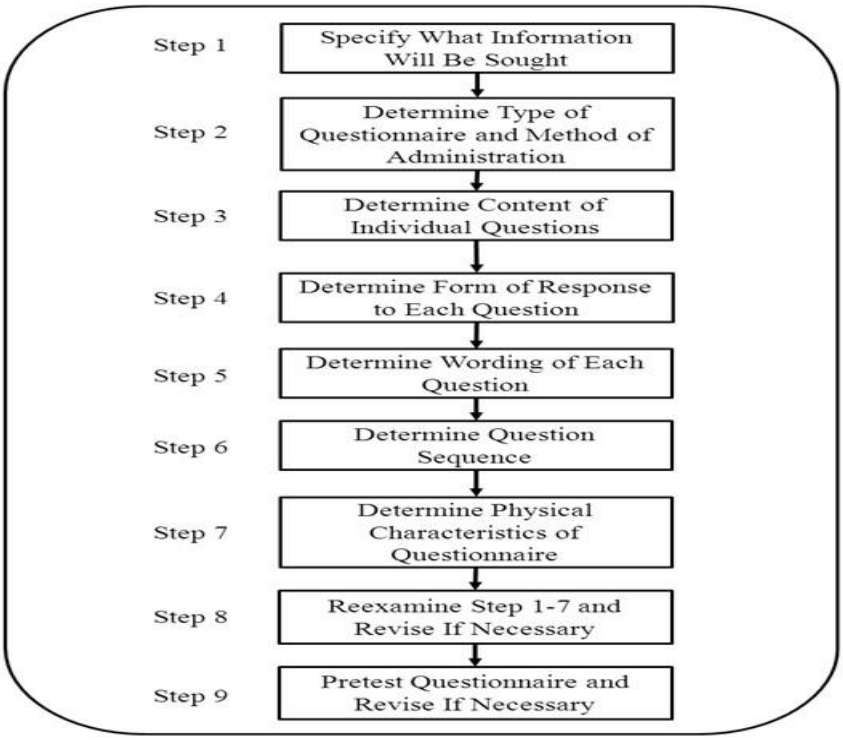


Figure 4.2 Procedure for developing a questionnaire

Source: (McDaniel and Gates, 2013)

The research method normally affects the questionnaire design (McDaniel and Gates, 2013). This study employs a structured questionnaire by online web-based survey (see **Appendix B**), since this method of collecting data is inexpensive to create and maintain it as well as to eliminate the risk of missing data, and facilitates accurate assembly of a complete dataset (Froehle and Roth, 2004). The observed variables which are rigorously extracted from literature review in the previous chapter are included in questionnaires after adequately revising. Given the novelty of KS, OF and PERF measures in a knowledge context, the DEA and fsQCA techniques facilitate verification and enhances content validity proceeding via a construct description phase, a random item list phase, and finally a set of sorting instructions.

4.4 Sampling strategy and pilot study

The ability of this study to make unbiased inferences about populations depends on having complete information about all selected sample units or establishing that the non-respondents do not differ from respondents in an important way (Bryman and Bell, 2011). Since it is difficult to rule out biased non-respondents who might use the process to protest against a particular issue it is desirable to obtain high response rates. This can be difficult with some populations (Bryman and Bell, 2011). Surveying the entire population within the seven chosen countries network was seen as a realistic goal for the researcher, (total sample size over 300 employees) and as a result did not require compromise between theoretical requirements and practical implications (Bryman and Bell, 2011). The participants for all surveys were located across seven countires in three continents, which was evenly distributed across these continents.

The researcher wrote to all of the respondents for their support and outlining the purpose and range of the research being undertaken, (see **Appendix A**). In addition, the process of research did have significant management support at all levels and with the support and assistance negotiated from a general air of enthusiasm was created given the previous professional position of the researcher with some of the organisations which were involved.

In case-oriented research (small and intermediate Ns) case selection is guided by explicit theoretical concerns and the underlying research questions (Ragin, 2008). Once the conceptual framework is established, two considerations need to be taken into account in defining the sampling strategy. First, the study must define an area of homogeneity, meaning that cases must parallel each other and be comparable in terms of their background characteristics.

Within this conceptual space, maximum heterogeneity over a minimum number of cases needs to be achieved (Ragin, 2008). This means that the sample requires cases with both positive and negative outcomes. The fact that fsQCA sees cases as configurations of factors enables

the emergence of a middle path between assuming that cases are homogenous enough to equate their dissimilarities and attending to the specificity of each case (Ragin, 2000).

Case selection in QCA does not rely on mechanistic procedures (e.g. random sampling), but rather on a tentative and iterative process where the criteria of sufficient homogeneity and maximum heterogeneity are constantly pursued (Ragin, 2008). The nature of the procedure used to construct the sample in fsCQA studies minimizes the threat of sample selection biases, which generally affect studies that require random sampling.

In any small-N or medium-N design the quest for generalisation should always be bounded, by comparing cases that share a sufficient number of features and that operate within sufficiently comparable contexts. (In contrast to large-N research) the population of cases is not a given; it is actually delimited by the researcher, informed by theory and empirical knowledge.

In quantitative studies, the sample size usually depends on three factors:

[1] the population size

[2] the variability in the instrument

[3] the size of the effect to be measure.

It is worth nothing that a large population may not necessarily require a larger sample size and the greater variability in the variable, or what is being measured, the larger the required sample size in cases of research where only small effects are expected in the population, such as exploratory medical research, a larger research may be required.

4.4.1 Sampling procedure

Sampling refers to the choice of a subset of a population used to derive conclusions about the characteristics of the whole population (Hair et al., 2007). Issues regarding sampling are important in determining the extent to which research findings are generalisable. Saunders et al. (2012) explained that collecting data from a sample that represents the entire population rather than from the entire population is necessary when budget and time constraints prevent the researcher from surveying the entire population. It is argued that using sampling can provide higher overall accuracy than surveying the entire population (Sekaran and Bougie, 2011).

Stratified Random Sampling has been found to be efficient and appropriate in extracting information from various strata (several sub populations) within the population (Sekaran, 2003). The technique involved in this sampling is to define the strata and also to determine how many members of each stratum to include in the sample. There are two common ways of allocating the sample. Firstly, equal numbers could be selected from the strata regardless of their sizes. Secondly, proportional allocation means that each stratum contributes to the sample a number of members proportional to its size. However, the most important reason for employing stratified random sampling is to ensure that members from each stratum are included in the sample and no stratum is excluded (Bryman and Bell, 2011). It has advantages over other probability samples because all groups are adequately sampled and comparisons between groups are possible.

Online links to a web-based survey were emailed to 524 potential respondents (see **Appendix C**). To increase response rates, respondents were promised to be offered anonymity and an executive summary of findings. Questionnaires were distributed from April to August 2015, followed by two email reminders generating over 300 responses, over 67.18% response rate. The covariance structure preferred for subsequent analysis assumes no missing values in the data set (Anderson and Gerbing, 1988), a condition guaranteed by the design of the web-based

questionnaire. In terms of sample size, there is no absolute standard. It can be considered as small (less than 100 samples), medium (between 100 and 200 samples) and large (more than 200 samples). Therefore, over 300 samples are judged as the large size (Hair et al., 2010).

4.4.2 Pilot test

Sekaran and Bougie (2011) noted that testing questionnaire before the conducting further data collection will help the researcher to find out if participants will understand the questions, if the questions mean the same thing to all participants, and how long it takes to complete. In the pilot test for this study, 21 responses were received from 30 pilot testing sent to KM experts, knowledge researchers and industry experts. Then, Cronbach's alpha values were calculated to establish the reliability (internal consistency) of the questions and to check whether the respondents understood all the questions (Saunders et al., 2012). Item-total correlations also used in this study to assess internal consistency, it reflects how one item is correlated with the other items in a given set of items (Saunders et al., 2012).

4.5 Validity

Validity is referred to as the accuracy of a measure. Hair et al. (2007) defined it as the extent to which a construct measures what it is supposed to measure. An instrument should be logically consistent and wholly cover all features of the abstract constructs or concepts to measure as illustrated in Table 4.1. Validity of each construct can be considered as a basic and fundamental condition in developing theory (Steenkamp and Van Trijp, 1991). Also, validity is concerned with systematic errors rather than random errors that can be the major source of reliability evaluation.

Table 4.1 Illustrates a short introduction to various types of validity

Validity	Description
Content validity	Does the measure adequately measure the concept?
Convergent validity	Do two instruments measuring the concept correlate highly?
Discriminant validity	Does the measure have a low correlation with a variable?

Source: Sekaran and Bougie (2009, p. 160)

4.5.1 Content validity

Content validity is often referred to as measurement validity, and this concept mainly applies to quantitative research (Bryman and Bell, 2011). In order to precisely measure latent variables, these have to be comprehensively defined from the extant literature as well as the author's comprehension of those (Dunn et al., 1994). Li et al. (2006) asserted that in-depth discussions with practitioners and academics are necessary to achieve content validity. Content validity is referred to as the appropriateness with which the domain of the characteristics is seized by the measure (Churchill, 2001). Churchill (2001) stated that content validity may exist when the domain of the characteristics is appropriately reflected by the scale items, but it largely relies on a researcher's subjective judgment. In addition, it is evaluated by testing the measure with a view to contending the domain being sampled. If domains are different from the domain of the variables as perceived, it can be considered as a lack of content validity (Churchill, 2001). On the other hand, if the instrument involves a representative sample of the universe of the subject concerned, content validity is good (Dunn et al., 1994). If the domain or universe of the variables is measured by a large number of items, it is regarded as having greater content validity (Sekaran and Bougie, 2009). However, there are no rigorous ways to confirm content validity (Dunn et al., 1994). Measuring multiple items is a typical way to thoroughly measure the constructs (Churchill, 2001). Churchill (2001) contended that specifying the domain of the construct, generating items that exhaust the

domain, and subsequently purifying the resulting scale should produce a measure which is content, and that content validity depends on examining procedures which are used to develop the instrument. If convergent and discriminant validity are significant, construct validity can be supported (Dunn et al., 1994).

4.5.2 Convergent validity

Convergent validity may be seen as the extent to which constructs have a correlation with other ways designed to measure the same construct (Churchill, 2001). Anderson and Gerbing (1988) argued that convergent validity can be evaluated from measurement models by determining whether each indicator's estimated coefficient on its posited underlying construct factors are statistically significant. This implies that it must correlate with other measures designed to measure at the same item (Churchill, 2001). In other words, convergent validity refers to the level of agreement between more than two attempts to gauge the same construct through different methods (Anderson and Gerbing, 1988). Evaluation of convergent validity can be elucidated by a confirmatory factor analysis. To appraise convergent validity, it is necessary to check whether the single item's standardised coefficient from the measurement model is significant or not, larger than twice its standard error (Anderson and Gerbing, 1988). It exists when factor loadings are all significant, meaning that the factor loading is different from zero in accordance with the t-values.

4.5.3 Discriminant validity

Discriminant validity refers to the extent to which the measure is indeed novel and not simply a reflection of some other variable (Churchill, 2001). According to Anderson and Gerbing (1988, p. 416), discriminant validity can be evaluated for two estimated constructs by constraining the estimated correlation parameter between them to 1.0 and performing a chi-square difference test on the values obtained for the constrained and unconstrained models". It must not correlate highly with measures intended to assess different items (Churchill, 2001).

In other words, individual items employed to measure one specific latent variable should not measure another latent variable simultaneously. Discriminant validity normally relies on the level to which a scale measures distinct constructs (Sekaran and Bougie, 2009). It can be assessed by testing the inter-correlations amongst the constructs that are generated and purified by exploratory factor analysis and confirmatory factor analysis. If the chi-squared difference value is associated with a p-value of less than 0.05, discriminant validity exists (Sekaran and Bougie, 2009).

4.6 Measurement approaches

As shown in Figure 4.3, three attributes combined to create the outcome, but with none by itself necessary or sufficient, these measuring approaches display a good example of the causal complexity of social phenomena, comprising many concepts that cannot be addressed by a correlational approach such as causal asymmetry (necessary and sufficient condition), combination (conjunctural causal condition) and equifinality (two different viable combinations of KS and OF). While correlation forces symmetry on asymmetric theoretical claims, set-theoretic analysis offers an analytical system that is faithful to verbal theory, which is largely set-theoretic in nature (Ragin, 2008), thus making it the most appropriate methodology for this research as it truly reflects its main arguments. By applying set theoretic notion into this research context.

[1] Relationship between KS and performance:

This study expect that a particular type of KS is a sufficient condition for a business process to achieve a specific (relevant) performance dimension.

A1: KAD + BPD + S + C ⊂ IE + OE + EF + AD

A1a: KAD ⊂ IE

A1b: BPD ⊂ OE

A1c: S ⊂ EF

A1d: C ⊂ AD

[2] Relationship between OF and performance:

This study anticipate that a particular type of FC is a sufficient condition for a business process to achieve a specific (relevant) performance dimension.

A2: OP + RD + LP + OS + CT ⊂ IE + OE + EF + AD

A2a: OP ⊂ IE

A2b: OL ⊂ OE

A2c: LP · OS ⊂ EF

Ad: CT ⊂ AD

[3] Combination between KS and OF on performance:

This study argues that compatibility between a particular integration of KS and a specific type of OF is a sufficient condition for a business unit to achieve a specific (relevant) performance dimension.

A3: KAD·OP + OL + BPD·OL + S·LP·OS + C·CT ⊂ IE + OE + EF + AD

A3a: KAD·OP ⊂ IE

A3b: BPD·OL ⊂ OE

A3c: S·LP·OS ⊂ EF

A3d: C·CT ⊂ AD

The fsQCA procedure comprises three steps: constructing property space, analysing by Boolean logic, and interpreting and evaluating the research result. (A flowchart of this procedure is shown in Figure 4.3. The details are as follows; constructing property space: fsQCA does not limit types of input data source. It may be derived from either primary data (e.g. survey or interview) or secondary data (e.g. financial reports, results of other research or economic indices). Once data have been obtained, both dependent and independent variables will be calibrated using Ragin's (1987, 2000) direct method, as mentioned earlier, to transform the raw scores of relative variables into more meaningful set measures. Specifying full membership, full non-membership, and a crossover point of maximum ambiguity (three thresholds) regarding membership in a set of interest in accordance with external standards allows the researcher to rescale an interval variable using the crossover point as an anchor from which deviation scores are calculated, taking the values of full membership and full non-membership as the upper and lower bounds. Then these deviation scores are transformed into the metric of log odds, which is centred around 0 and has no upper or lower bound (Ragin, 2008). Thus, the rescaled measures range from 0 to 1, and the converted scores are tied to three theoretically-led thresholds. Note that, because the laws governing the intersection of fuzzy sets make cases with scores of exactly 0.5 difficult to analyse, Ragin (2008) recommends avoiding the use of a precise 0.5 membership score for causal conditions.

According to the KSP conceptual framework mentioned in previous sections, the KSP model is as follows:

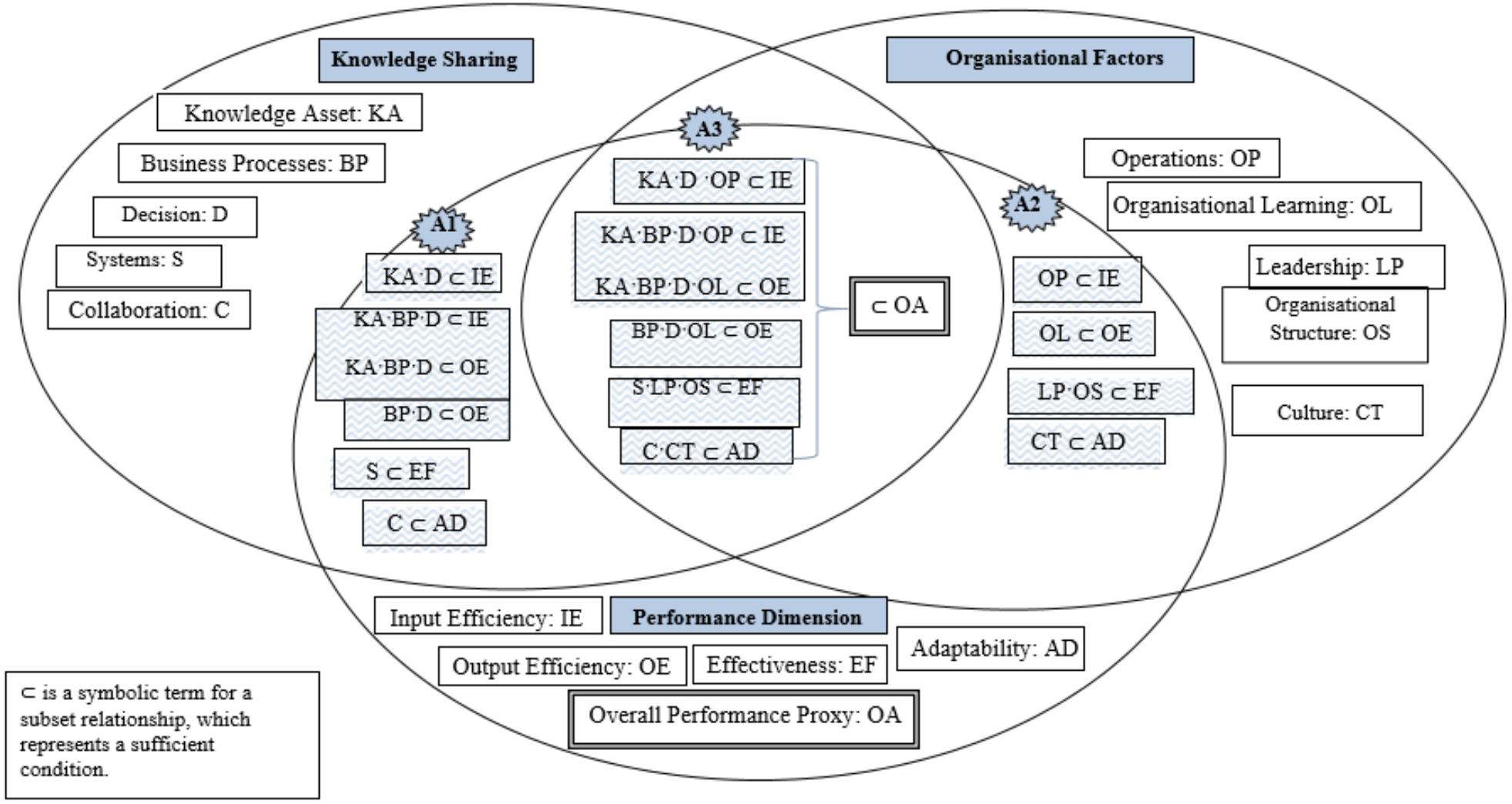


Figure 4.3 KSP implementation model

4.7 Knowledge DEA efficiency

This section starts by defining knowledge DEA efficiency, the technical relationship between inputs and outputs. Athanassopoulos (1994) notes that efficiency is described in economic terms as "the outcome of comparing the actual output of a productive unit against a theoretically defined maximum output given the resources used". The maximum outputs that can be obtained from a given vector of inputs are defined by the production function. The term "efficiency" has been used by economists such as Schmidt (1985) to describe how well an organisation is performing in terms of utilising its resources in order to produce meaningful outputs (Norman and Stoker, 1991). The knowledge DEA efficiency has two components. The first one is called technical or physical, this component attributes to management capability for avoiding waste by producing as much outputs as inputs usage allows, or using as little inputs as outputs production allows. The second component is allocative, this component refers to management's ability to combine inputs and outputs in optimal performance in the light of current operations factors (Fried et al., 1993). Farrell (1957) discussed a simple measure of firm efficiency, demonstrated that the terms "efficiency" can be divided into two different measures; these are "Allocative efficiency" and "Technical efficiency". Technical efficiency reflects the firm's ability to generate maximum output from a given set of inputs. Accordingly, Fried et al., (1993) technical efficiency is defined as: a procedure is technically efficient (or Pareto optimal) if an increase in output requires a reduction in at least one other output or an increase in at least one input. Allocative efficiency reflects the firm's ability to use the inputs in optimal operations, given the respective processes and the production technology (Coelli et al., 1998).

Many different classifications of the different research types exist and the boundaries between each type can sometimes be a little fuzzy. Kontio (2005) distinguishes the following three however:

[1] Exploratory research which structures and identifies new issues and problems.

[2] Constructive research which identifies and develops methods to solve issues or problems.

[3] Empirical research which tests a solution's feasibility using empirical data.

This particular research is exploratory due to the way in which the literature review investigated the current state of research and identified gaps within it. However, due to the experimental aspects this research demonstrates (i.e. to test the feasibility of measuring knowledge sharing efficiency using DEA), the study can also be classified as a quantitative empirical research. This research is consequently both exploratory and empirical.

In regards to applying DEA to knowledge sharing efficiency measurement, the following research question has been formulated:

[1] How can DEA be a tool for knowledge sharing efficiency measurement?

[2] This prompts a series of other more specific research questions:

[3] What are the factors affecting knowledge sharing efficiency?

[4] What is each factor's exact effect on knowledge sharing efficiency?

[5] How user friendly is applying a DEA tool to knowledge sharing efficiency measurement?

[6] How useful is applying DEA to knowledge sharing efficiency?

Yin (1994) explains that the decisions of DEA approach to knowledge sharing performance measurement depends on three conditions: the type of research question, the control an investigator [or researcher] has over actual behavioural events, and the focus on contemporary

as opposed to historical phenomena. As Yin (1994) comes from a more theoretical and social sciences background, only the first criterion (the type of research question) is relevant to this discussion. The application of DEA to knowledge sharing efficiency measurement is believed to be entirely new, it is consequently not possible to look at past research (although there is extensive literature on DEA's application to efficiency measurement). Furthermore, experts' opinion gathered from methods such as the Delphi technique or conventional surveys can only probe people's opinion on this specialist subject which would unfortunately not really answer the different research questions listed above (in this case experts would be the people using the measure and academics specialised in the efficiency measurement). Yin (1994) mentions that most texts about experimental efficiency measurement study's methodology tend to focus chiefly on data collection. He argues that the design and analysis steps are as important as the data collection step despite being often neglected. This section will consequently briefly discuss all of these important steps.

Yin lists five components of importance for efficiency measurement study's methodology.

These are questions generally written in the form of 'who', 'what', 'where', 'how' and 'why' questions. Writing these questions helps deciding which research method should be used. This study's questions have already been listed above.

This is essential as it helps the researcher understanding what needs to be researched and answered. The proposition helps the researcher to move in the right direction and to look at the right place to find evidences. Yin (1994) notes that some studies do not have a research proposition. This can be the case for some experiments or surveys. The study's proposition corresponds to the model which was introduced at the very beginning of this thesis.

This relates to 'what the case is' (or cases are); in many social sciences studies the unit of analysis is an individual. In this particular study however, knowledge sharing efficiency

performance is measured for the organisation. Yet, as DEA is an efficient frontier benchmarking technique, knowledge sharing efficiency can only be calculated for a group of conditions or more precisely factors. Furthermore, and although analysis can be made individually for each factor, knowledge sharing efficiency tend to consider DMUs wide exercise. Consequently, and although individual performance analysis will be conducted for some factors, this study's real units of analysis is a whole KSP model.

Linking data to proposition. This step needs to be done in order to connect the data, or data results, to the model. There is no clearly defined method to link data to the research proposition although the thorough observation of the DEA results along with traditional benchmarking analysis should provide a robust link to the proposition.

Criterion for interpreting the study's finding. These criteria are essential to test the results' validity and analyse the results. This study will use KSP model' opinion on the DEA and traditional benchmarking results to evaluate the validity and usefulness of this study's approach against those of others.

Criteria to interpret study's findings include:

[1] The measure is coherent with knowledge sharing efficiency understanding.

[2] The measure can be easily understood.

[3] The measure includes OFs impacting knowledge sharing efficiency and is an essential point in justifying an improvement on the performance measure.

[4] The measure can help organisation' management to make better informed decisions, which could in turn lead to better knowledge sharing efficiency (this point is also essential in justifying an improvement on the performance measure).

[5] The measure's calculations are reproducible (this refers to the method validity).

It is essential to conceptualise the DEA model first as this will tell what data need to be gathered. Because the data are of a quantitative nature, the data collection steps do not demonstrate the traditional caveats of qualitative data analysis in social sciences. This study's analysis should be done by comparing individual DEA performance score with their corresponding scores and model' perception of the measure. Similarly, the ranking provided by the DEA models should be compared with a corresponding efficiency benchmarking analysis. This theoretical triangulation (Bryman, 2001) should hopefully assist in appraising the differences between DEA and traditional efficiency analysis results.

One of DEA's major strength is that no assumption has to be made and that any input or output of the efficiency process can be included in the model (Cullinane et al., 2006). However, this characteristic introduces an element of appreciation on which variable should be actually included in a DEA model which is a frequent criticism against DEA's robustness. Cooper et al (2007) recommend a careful selection of the model variables to ensure the model is robust and correctly reflects the performance process.

The literature review chapters explained components of knowledge sharing, organisational factors and performance management. In order to create a DEA model which would improve knowledge efficiency measurement, it is important to include all the variables which can impede the interpretation of performance. This section will list all the variables of interest, the first variables to include are the 'knowledge sharing' and the number 'output efficiency OE' (during the measurement period) so that the model could be illustrated as in Figure 4.4

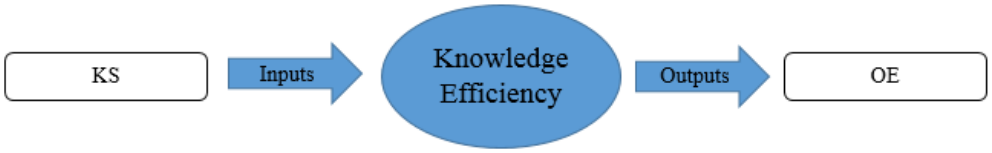


Figure 4.4 Knowledge sharing efficiency 1

Knowledge sharing efficiency 1 as an isotonic input and 'output efficiency OE' as an isotonic output. Isotonic inputs are inputs which have a beneficial impact on the outputs production; i.e. an increase in isotonic input levels should translate to greater output levels. The KS data is to be collected from participants in the carried survey questionnaire. Another aspect of knowledge efficiency model is organisational factors OFs. Indeed, it is conceivable that an organisation can be efficient (i.e. in respects to the operation turnaround time), but inefficient (i.e. in this case the cost of turnaround time). To reflect the possible fact that an organisation might be efficient but inefficient with cost of turnaround time, the 'organisational factors OF' is added to the previous model. This is illustrated as in Figure 4.5

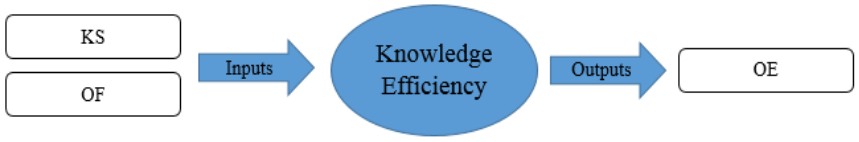


Figure 4.5 knowledge sharing efficiency 2

Although other conditions could have a potential impact on knowledge sharing efficiency which may not be included in the study. This is because there are numerous conditions that have short term impact which include uncertainties surrounding the organisation. This generally hides the real cost of measuring and is the main reason for marginal errors in the cost of the knowledge sharing efficiency model.

4.8 Summary

In this chapter, data collection for this study was discussed by looking into data collection protocol, questionnaire design, sampling strategy and pilot study. Also KSP model was developed after data collection was carried out. Despite the differences between DEA and fsQCA in underlying assumptions and presupposed sources of sustainable competitive

advantage, both can co- exist and shape actual organisation' performance (Spanos and Lioukas, 2001: 911). In addition to Spanos and Lioukas (2001), a number of previous research studies have supported integration of analysis techniques, combination between these two analysis tools and the KSP model. For example, Williamson (1991) and Teece, Pisano and Shuen (1997) argue that the effects of each are not mutually exclusive. Mauri and Michaels (1998) also propose that sustainable competitive advantage may result from the effects of both, which may also be complementary.

Furthermore, Spanos and Lioukas' (2001) empirical test results support Henderson and Mitchell's (1997) argument for considering both industry and firm level effects on performance and suggest that where industry forces influence organisational performance and profitability, knowledge assets act upon accomplishments in the competitive arena and via the latter, to profitability" (Spanos and Lioukas, 2001: 908). In other words, industry and firm effects are not only both potentially significant, but instead, they need to complement each other given that they affect distinct but strongly linked dimensions of performance (Spanos and Lioukas, 2001: 922). Note that although there are many calls for future investigation regarding integrating both DEA and fsQCA, the lack of proper research method in terms of the underlying causal relationship assumptions hinders researchers from solving this puzzle up until recently.

Chapter five: Data analysis and findings

5.1 Introduction

This chapter discusses the data analysis processes and report the findings of testing the first two main entities regarding the relationship of each separate proposed research construct (KS in A1 and OF in A2) with different performance dimensions. In addition to using two types of performance measure for each performance dimension, and taking into consideration concern about common method bias (Podsakoff et al., 2003), for triangulation purposes this chapter will also report findings which match the survey data used for each performance dimension in the analysis. Figure 5.1 shows an overall structure for the data analysis and findings reporting.

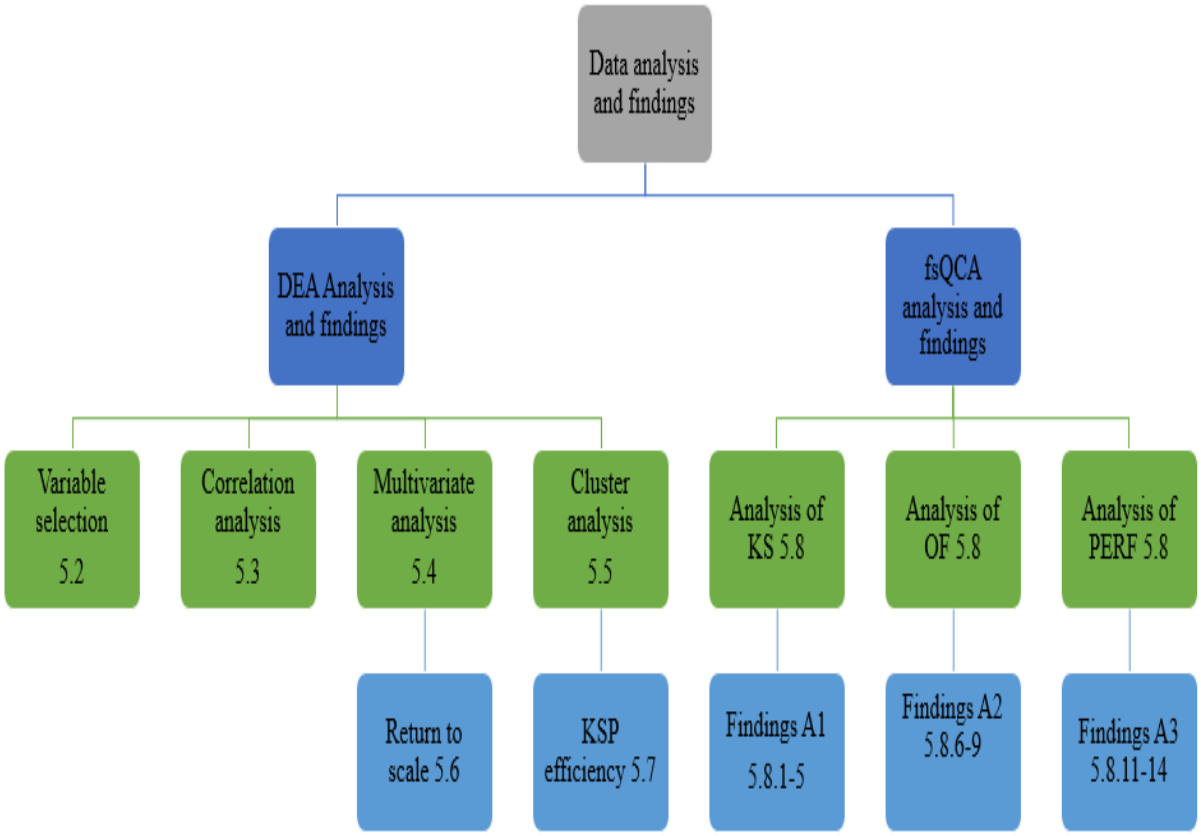


Figure 5.1 Overview of data analysis and findings reporting

Each section in this chapter (after the DEA analysis) and each section in the next chapter will follow the same format, presenting a summary table of the findings (solution paths) and a brief interpretation of the results, as well as a possible explanation for any deviation from the proposed KSP model. At the end of the chapter, post-hoc analysis of each of the two main entities will be conducted to examine patterns and further implications and, finally, each sub-entity and each entity as a whole will be summarised.

5.2 Selecting the variables

The DEA approach is significantly affected by the number of inputs and outputs, the higher the number of inputs and outputs the less discerning the analysis. The guideline for choosing the number of inputs and outputs is less than one third of the number of DMUs. Correlation is used to improve discrimination among DMUs.

In this work multivariate statistical analysis was implemented to specify the number of variables to be used in the analysis. This was based on partial covariance analysis developed by Jenkins and Anderson (2003). This approach compares the sum of covariance of certain variable(s) relative to the sum of the covariance of the total variables so that most information appears in the retained variables. Both correlation analysis and multivariate analysis, including partial covariance and cluster approach, were implemented. They were applied to reduce the inputs and outputs for performing DEA analysis on the data collected as shown in Table 5.1. The data covered seven DMUs (countries) as follows: United Kingdom (UK), United States of America (USA), Nigeria (NG), South Africa (KSA), Ghana (GH), Germany (GER), Sweden (SWE). Each DMU has four inputs: A1, A2, A3 and H; and two outputs: IE and OE.

Table 5.1 KSP efficiency data

		Inputs	Outputs
DMU	Country		

		A1	A2	A3	H	IE	OE
1	UK	150	28	3517	50496	496	99
2	USA	53	3	5033	51801	632	20
3	NG	77	8	2002	108595	489	16
4	KSA	102	6	1401	103846	359	75
5	GH	76	1	902	44261	143	81
6	GER	47	12	2140	21458	234	23
7	SWE	27	1	1145	32458	147	15

Where A1 = KS, A2 = OF, A3 = PERF, H = Co efficiency, IE = Input efficiency, OE = output efficiency

5.3 Correlation analysis

Correlation is used to improve discrimination among DMUs. For instance, if some of the input or output variables are highly correlated, one or more of these input or output variables might be eliminated as they have least impact on DEA outcomes (Jenkins, 2003). On the other hand, input variables that have high correlation coefficient with output variables are recommended to be involved in the variables set. Correlation analysis was applied to examine the relationship between the variables in Table 5.2.

Table 5.2 Results of correlation analysis

DMU	I_1	I_2	I_3	I_4	O_1	O
I_1	1					
I_2	**0.763**	1				
I_3	0.179	0.352	1			
I_4	0.379	-0.0439	-0.0922	1		
O_1	0.388	0.357	0.852	0.433	1	
O_2	0.837	0.487	**-0.103**	**0.0971**	-0.0442	1

Table 5.2 presents the correlation analysis outcome. The yellow shaded area in Table 5.2 shows the relationship (correlation) between input and output variables and the bold data are those that need to be omitted from the correlation matrix (Table 5.2), input variables I1, I3, or I4 could be omitted, whilst of the output variables the analysis suggests that O2 should be

removed. Clearly, using this analysis is not sufficient to decide which variable(s) can most appropriately be omitted. For instance, which variable(s), if omitted, have the least effect on DEA outcome?

5.4 Multivariate analysis

Multivariate analysis based on partial covariance was implemented to investigate the variable(s) that if they were removed would result in least information loss. The effect on the efficiency if one of the variables is removed is considered first and the results are presented in Table 5.3 below, where I and O represent input and output variables respectively, whilst the numbers before them indicate which variables have been omitted. For example, the column headed 3I, 2O,1I shows the results from only having 3 inputs (3I) and 2 outputs (2O) when input 1 is omitted (1I).

Table 5.3 Efficiency changes due to omitting one variable

DMU	4I,2O,0	3I,2O,1I	3I,2O,2I	3I,2O,3I	3I,2O,4I	4I,1O,1O	4I,1O,2O
1	1.000	1.000	1.000	1.000	0.787	1.000	1.000
2	1.000	1.000	1.000	1.000	1.000	0.354	1.000
3	1.000	1.000	1.000	0.715	1.000	0.195	1.000
4	1.000	1.000	1.000	0.822	1.000	0.690	1.000
5	1.000	1.000	1.000	1.000	1.000	1.000	1.000
6	0.969	0.969	0.969	0.969	0.728	0.570	0.894
7	0.822	0.762	0.818	0.768	0.822	0.521	0.900
Relative Variance	1.16E+09	1.16E+09	1.16E+09	1.15E+09	2.20E+06	1.32E+03	3.62E+04
Relative Variance percentage	100.00	100.00	100.00	99.81	0.19	3.521	96.479
No. Of Efficient DMUs	5	5	5	3	4	2	5

Table 5.3 shows the changes to efficiency resulting from applying basic DEA (i.e. dual CCR output oriented model) with different inputs and outputs variables omitted. The three bottom rows show the variance, variance percentage and number of efficient DMU changed as an effect of omitting a variable.

Based on the results in Table 5.3 input 1 (A1), input 2 (A2) or output 2 (OE) can be omitted without losing information because the number of efficient DMUs does not change. On the other hand, much information could be missed if input 3 (A3) or output 1 (IE) are removed. It is worth nothing that omitting output 1 (IE) omits most information, i.e. number of the efficient DMUs is reduced to 2. For more discernment in the DEA, further reduction in the number of variables was attempted. Partial covariance was again employed but this time when more than one input variable was removed. Note that the column headings are defined as in Table 5.3, for example, column 1 shows the results from the omission of inputs 1 and 2 (i.e. 12I) whilst column 2 shows the results from omitting inputs 1 and 3 (i.e. 13I).

From the results in Table 5.4, one remarkable point can be seen, that all the information is retained (i.e. no loss) when both inputs 1 and 2 are omitted simultaneously.

Table 5.4 Efficiency changes due to omitting more than one variable

DMU	2I,2O,12I	2I,2O,13I	2I,2O,14I	2I,2O,23O	2I,2O,24I	2I,2O,34I	1I,2O,234I	1I,2O,134I	1I,2O,124I	1I,2O,123I
1	1.000	1.000	0.550	1.000	0.821	0.742	0.742	0.097	0.550	1.000
2	1.000	1.000	0.729	1.000	1.000	1.000	1.000	1.000	0.490	1.000
3	1.000	0.370	0.978	0.538	1.000	0.538	0.538	0.290	0.953	0.370
4	1.000	0.525	1.000	0.817	1.000	0.817	0.817	0.329	1.000	0.368
5	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.933
6	0.980	0.980	0.427	0.980	0.757	0.695	0.695	0.098	0.427	0.980
7	0.724	0.566	0.719	0.777	0.861	0.777	0.777	0.741	0.501	0.409
Relative Variance	1.16E+09	2195185	1154349650	1.15E+09	1.15E+09	1744.286	1654	90.28571	2193530.6	1.15E+09
Relative Variance percentage	100.000%	0.190%	99.810%	99.810%	99.810%	0.000%	0.000%	0.000%	0.190%	99.810%
No. Of Efficient DMUs	5	3	2	3	4	2	2	2	2	2

5.5 Cluster analysis

Cluster analysis groups data objects based on information found in the data that describes the objects and their relationship. The goal is that the objects within a group be similar (or related) to one another and different from (or unrelated to) the objects in the other groups. The greater the similarity (or homogeneity) within a group and the greater the difference between groups the better or more distinct the cluster.

There are several techniques for conducting cluster analysis with binary data, all of which involve calculating distances between groups of data based upon the observed variables and then applying one of the standard cluster analysis algorithms to these distances. A popular group of these measures designed for binary data is known collectively as matching coefficients (Dillon and Goldstein, 1984). There are many techniques of matching coefficient, all of which take as their main goal the measurement of response set similarity between any two groups. The logic underlying these methods is that two individuals should be viewed as similar if they share a common pattern of attribute among the binary variables (Snijders et al, 1990).

In this study cluster analysis was implemented to measure the efficiency similarity and dissimilarity within the input variables. If input variables share a common pattern of attribute one of them may be omitted. The omitted inputs are those that contain least information.

Cluster analysis suggests that input 1 (A1) or input 2 (A2) can be eliminated resulting in 3 inputs and 2 outputs. Table 5.5 shows the data after removing input 2 (A2).

Table 5.5 Country data after cluster analysis

DMU	Country	Inputs			Outputs	
		A1	A3	H	IE	OE
1	UK	150	3517	50496	496	99
2	USA	53	5033	51801	632	20
3	NG	77	2002	108595	489	16
4	KSA	102	1401	103846	359	75
5	GH	76	902	44261	143	81
6	GER	47	2140	21458	234	23
7	SWE	27	1145	32458	147	15

5.6 Identifying the type of returns to scale

Identification of the type of returns to scale, i.e. CCR with Constant Returns to Scale (CRS) or BCC with Variable Returns to Scale (VRS) is essential in DEA analysis. Failing to do so might result in inconsistent inefficiency scores. For example, if VRS is wrongly implemented the resulting efficiency scores will be greater than the true efficiency scores because of the restrictive property of the VRS which assumes that the efficient frontier always produces a closer of the envelopment of the data. Hence, it is essential to examine the returns to scale properties, which can be satisfied by using an association test. The association test allows identification of the type of data whether it is CRS or VRS so it should be adopted for a particular case study.

Several authors have implemented a two-sample t-test (an association test used for small samples) to identify the type of returns to scale (Camanho and Dyson, 2005; Banker et al, 1996; Banker et al, 1993). In practice the association test compares the mean of two samples to identify the probability that the two samples are likely to come from the same population.

Say βi and βj are the population means for the distributions of DEA outcome scores from applying the CCR and BCC models. The null association assumes that there is no difference between the mean of the two samples whilst the alternative association opposes it, i.e. In the case that the null association does not pertain i.e. $\beta i - \beta j \neq 0$ within the 5% significance interval, it is rejected and the p-value is investigated. The p-value indicates the observed probability of obtaining the sample results when the null association is assumed to be true (Kinnear and Gray, 2004). If so, the βi and βj are not equal, which implies that the CCR and BCC models have different outcome scores. Hence, it inplies that data are more likely exhibiting VRS, in which case the BCC model should be used.

Table 5.6 The outcomes of CRS (CCR) and VRS (BCC) and their means

	DEA Efficiency Scores	
	CRS (CCR)	VRS (BCC)
UK	1.000	1.000
USA	1.000	1.000
NG	1.000	1.000
KSA	1.000	1.000
GH	1.000	1.000
GER	0.980	0.980
SWE	0.933	0.933
Mean	**0.988**	**0.988**

Table 5.6 shows that the DEA efficiency scores for CRS (i.e. CCR model) and VRS (i.e. BCC model) have similar means.

5.7 Measuring Germany KSP efficiency

This data was entered into Excel Solver and the DEA software with Excel Solver used to identify the efficiency scores and DEA software used to determine the normal vector. The results are shown in Table 5.7 which was obtained by running the output-oriented CCR dual KSP model.

Table 5.7 The DEA CCR model outcome score

DMU	Con.	DEA Score($1/\theta$)	Intensity (θ)	λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7
1	UK	1.000	1.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2	USA	1.000	1.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000
3	NG	1.000	1.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000
4	KSA	1.000	1.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000
5	GH	1.000	1.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000
6	**GER**	**0.980**	**1.021**	**0.191**	**0.228**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
7	**SWE**	**0.861**	**1.161**	**0.000**	**0.181**	**0.000**	**0.141**	**0.040**	**0.000**	**0.000**

Where θ = Theta, λ = Lambda,

Score($1/\theta$) and intensity (θ) are the trade-off vectors for inputs and outputs respectively and the λs are the decision variables. Table 5.7 shows the relative efficiency scores and the composite inputs and outputs for all DMUs. The bold scores are the inefficient DMUs (1, 6 and 7). The score of these DMUs are: 44.1%, 98.4% and 45.0% respectively whilst the DMUs that have efficiency scores of unity lie on the efficient frontier.

Table 5.7 shows two inefficient countries: GER and SWE (in bold). The GER country was considered because it had the lowest efficiency score of 86% and its virtual or composite components on the efficient frontier are a convex combination of: 0.181 of the USA country, 0.141 of KSA country and 0.040 of the GH country. It is worth noting that the sums of the convex combinations for these inefficient countries is not normal. In the first step the P and Q vectors need to be determined and this was achieved by the input A2. Recall that P and Q may cause an increase on the feasible region and if this occurs then it could imply that the collected raw data could be considered realistic. The OE would be needed to increase efficiency by one but this would be at the expense of A2, which needed to be decreased by one. Therefore, the P and Q vectors could be written as P= (0,0) and Q= (-1,1). This seems reasonable because to

improve more OE, the A2 need to have more variables to undertake the inefficient and efficient frontier components and this might be achieved by decreasing the impact load through reducing the number of A2. By including these decisions and running model, it was found that DMU5, DMU6 and DMU7 became inefficient as shown by the italic entries in Table 5.8 below.

Table 5.8 Changes in efficiency after adding the P and Q vectors

DMU	1/θ	θ	λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7
1	1.000	1.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
2	1.000	1.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000
3	1.000	1.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000
4	1.000	1.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000
5	*0.990*	*1.010*	*0.108*	*0.000*	*0.000*	*0.374*	*0.000*	*0.000*	*0.000*
6	*0.952*	*1.051*	*0.000*	*0.414*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
7	***0.780***	***1.283***	***0.017***	***0.123***	***0.232***	***0.000***	***0.000***	***0.000***	***0.000***

The range by which the objectives can be varied is determined by generating the pay-off table using model. Table 5.9 shows that to improve each DMU other DMUs need to be sacrificed, i.e. DMU1 needs to be excluded. Furthermore, it shows that for the inefficient DMUs (5, 6 and 7) both outputs can be further improved. For example, the SWE f1 can be increased from 50.80 up to 199.88 and f2 from 7.89 up to 28.78. Hence, for DMU7 SWE the maximum composite output for f 1 is 277.75 whereas for f2 is 26.97. Hence, the maximum values of the both outputs can be expressed as a maximum output vector f1 is 199.88, f2 is 28.78 which was used in the next as step of the analysis.

Table 5.9 The new pay-off table

	Max f_1	Max f_2	Maximum Values

DMU	Dep	f_1	f_2	f_1	f_2	f_1	f_2
1	UK	496.00	99.00	496.00	99.00	496.00	99.00
2	USA	632.00	20.00	99.72	56.49	632.00	56.49
3	NG	489.00	16.00	144.88	82.07	489.00	82.07
4	KSA	359.00	75.00	191.92	108.71	359.00	108.71
5	GH	208.24	9.57	143.00	81.00	208.24	81.00
6	GER	261.80	8.28	122.73	40.33	261.80	40.33
7	**SWE**	**199.88**	**7.89**	**50.80**	**28.78**	**199.88**	**28.78**

The interactive procedure was started by solving model after changing the weight values of both objectives. The initial starting optimal solution came from applying the basic dual KSP model for the SWE. The composite output will be located on the efficient frontier (the DM can accept or reject at this point). At this point the country is a linear convex combination of DMU1, DMU2, DMU3 and DMU4 (UK 0.0174, USA 0.123, NG 0.232 and KSA 0.000139) at which f1(λ0) = 199.87 and f1 (λ0) =7.90. It is worth noting that the latter values are closer to that obtained from the composite output KSP model, so the efficiency score point will be closer to the efficient frontier. Note that f1 does not exceed the maximum value obtained from the pay-off table.

Table 5.10 Comparison between old and new trade-off values

Objectives		Decision variables							Normal vectors	
$f(\lambda^0)$	$f(\lambda^0)$	λ^0	λ^0	λ^0	λ^0	λ^0	λ^0	λ^0	N^0	N^0
199.87	7.90	0.0173	0.123	0.232	0.000139	0.00	0.00	0.00	0.028	0.048

Table 3.14 The objectives, decision variables and normal vectors for the initial values.

Indifference trade-offs	Values
Old trade-offs	(199.87,7.90) ↔(199.87-1.00, 7.90+1.72)
New trade-offs	(199.87,7.90) ↔(199.87-1.00, 7.90+2.00)

The KSP model suggests that to improve the efficiency of the SWE, IE should be increased by 36% and OE increased by 47% as can be seen from Table 5.10. These results were obtained

with composite outputs resulting from projecting SWE on the efficient frontier. These results (efficiency scores) were obtained by comparing the targeted DMU score, which is inefficient, relative to efficient DMUs. It is worth noting that by using the basic CCR model these results could not be improved or changed and hence the DM has no choice but to accept them.

Unlike basic DEA, which compares the efficiency of the targeted DMU relative to the others, the developed DEA-KSP integrated model seeks the most preferred solution (MPS) according to DM preferences. For instance, in the SWE, the DM managed to increase efficiency up to 28%; from the value proposed by CCR model but to do so the number of IE should be reduced by almost 2% and H should be raised by 0.10%.

Table 5.11 Summary of target setting and resource allocation for the SWE

	Inputs			Outputs	
	A1	A3	H	IE	OE
Raw value	27	1145	32458	147	15
DEA results	27	1145	32458	200	8
Improvements %	0.00%	0.00%	0.00%	35.97%	47.37%
Raw value	27	1145	32458	147	15
DEA_KSP results	27	1145	32425	196	10
Improvements %	0.00%	0.00%	0.10%	33.34%	32.58%
DEA results	27	1145	32458	200	8
DEA_KSP results	27	1145	32425	196	10
Improvements %	0.00%	0.00%	0.10%	1.94%	28.11%

In comparison the DEA_KSP implemented model allows alternative outcomes according to DM preferences which, in this case adds more flexibility to the basic DEA solution. Nevertheless, the basic DEA method did find the composite outcome of the inefficient DMU projection on the efficient frontier.

5.8 Knowledge fsQCA comparability

This section will report the findings of the data analysis the first the KSP model regarding the relationship of each separate proposed research construct (KS in A1 and OF in A2) with different performance dimensions. In addition to using two types of performance measure for each performance dimension, and taking into consideration concern about common method bias (Podsakoff et al., 2003), for triangulation purposes this section will also report findings using data which match the survey data used for each performance dimension in the analysis.

Each segment in this section will follow the same format, presenting a summary table of the findings (solution paths) and a brief interpretation of the results, as well as a possible explanation for any deviation from the proposed model.

At the end of the chapter, post-hoc analysis of each of the two main KSP model will be conducted to examine patterns and further implications and, finally, each sub-association and each association as a whole will be summarised.

However, since fsQCA is a relatively new technique which requires some rules and pre-specified conditions as part of the calculation, this study provides an in-depth example of an analytical process and a justification for any rule and condition used in the analysis, as well as an explanation of the data analysis testing which will be applied to all findings in this dissertation. Please also refer to the summarised conventional steps in interpretation of fsQCA results (Crilly, 2011; Fiss, 2011; Greckhamer, 2011) that involve considering both parameters and contexuality of solution paths, especially definitions and implications of core and peripheral conditions, first-order equifinality (different across-group), second-order equifinality (different within-group) and an empirically dominant combination.

5.8.1 Association testing: relationship between KS and performance (A1)

In order to test the first main association regarding the relationship between KS and performance dimensions (A1), each of the four sub-associations is tested separately, which corresponds with four performance dimensions as follows;

[1] Input Efficiency: “ie” represents a high membership score with a high input efficiency (expense ratio), while “~ie” represents a low membership score with a high input efficiency.

[2] Output Efficiency: “oe1” and “oe2” represent high membership scores with a high output efficiency 1 (loss ratio) and 2 (investment yield) while “~oe1” and “~oe2” represent low membership scores with a high output efficiency 1 and 2.

[3] Effectiveness: “ef1” and “ef2” represent high membership scores with a high effectiveness 1 (net written premium growth) and 2 (relative market shares) while “~ef 1” and “~ef 2” represent low membership scores with a high effectiveness 1 and 2.

[4] Adaptability: “ad1” and “ad2” represent high membership scores with a high adaptability 1 (number of new products within the past year) and 2 (percentage of net written premiums accounted for by new products within the past year) while “~ad1” and “~ad2” represent low membership scores with a high adaptability 1 and 2). These symbolic expressions are also applied to their financial data (ief, oef1, oef2, eff1, eff2).

Using fsQCA, this study sets one performance dimension as the outcome of interest and tests it against all five possible KS attributes as causal conditions;

[1] Collaboration: “c” represents a high membership score with a strong characteristic of collaboration while “~c” represents a low membership score with a strong characteristic of collaboration.

[2] Systems: “s” represents a high membership score with a strong characteristic of systems while “~s” represents a low membership score with a strong characteristic of systems.

[3] Decision: “d” represents a high membership score with a strong characteristic of decision while “~d” represents a low membership score with a strong characteristic of decision.

[4] Business processes: “bp” represents a high membership score with a strong characteristic of business processes while “~bp” represents a low membership score with a strong characteristic of business processes.

[5] Knowledge asset: “ka” represents a high membership score with a strong characteristic of knowledge asset while “~ka” represents a low membership score with a strong characteristic of knowledge asset.

This section will report the results of fuzzy set analyses for each association using the notation of the solution table recently introduced by Ragin and Fiss (2008), which has been widely adopted by later fsQCA research (Crilly, 2011; Fiss, 2011; Greckhamer, 2011) because it is able to present combinations of both parsimonious and intermediate solutions at the same time.

According to this notation, each row represents each causal condition or ingredient for the outcome, while each column represents an alternative combination of causal conditions or recipe or solution path linked to the respective outcome, consecutively numbered S1, S2, etc. Full circles (●) indicate a condition’s presence, while barred circles (Ɵ) indicate a condition’s absence. Core and peripheral conditions are distinguished by the size of the symbols: larger circles indicate core conditions (conditions that are part of both parsimonious and intermediate solutions), while small circles indicate peripheral conditions (conditions that occur only in intermediate solutions). This study also adds an asterisk (*) to indicate a trivial necessary

condition. Blank spaces in a solution indicate a "don't care" situation, in which that causal condition may be either present or absent. In the numerical section, this study reports the number of observed cases that match the respective solution path, followed by consistency, raw coverage, unique coverage of each solution path, and all solutions in combination. A bold number in the consistency value indicates a consistency level above 0.7 (the consistency threshold for this research), suggesting that this solution path is at an acceptable consistency level and will be considered further for its relative empirical weight by assessing its raw and unique coverage, as suggested by Greckhamer (2011). Only such solution paths will be the focus of association testing.

In addition to Ragin and Fiss's (2008) solution table, this study presents the consistency and raw coverage of four intersections between the model and each empirical solution path for the model analyses mentioned. Again, a bold number in the consistency value for association test 1 (T1: H•S⊂Y) indicates a consistency level above 0.7 and suggests that the proposed association is highly supported by this solution path derived from the empirical analysis, while an italic bold number in the consistency value, which will be displayed only for association tests 2, 3, and 4 ((T2: ~H•S⊂Y), (T3: H•~S⊂~Y), and (T4: ~H•~S⊂Y)) indicates a consistency level above 0.7 and suggests that the proposed association is less supported by the solution result. Finally, this section provides the result of each solution path association based on the criteria previously discussed, the result for the combined solution path's unique coverage of the same association, and the result for the overall association for each analysis. Solution tables for each association will be presented together to provide an overall picture of each association as well as allowing for triangulation between different sources of outcome data.

Like that of Crilly (2011), Fiss (2011) and Greckhamer (2011), the explanation format for the analysis of each sub-association will begin with an analysis of necessity, followed by an analysis of sufficiency: only solution paths which pass the consistency threshold of this

research (0.7) will be discussed further regarding their unique coverage (issue of dominant combination) and grouped by their core conditions (issues of first-order and second-order equifinality (Fiss, 2011). An overview of the validity of the sub-associations will then be supported with an interpretation of the association testing. For triangulation purposes, analysis of another performance measure within the same dimension and analysis of financial outcome data may be described separately from or concurrently with the primary sub-association analysis, depending on how space can best be utilised from the observed results.

This study will suggest possible explanations for any deviation from the proposed association. In this regard, this study expects there to be three possible explanations for deviation, ranging from those least against the current association to those most against as follows.

[1] External validity (particularly the problem of measurement), which exists when respondents find it difficult to answer the questionnaire (e.g. in order to answer a comparative question correctly, respondents must closely monitor all competitors' market positions, which they do not always do, hence the answer may not truly represent the actual situation). This problem may be solved and the association may still be supported only by adjusting the question to better suit the respondent's knowledge or by using financial rather than survey data.

[2] Empirical context, in which a specific characteristic leads to a weakly supported association, hence the validity of the association cannot be confirmed using only current empirical data (e.g. when a dataset's products are treated as commodities, rather than differentiated products, the study findings may not be generalisable). This problem may be solved and the association may still be supported by repeating the analysis in a different empirical context (e.g. one that is generalisable). In this way, the association may be refined to allow for different conclusions depending on different empirical contexts.

[3] Alternative theory, which suggests other explanations for the concerned phenomenon.

[4] Alternative theory may be based on either different factors within the model of the current study (e.g. a different sub-group within the same research construct or a different research construct) or on a completely different causal factor that has not previously been tested in the current study. The former is less detrimental to the current study than the latter.

Obviously, these three alternative explanations provide different levels of justification for the current association. This study will also refer to previous research findings wherever applicable.

Reports for each sub-association of A1, which test all KS-OF integrations with one performance dimension at a time, are as follows.

5.8.2 Analysis of A1a (KAD-IE)

Only two trivial necessary conditions (~c, ~ka) are found. Therefore, even though they are shown in all paths, they are not necessary conditions. Rather, this situation occurs simply because of the highly skewed distribution of the dataset toward ~c and ~ka. Consequently, both are trivial necessary conditions for all subsequent analyses that have KS as a causal condition of concern. From now on this study will report trivial necessary conditions only when additional ones are observed (e.g. ~d in A1b).

A sufficiency analysis of the survey data of ie suggests three combinations of conditions that predict input efficiency, all of which pass the consistency threshold. The consistency and coverage of the solution are 0.72 and 0.44 respectively. These paths encompass different core and peripheral conditions and thus cannot be grouped further, indicating a situation of first-order (across-type) equifinality. Only S2 (ka*~bp*~d*s*~c), which can be categorised as knowledge asset systems, is coherent with A1a. However, S2 is not the dominant combination

because it does not have the highest unique coverage level, suggesting that it is not the most empirically relevant in generating ie. Interestingly, S3 (~ka*bp*~d*s*~c) also achieves ie. This is probably due to the use of a Business Processes strategy that also helps reduce its costs (distribution channel).

However, S3 has the lowest score for all three parameters, suggesting that Business Processes is the least likely to generate ie. Surprisingly, S1 (~ka*~bp*~d*~s*~c), which can be categorised as a stuck in the middle condition according to the theoretical definition and previous research since S1 has no majority in any integrations, has the highest levels for consistency, raw coverage and unique coverage. This is possibly because knowledge asset can take better advantage of available opportunities in business processes of any organisation. Therefore, in general, A1a is not supported. The association testing section also endorses this conclusion. T1 displays low consistency for all paths, while T2 and T3 show high consistency for all paths; all of which suggest that A1a is rejected.

Unlike the previous analysis that has three paths, the analysis using data (ief) exhibits only one path with very high consistency (0.9) but covers only one observed case, resulting in very low unique coverage (0.02). However, this solution is consistent with S1 and S3 of the analysis of survey data. Moreover, although T1's consistency level is high (0.81), its coverage is very low (0.003), and T2's consistency level is also high (0.89), suggesting that although A1a for ief is supported, it could be extended further to better explain the presence of ief. Deviation from A1a (KAD-IE) probably arises from all three possible explanations. Regarding external validity, KS integration classification technique complies with previous research (Hambrick, 1983c; Miller and Dess, 1993; González-Benito and Suárez-González, 2010) and enables this study to consider both best cost and processes in the middle. Therefore, (Cronshaw et al,1994) suggests that this study incorrectly classifies KS for which both KA and BP scales are below the median as stuck in the middle, which in turn results in the finding that stuck in the middle

also performs well in ie. (This argument also applies to any sub-association in this study that has stuck in the middle as one of many solutions leading to high performance, a situation that arises occasionally though infrequently.) In other words, it can be inferred from their research that this study incorrectly classifies KS as stuck in the middle, thereby producing erroneous findings. Rather, Cronshaw et al (1994) propose two broader interpretations: one uses strategic clarity as a criterion (a firm which is stuck in the middle has multiple objectives rather than a single goal), while the other uses strategic outcome as a criterion (a firm which is stuck in the middle does not establish lower costs or better differentiated products). They prefer the latter. However, this study would suggest that future research studies should adjust their questionnaires and classification techniques to incorporate the concept of strategic clarity rather than strategic outcome because the latter encounters a problem of tautology in this research model. This format for presenting the results of fuzzy-set analysis is based on Ragin and Fiss (2008) with additional information for subset/superset analysis. It will be applied to all findings of this thesis.

Table 5.11 fsQCA findings for H1a: LCD-BCD-IE/IEF

	A1a: KS-IE			A1a: KS-IEF
Condition	S1	S2	S3	S1
Collaboration (C)	ʘ*	Ɵ*	Ɵ*	Ɵ*
	Ɵ	●	●	Ɵ
Decisionr (D)	Ɵ	Ɵ		
	Ɵ	Ɵ	●	
	Ɵ	●	Ɵ	
Observed cases	7	5	4	1
Consistency	**0.724529**	**0.713514**	**0.704821**	**0.900405**
Raw coverage	0.229618	0.209680	0.183706	0.022014
Unique coverage	0.137127	0.107350	0.069850	0.022014
Solution consistency	**0.718015**			**0.900405**
Solution coverage	0.437901			0.022014
T1: H•S⊂Y -Consistency	0.539667	0.545450	0.622072	**0.808104**
T1: H•S⊂Y -Raw coverage	0.043730	0.043524	0.036555	0.003689
T2: ~H•S⊂Y -Consistency	***0.722497***	***0.713185***	***0.703511***	***0.890097***
T2: ~H•S⊂Y -Raw coverage	0.227479	0.210136	0.183932	0.022590
T3: H•~S⊂~Y - Consistency	***0.814957***	***0.814957***	***0.814957***	0.651971
T3: H•~S⊂~Y -Raw coverage	0.112421	0.112421	0.112421	0.100733
T4: ~H•~S⊂Y -Consistency	0.463812	0.478831	0.485383	0.523584
T4: ~H•~S⊂Y -Raw coverage	0.837649	0.873858	0.891719	0.934861
Solution path hypothesis result	Reject	Reject	Reject	Support
Combined solution path unique coverage of same hypothesis result				
Overall hypothesis result	**Reject**			**Support**

Legend:

(Also provided in looseleaf glossary)

● = Core causal condition present

Ɵ = Core causal condition absent

5.8.3 Analysis of A1b: BPD-OE

Two solution paths (S3, S4) out of four pass the consistency threshold (Table 5.12). The core conditions of both combinations show a lack of both knowledge asset and Collaboration cases, and peripheral conditions exhibit a lack of systems. While the presence of Business Processes is a core condition of S4, it is only a peripheral of S3. In addition, while the presence of knowledge is a core condition of S4, neither the presence nor absence of team affects the

generation of oe1 for S3. Likewise, while the absence of decision is a peripheral condition of S3, neither the presence nor absence of decision affects the generation of oe1 for S4. This situation suggests a trade-off the absence decision within the Business Processes group, indicating the presence of second-order equifinality. Both have fair raw coverage but very low unique coverage, indicating that the coverage of these combinations overlaps with each other and perhaps with S1. From core and peripheral analysis, these two causal paths support A1b, as shown in their high T1 and T2 consistency.

Sufficiency analysis for oe1f (survey data) fairly supports the previous analysis for oe1, as two combinations (S2, a dominant combination with the highest unique coverage, and S4) out of three that pass the consistency threshold are in line with S4 of the previous analysis, especially in the core condition of Business Processes and a lack of low cost. Although the other solution path (S3) suggests the opposite, with a core condition of low cost and a lack of Business Processes, it covers only one observation with very low unique coverage and is therefore negligible. Like those for oe1, the associations test results (T1, T2) of this analysis (oe1f) also support A1b.

In considering the analysis for oe2 (in which, apart from ~c and ~d is found to be trivial necessary conditions.) and oe2f, the sufficiency analysis produces different results (Table 5.12). Four and three paths, respectively, pass the consistency threshold, each of which portrays first-order equifinality. Moreover, the former also displays second-order equifinality. As in the analysis of oe2 that has three main groups of combinations – knowledge asset (S1), a dominant combination; systems decision (S2); and differentiator and differentiated decision (S3, S5) – the analysis of oe2f also contains three different groups: knowledge asset (S1), the lowest unique coverage; differentiator (S2), a dominant combination; and best method (S3). These two analyses suggest that there are many possible ways other than just being a differentiator to achieve high oe2 or oe2f. Moreover, the high consistency level for T2 and T3

also suggests that A1b, using oe2 and oe2f as outcomes, can be improved further or should even be dropped, resulting in fair support, rather than strong support for A1b. A possible explanation for this result is that oe2 and oe2f, which is the investment yield, may not be suitable parameters for output efficiency in this analysis because any integration of KS may have either strong or weak resource skills. Some may be more risk-taking, while others may be more conservative, resulting in a variety of investment yields beyond the control of the chosen KS integration. Thus, although the overall association results are consistent with those of oe1 and oe1f, they can be ignored as their outcomes do not strictly relate to the proposed causal condition. In summary, A1b is supported by the analysis of oe1and oe1f.

Table 5.12a fsQCA findings for H1b: BPD-OE1/OE1F

	A1b: KS-OE1				**A1b: KS-OE1F**			
Condition	S1	S2	S3	S4	S1	S2	S3	S4
Collaboration (C)	ϴ*	ϴ*	ϴ*	ϴ*	ϴ*	ϴ*	ϴ*	ϴ*
Systems (S)			ϴ	ϴ	●	ϴ	ϴ	
Decision (D)	ϴ		ϴ		●	ϴ	ϴ	•
Business Processes (BP)		ϴ	•	●		●	ϴ	●
Knowledge Asset (KA)	ϴ	●	ϴ	ϴ		ϴ	●	ϴ
Observed cases	33	11	5	5	5	5	1	1
Consistency	0.625760	0.693128	**0.772698**	**0.752416**	0.663176	**0.724664**	**0.794016**	**0.709135**
Raw coverage	0.479140	0.226493	0.172121	0.172026	0.098641	0.159101	0.110858	0.055455
Unique coverage	0.238754	0.069801	0.002659	0.002450	0.040192	0.074229	0.019843	0.002375
Solution consistency	0.602613				0.688200			
Solution coverage	0.554164				0.242285			
T1: H•S⊂Y -Consistency	**0.782081**	**0.873616**	**0.775306**	**0.728530**	0.674924	**0.778808**	**0.824348**	**0.711809**
T1: H•S⊂Y -Raw coverage	0.056821	0.052946	0.054630	0.057186	0.050152	0.054088	0.043457	0.056607
T2: ~H•S⊂Y -Consistency	0.625714	0.692681	***0.771952***	***0.779462***	0.678735	***0.723961***	***0.793858***	***0.763640***
T2: ~H•S⊂Y -Raw coverage	0.478587	0.226085	0.171354	0.171172	0.100992	0.158391	0.109838	0.056607
T3: H•~S⊂~Y - Consistency	0.666045	0.666045	0.666045	0.636616	0.670967	0.681394	0.681394	0.663628
T3: H•~S⊂~Y -Raw coverage	0.072447	0.072447	0.072447	0.063638	0.071768	0.075269	0.075269	0.069434

T4: ~H•~S⊂Y -Consistency	0.538359	0.532113	0.526908	0.527574	0.536492	0.536244	0.537995	0.530698
T4: ~H•~S⊂Y -Raw coverage	0.623064	0.842742	0.894709	0.896900	0.936302	0.897471	0.934667	0.967440
Solution path association result	Ignore	Ignore	Support	Support	Ignore	Support	Support	Support
Combined solution path unique coverage of same association result			0.005109			0.096447		
Overall association result	**Support**				**Support**			

Table 5.12b fsQCA findings for A1b: BPD-OE2/OE2F

	A1b: KS-OE2					**A1b: KS-OE2F**		
Condition	S1	S2	S3	S4	S5	S1	S2	S3
Collaboration (C)	⊖*	⊖*	⊖*	⊖*	⊖*	⊖*	⊖*	
Systems (S)		●	⊖	⊖		⊖	⊖	⊖
Decision (D)		●	⊖*	⊖*	•			⊖
Business Processes (BP)	⊖		●	●	●		●	●
Knowledge Asset (KA)	●		⊖		⊖	●		•
Observed cases	11	5	5	10	1	9	11	10
Consistency	**0.714269**	**0.745312**	**0.756022**	0.673542	**0.760762**	**0.821701**	**0.769282**	**0.849219**
Raw coverage	0.272201	0.131173	0.196403	0.265147	0.070395	0.259547	0.284802	0.266998
Unique coverage	0.137118	0.037563	0.005708	0.054258	0.002810	0.051003	0.076259	0.060114
Solution consistency	0.660851					**0.802112**		
Solution coverage	0.477160					0.395919		
T1: H•S⊂Y-Consistency	**0.901349**	**0.819554**	**0.823014**	**0.816842**	**0.760675**	**0.865469**	**0.850784**	**0.862620**
T1: H•S⊂Y -Raw coverage	0.063707	0.072059	0.067632	0.084341	0.071578	0.071564	0.087208	0.069849
T2: ~H•S⊂Y -Consistency	***0.715188***	***0.762347***	***0.755263***	0.673175	***0.816064***	***0.821572***	***0.760743***	***0.849751***
T2: ~H•S⊂Y -Raw coverage	0.272237	0.134220	0.195520	0.263983	0.071578	0.256083	0.270314	0.266000
T3: H•~S⊂~Y - Consistency	***0.910560***	***0.907633***	***0.910560***	***0.910560***	***0.905573***	0.529645	0.595851	0.520320
T3: H•~S⊂~Y -Raw coverage	0.086160	0.083161	0.086160	0.086160	0.081162	0.054214	0.054214	0.054214
T4: ~H•~S⊂Y -Consistency	0.474625	0.472827	0.471777	0.481787	0.458589	0.478524	0.473277	0.463005
T4: ~H•~S⊂Y -Raw coverage	0.876657	0.976411	0.934270	0.900039	0.989185	0.813244	0.787465	0.786341
Solution path association result	Support	Support	Support	Ignore	Support	Support	Support	Support
Combined solution path unique coverage of same association result	0.183199					0.187376		
Overall association result	**Support**					**Support**		

5.8.4 Analysis of A1c: S-EF

All five solution paths pass the consistency threshold (Table 5.13), which can be categorised into three different groups, suggesting a first-order equifinality. S1 (ka*~bp*~s*~c) and S4

(ka*~bp*d*~c) can be grouped as same category, with S4 as a specific type with a decision characteristic. Another group is differentiator, comprising S2 (~ka*bp*~d*~s*~c) and S3 (~ka*bp*~s*~c). Both share all core conditions (high in business processes with a lack of collaboration, systems and knowledge asset) and differ only in one peripheral condition (lack of decision), indicating second-order equifinality and suggesting a trade-off between these peripheral conditions.

The last group is collaboration, S5 (ka*bp*~d*c), which is the dominant combination with the highest unique coverage of 0.07. Interestingly, while all solutions have specific Porter's (1980) integrations, none has a fully-specified Miles and Snow's (1978) integration (all paths have one "don't care" condition), suggesting that the presence or absence of Miles and Snow's (1978) integrations depend on the context provided by Porter's (1980) integrations. In other words, Porter's (1980) integrations seem to better predict effectiveness than Miles and Snow's (1978) integrations.

The results for the survey data outcome (ef1f) are quite similar to those of the entities. Three solutions passing the consistency threshold can be classified into two groups. The first is differentiator (S3 (~ka*bp*~d*~s*~c) and S2 (~ka*~s*~c)), although in S2 business processes is a "don't care" condition and knowledge asset cannot be present. Thus, S2 may be either a differentiator or stuck in the middle. However, the latter is unlikely to achieve high effectiveness. The second group is knowledge asset decision (S5 (ka*~bp*d*~c)). Nevertheless, the lack of collaborations in the survey outcome raises a concern that only the pure form, rather than the hybrid, of Porter's (1980) integrations leads to high effectiveness.

The analyses for ef2 and ef2f (Table 5.13) show only one group of solutions, differentiator. All paths are high in business processes and lack knowledge asset as common core conditions, while the remaining conditions are quite similar. Combined with the previous analysis for ef1/ef1f, they suggest that a differentiator has a better chance of generating effectiveness than

other KS. Unlike the analyses for ef1, ef1f and ef2f that support A1c, analysis of ef2 rejects A1c. This raises a concern but is not significant enough to change the overall validity of the association owing to its low consistency (0.711).

Deviation from A1c (S-EF2) probably arises only from the empirical context. Most industry players fall into a questionable organisational orthodoxy (Kuhn and Marsick, 2005: 31), which is "self-imposed beliefs and theories of success about business", particularly a belief that the service industry is a commodity business and is a highly-regulated and mature industry. Therefore, they mistakenly believe that truly new products and innovation are difficult to create; conditions can only be changed slightly. Furthermore, even if they devise innovative products, such products will be imitated almost instantly by the competition (Kuhn and Marsick, 2005). Consequently, they tend to compete in terms of scale via price, not business processes.

However, with a price range requirement, price competition is not a viable option to gain competitive advantage. On the other hand, only a handful of business organisations that do not fall into this organisational orthodoxy pursue business processes and enjoy high market share, as shown in the findings. Evidently, an organisation gains a higher market share by pursuing business processes rather than a systems strategy because brand capacity resulting from business processes directly and simultaneously helps a business unit both in maintaining its current customers and in gaining new markets, while a system must pursue both decision and collaboration strategies in order to achieve the same result. It is more difficult to balance these activities in the competitive market.

Table 5.13a fsQCA findings for A1c: S-EF1/EF1F

	A1c: KS-EF1					A1c: KS-EF1F				
Condition	S1	S2	S3	S4	S5	S1	S2	S3	S4	S5
Collaboration (C)	⊖*	⊖*	⊖*	⊖*	●	⊖*	⊖*	⊖*	⊖*	⊖*

Systems (S)	ϴ	ϴ	ϴ			ϴ	ɵ	ɵ		
Decision (D)		ɵ		●	ϴ	ɵ		ϴ	ɵ	●
Business Processes (BP)	ϴ	●	●	ɵ	•			●	●	ɵ
Knowledge Asset (KA)	●	ϴ	ϴ	●	•		ϴ	ϴ	ϴ	●
Observed cases	3	5	5	5	4	18	22	5	8	5
Consistency	**0.770447**	**0.756489**	**0.739491**	**0.800157**	**0.777157**	0.695167	**0.701578**	**0.762059**	0.689534	0.**746008**
Raw coverage	0.136668	0.185175	0.185791	0.102848	0.105708	0.341586	0.361502	0.165036	0.219214	0.084834
Unique coverage	0.008621	0.005378	0.005869	0.011813	0.071621	0.081440	0.103796	0.004758	0.056710	0.012912
Solution consistency	**0.718146**					0.668564				
Solution coverage	0.326723					0.525807				
T1: H•S⊂Y-Consistency	**0.748112**	**0.777327**	**0.777656**	**0.766726**	**0.758921**	**0.783995**	**0.772517**	**0.851344**	**0.717966**	**0.782018**
T1: H•S⊂Y -Raw coverage	0.096045	0.105565	0.105766	0.073980	0.043083	0.184637	0.153828	0.102289	0.161569	0.066757
T2: ~H•S⊂Y -Consistency	***0.767797***	***0.754910***	***0.737366***	***0.852405***	***0.774985***	0.695350	***0.701556***	***0.761716***	***0.756305***	***0.777220***
T2: ~H•S⊂Y -Raw coverage	0.134921	0.184143	0.184745	0.091993	0.096075	0.339862	0.360202	0.164385	0.159593	0.074210
T3: H•~S⊂~Y - Consistency	0.624387	0.624387	0.624387	0.627555	0.628727	0.573064	0.573064	0.573064	0.586666	0.575807
T3: H•~S⊂~Y -Raw coverage	0.690934	0.690934	0.690934	0.682360	0.688585	0.715457	0.715457	0.715457	0.662948	0.706377
T4: ~H•~S⊂Y -Consistency	0.601636	0.589292	0.597139	0.598663	0.582272	***0.735984***	***0.723446***	***0.707032***	***0.708400***	0.678233
T4: ~H•~S⊂Y -Raw coverage	0.499644	0.453575	0.455782	0.505462	0.464408	0.385193	0.334464	0.481466	0.484661	0.506632
Solution path association result	Support	Support	Support	Support	Support	Ignore	Support	Weak Support	Ignore	Support
Combined solution path unique coverage of same association result	0.103302						0.116708	0.004758		
Overall association result	**Support**					**Support**				

Table 5.13b fsQCA findings for A1c: S-EF2/EF12F

	A1c: KS-EF2	**A1c: KS-EF2F**	
Condition	S1	S1	S2
Collaboration (C)	ɵ*	ϴ*	ϴ*
Systems (S)	ϴ		
Decision (D)	ϴ	ϴ	
Business Processes (BP)	●	●	●
Knowledge Asset (KA)	ϴ	ϴ	ϴ
Observed cases	5	9	9
Consistency	**0.710821**	**0.765686**	**0.765449**
Raw coverage	0.161335	0.271478	0.276201
Unique coverage	0.161335	0.005228	0.009951
Solution consistency	**0.710821**	**0.768799**	
Solution coverage	0.161335	0.281429	
T1: H•S⊂Y-Consistency	0.691323	**0.759535**	**0.759724**
T1: H•S⊂Y -Raw coverage	0.087053	0.187811	0.188006
T2: ~H•S⊂Y -Consistency	***0.707803***	***0.741407***	***0.742004***
T2: ~H•S⊂Y -Raw coverage	0.160089	0.175810	0.180727

T3: H•~S⊂~Y - Consistency	0.560523	0.623238	0.623238
T3: H•~S⊂~Y -Raw coverage	0.665845	0.640238	0.640238
T4: ~H•~S⊂Y -Consistency	0.597557	0.559862	0.556151
T4: ~H•~S⊂Y -Raw coverage	0.426468	0.417932	0.411692
Solution path association result	Reject	Support	Support
Combined solution path unique coverage of same association result	0.161335	0.015179	
Overall association result	**Reject**	**Support**	

5.8.5 Analysis of A1d: C-AD

Three out of five solution paths pass the consistency threshold (Table 5.14), which can be categorised in two different groups, suggesting first-order equifinality. The differentiator group comprises S3 (~ka*bp*~d*~s*~c) and S4 (~ka*bp*~s*~c), which share the same core and peripheral causal conditions except that the core condition lacks decision, which can be treated as substitutes, indicating second-order equifinality. Although these combinations lack collaboration (~c), business processes are the characteristic quite similar to collaboration (Fiss, 2011), and thus still supports the association. In the second group, knowledge asset decision, S5 (ka*~bp*d*~c) is a dominant combination with a unique coverage of 0.032. This is probably because current industry conditions allow copycats (market followers) to issue new products resembling those of pioneers without incurring OL costs. Note that ~c is a trivial necessary condition (because of data skewness); therefore, it cannot be inferred that the association is rejected only from the observed solutions. Rather, the proposed association testing criteria are preferred and suggest support for A1d.

Analysis of AD2 provides slightly different solutions. While S1 (~ka*bp*~d*~s), differentiated systems, is consistent with previous analysis, S2 (ka*bp*~d*s), which is a dominant combination with a sizeable unique coverage of 0.43, indicates best-cost systems, contradicting the previously-observed low-cost systems. This probably suggests that in order to achieve high adaptability it is more important to be a best-cost system than a low- cost

system (copycat). Moreover, both solution paths require the presence of business processes, notwithstanding at different levels of importance, thereby fairly endorsing the association.

In summary, both tests support the association.

Table 5.14 fsQCA results for A1d: C-AD1/AD2

	A1d: KS-AD1					A1d: KS-AD2	
Condition	S1	S2	S3	S4	S5	S1	S2
Collaboration (C)		ϴ*	ϴ*	ϴ*	ϴ*		
Systems (S)	ϴ		ɵ	ɵ		ϴ	●
Decision (D)	ϴ	ɵ	ϴ		●	ϴ	ϴ
Business Processes (BP)		●	●	●	ɵ	•	●
Knowledge Asset (KA)	●		ɵ	ɵ	●	ɵ	●
Observed cases	11	40	5	5	5	1	26
Consistency	0.698892	0.692181	**0.740252**	**0.733449**	**0.785004**	**0.970090**	**0.712693**
Raw coverage	0.236909	0.566492	0.164245	0.167030	0.091458	0.027005	0.445208
Unique coverage	0.048374	0.336715	0.002648	0.005320	0.031859	0.010598	0.428800
Solution consistency	0.686555					**0.716547**	
Solution coverage	0.665239					0.455806	
T1: H•S⊂Y-Consistency	**0.75716**	**0.812902**	**0.827317**	**0.827317**	**0.988559**	**0.991696**	**0.916804**
T1: H•S⊂Y -Raw coverage	0.085357	0.067400	0.034448	0.034448	0.008089	0.006429	0.054261
T2: ~H•S⊂Y -Consistency	0.689295	0.692412	***0.739000***	***0.731484***	***0.786105***	***0.959823***	***0.711222***
T2: ~H•S⊂Y -Raw coverage	0.191634	0.565667	0.163395	0.166122	0.092622	0.027701	0.435212
T3: H•~S⊂~Y - Consistency	0.600079	0.466213	0.466213	0.466213	0.466213	0.548037	0.577609
T3: H•~S⊂~Y -Raw coverage	0.058389	0.074411	0.074411	0.074411	0.074411	0.076858	0.074661
T4: ~H•~S⊂Y -Consistency	0.535569	0.476600	0.532806	0.534341	0.512781	0.446069	0.388852
T4: ~H•~S⊂Y -Raw coverage	0.841081	0.505483	0.860575	0.859848	0.864034	0.910765	0.582426
Solution path association result	Ignore	Ignore	Support	Support	Support	Support	Support
Combined solution path unique coverage of same association result			0.039827			0.439398	
Overall association result	**Support**					**Support**	

Association testing: relationship between OF and performance (A2) In order to test the second main association regarding the relationship between OF and performance dimensions (A2), this study again implements fsQCA to test each of the four sub-associations separately, which correspond with four performance dimensions, by setting one performance dimension as the

outcome of interest and testing it with all five possible OF attributes as causal conditions as follows;

[1] Operations capability: “op” represents a high membership score with a strong operations capability while “~op” represents a low membership score with a strong operations capability.

[2] Organisational learning capability: “ol” represents a high membership score with a strong organisational learning capability while “~ol” represents a low membership score with a strong organisational learning capability.

[3] Leadership capability: “lp” represents a high membership score with a strong leadership capability while “~lp” represents a low membership score with a strong leadership capability.

[4] Organisational structure capability: “os” represents a high membership score with a strong organisational structure capability while “~os” represents a low membership score with a strong organisational structure capability.

[5] Culture capability: “ct” represents a high membership score with a strong culture capability while “~ct” represents a low membership score with a strong culture capability.

Reports for each sub-association of A2, which test all OFs against one performance dimension at a time, are as follows.

5.8.6 Analysis of A2a: OP-IE

Since A2 concerns only OF, there is no trivial necessary condition (~c) in any of the A2 analysis. Both solution paths of the A2a analysis are above the consistency threshold with different patterns (Table 5.15). S1 (~ct*~os*lp*os) has high leadership and a lack of

organisational structure as core conditions, while S2 (ct*os*~lp*ol*op) has culture and organisational learning and lacks leadership as core conditions. S1 has a lower unique coverage, probably because leadership has an indirect influence on input efficiency, whereas S2's culture and organisational learning strengths in expansion directly reduce costs through economies of scale and risk diversification. Consequently, S1 rejects the association while S2 strongly supports it. Note that S2's peripheral conditions are the presence of operations (the proposed association) and organisational structure, so it has all OFs except leadership. This may suggest that, in order to achieve high input efficiency, almost all OFs must exist and work in cooperation.

Survey data also reveal similar patterns. All three solution paths are above the consistency threshold and can be classified into two groups. S1 and S2 are similar to S2 of the previous test, while S3 is similar to S1 of the previous test. The results for the association are fairly consistent, with a slightly lower level of support in S1 and S2, which only support, rather than strongly support, A2a.

Table 5.15 fsQCA findings for A2a: OP-IE/IEF

	A2a: OF-IE		**A2a: OF-IEF**		
Condition	S1	S2	S1	S2	S3
Operations (OP)		•		●	Θ
Organisational Learning (OL)	•	●	ɵ		•
Leadership (LP)	●	Θ	Θ	Θ	•
Organisational Structure (OS)	Θ	•	●	•	ɵ
Culture (CT)	ɵ	●	●	•	Θ
Observed cases	1	1	3	1	1
Consistency	**0.737169**	**0.710147**	**0.764703**	**0.776655**	**0.790485**
Raw coverage	0.085003	0.100142	0.115943	0.123956	0.073065
Unique coverage	0.049563	0.064702	0.025406	0.033267	0.041147
Solution consistency	**0.736867**		**0.821077**		
Solution coverage	0.149705		0.191247		

T1: H•S⊂Y-Consistency	0.695337	**0.707760**	**0.725705**	**0.777665**	0.693290
T1: H•S⊂Y -Raw coverage	0.055628	0.098067	0.088645	0.122538	0.041773
T2: ~H•S⊂Y -Consistency	***0.739448***	0.646986	***0.744838***	***0.709019***	***0.792344***
T2: ~H•S⊂Y -Raw coverage	0.076386	0.059097	0.082686	0.064340	0.072480
T3: H•~S⊂~Y - Consistency	0.631375	0.647222	0.607701	0.623507	0.591050
T3: H•~S⊂~Y -Raw coverage	0.595426	0.591453	0.623162	0.621822	0.630869
T4: ~H•~S⊂Y -Consistency	0.540970	0.541457	0.625643	0.623802	0.619940
T4: ~H•~S⊂Y -Raw coverage	0.552580	0.572168	0.567398	0.583724	0.560753
Solution path association result	Reject	Strong support	Support	Support	Reject
Combined solution path unique coverage of same association result	0.049563	0.064702	0.058673		0.041147
Overall association result	**Strong support**		**Support**		

5.8.7 Analysis of A2b: OL-OE

All seven solution paths of the A2b analysis are above the consistency threshold (Table 5.16), and can be sorted into three main groups based on the requirement for organisational learning (proposed association). First, those for which organisational learning is a "don't care" condition (S1 (ct*~lp*~op) and S2 (~ct*~os*~lp*op)), which are two dominant conditions with unique coverage of 0.063 and 0.067 respectively, suggest that there are trade-offs between a high degree of operations and culture in generating oe1 (loss ratio, which is equivalent to profit margin ratio). Nevertheless, the existence of this group does not reject A2b. Secondly, those in which organisational learning is present (S3 (ct*os*ol*~op), S5 (~ct*os*ol*op), S6 (~ct*~os*lp*ol*~op) and S7 (os*~lp*ol*op)), in which organisational learning is a core condition for three out of four paths, suggest that organisational learning is an INUS condition (Mackie, 1974) for generating oe1. Thirdly, the group in which organisational learning is absent (S4 (ct*os*~ol*op)) suggests that strong culture, organisational structure, and operations can be treated as substitutes for organisational learning in creating oe1. This agrees with the notion that business processes can be achieved through either organisational learning or culture, or both. Clearly, all three groups support the association.

Survey data reveal identical patterns, except for S6 (ct*os*~lp) which is almost a subset of S3 from the previous analysis. Similarly, analysis for oe2 provides five out of seven identical solutions (Table 5.17) to that of oe1. The deviation is only slight as the solution for oe2 (S6) is almost a subset of that for oe1 (S3). Likewise, all four paths of the oe2f analysis that pass the consistency threshold are identical with those of oe2, reconfirming support for A2b.

Table 5.16 fsQCA findings for A2b: OL-OE1/OE1F

	A2b: OL-OE1						
Condition	S1	S2	S3	S4	S5	S6	S7
Operations (OP)	⊖	●	Θ	•	•	⊖	●
Organisational Learning (OL)			●	Θ	●	●	•
Leadership (LP)	Θ	Θ				•	Θ
Organisational Structure (OS)		⊖	•	•	•	⊖	•
Culture (CT)	●	⊖	•	●	Θ	Θ	
Observed cases	3	5	5	2	5	1	2
Consistency	**0.793156**	**0.777088**	**0.775229**	**0.755311**	**0.860643**	**0.762031**	**0.781217**
Raw coverage	0.151049	0.134623	0.142804	0.125786	0.130888	0.070419	0.109356
Unique coverage	0.062875	0.066940	0.047280	0.029209	0.048338	0.017503	0.013124
Solution consistency	**0.760072**						
Solution coverage	0.430462						
T1: H•S⊂Y-Consistency	**0.785602**	**0.805686**	**0.775045**	**0.825182**	**0.862248**	**0.757407**	**0.780279**
T1: H•S⊂Y -Raw coverage	0.084181	0.080744	0.141481	0.098665	0.130956	0.069269	0.107682
T2: ~H•S⊂Y -Consistency	***0.808090***	***0.785524***	***0.855294***	***0.754137***	***0.837106***	0.695468	***0.852027***
T2: ~H•S⊂Y -Raw coverage	0.146776	0.127047	0.083998	0.124586	0.063875	0.050274	0.076678
T3: H•~S⊂~Y - Consistency	0.517142	0.518360	0.534262	0.516897	0.548324	0.526356	0.524705
T3: H•~S⊂~Y -Raw coverage	0.564092	0.563832	0.540307	0.568478	0.559569	0.568297	0.550638
T4: ~H•~S⊂Y -Consistency	0.573405	0.571344	0.545416	0.549898	0.545416	0.545416	0.545416
T4: ~H•~S⊂Y -Raw coverage	0.471235	0.475278	0.493535	0.472495	0.493535	0.493535	0.493535
Solution path association result	Support	Support	Support	Support	Support	Strong support	Support
Combined solution path unique coverage of same association result	0.267766					0.017503	
Overall association result	**Support**						

Table 5.17 fsQCA findings for A2b: OL-OE1F

	A2b: OL-OE1F						
Condition	S1	S2	S3	S4	S5	S6	S7

Operations (OP)	⊖	●	•	•	⊖		●
Organisational Learning (OL)			Θ	●	●		•
Leadership (LP)	Θ	Θ			•	Θ	Θ
Organisational Structure (OS)		⊖	•	•	⊖	•	•
Culture (CT)	●	⊖	●	Θ	Θ	●	
Observed cases	3	5	2	5	1	4	2
Consistency	**0.784883**	**0.753194**	**0.768164**	**0.738856**	**0.718017**	**0.774667**	**0.769932**
Raw coverage	0.147324	0.128608	0.126087	0.110751	0.065398	0.146150	0.106227
Unique coverage	0.035045	0.059687	0.029041	0.038328	0.011757	-0.000000	0.002621
Solution consistency	0.669155						
Solution coverage	0.377785						
T1: H•S⊂Y-Consistency	**0.795529**	**0.769410**	**0.889051**	**0.739157**	**0.718292**	**0.819156**	**0.772127**
T1: H•S⊂Y -Raw coverage	0.084019	0.076000	0.104773	0.110647	0.064747	0.110243	0.105025
T2: ~H•S⊂Y -Consistency	***0.795205***	***0.767365***	***0.769518***	***0.850465***	***0.787816***	***0.800764***	***0.861565***
T2: ~H•S⊂Y -Raw coverage	0.142358	0.122326	0.125299	0.063961	0.056131	0.119149	0.076422
T3: H•~S⊂~Y - Consistency	0.516712	0.516407	0.515966	0.527055	0.515446	0.523272	0.521746
T3: H•~S⊂~Y -Raw coverage	0.572383	0.570438	0.576273	0.546223	0.565166	0.562655	0.556042
T4: ~H•~S⊂Y -Consistency	0.572778	0.569176	0.572563	0.560459	0.560459	0.560391	0.560459
T4: ~H•~S⊂Y -Raw coverage	0.463952	0.466666	0.484897	0.499855	0.499855	0.470252	0.499855
Solution path association result	Support	Support	Support	Support	Support	Support	Support
Combined solution path unique coverage of same association result	0.176479						
Overall association result	**Support**						

Table 5.18 fsQCA findings for A2b: OL-OE2/OE2F

	A2b: OL-OE2							**A2b: OL-OE2F**				
Condition	S1	S2	S3	S4	S5	S6	S7	S1	S2	S3	S4	S5
Operations (OP)	●		•	•	Θ	Θ	●	⊖	●	•	●	⊖
Organisational Learning (OL)		Θ	Θ	●	●	●	•	Θ		Θ	•	●
Leadership (LP)	Θ	⊖			•	•	Θ	⊖	Θ		Θ	•
Organisational Structure (OS)	⊖	●	●	•	⊖	•	•		⊖	•	•	Θ
Culture (CT)	⊖	•	•	Θ	⊖	•		●	⊖	●		⊖
Observed cases	5	3	2	5	1	5	2	3	5	2	2	1
Consistency	**0.758981**	0.672589	**0.746798**	**0.788748**	**0.872892**	**0.753113**	**0.745734**	0.697646	**0.802344**	**0.893413**	**0.714466**	**0.768479**
Raw coverage	0.153345	0.118903	0.145043	0.139896	0.094074	0.136517	0.121743	0.131969	0.145075	0.155288	0.104384	0.074119
Unique coverage	0.077501	0.012854	0.020641	0.048869	0.027373	0.048765	0.021669	0.040570	0.068934	0.063018	0.020535	0.014923
Solution consistency	0.688993							0.699581				
Solution coverage	0.410388							0.322408				
T1: H•S⊂Y -Consistency	**0.794100**	**0.871676**	**0.833135**	**0.786903**	**0.870305**	**0.752888**	**0.746007**	**0.853988**	**0.883733**	**0.862407**	**0.712902**	**0.764976**
T1: H•S⊂Y -Raw coverage	0.092813	0.099467	0.116176	0.139381	0.092826	0.134638	0.120067	0.087861	0.092437	0.107623	0.102684	0.073019
T2: ~H•S⊂Y -Consistency	***0.779091***	0.673811	***0.747583***	***0.849189***	***0.835916***	***0.888739***	***0.855904***	0.698485	***0.809106***	***0.895238***	***0.864201***	***0.910380***
T2: ~H•S⊂Y -Raw coverage	0.146954	0.118632	0.144035	0.075568	0.070472	0.074925	0.089832	0.132414	0.136581	0.154362	0.081173	0.068686

T3: H•~S⊂~Y - Consistency	0.557086	0.556765	0.556765	0.578579	0.567134	0.572559	0.561409	0.575412	0.578739	0.575412	0.575637	0.571539
T3: H•~S⊂~Y -Raw coverage	0.527130	0.532670	0.532670	0.513636	0.532670	0.505430	0.512516	0.606197	0.603014	0.606197	0.578663	0.591108
T4: ~H•~S⊂Y -Consistency	0.447217	0.447961	0.435137	0.434078	0.434078	0.434078	0.434078	0.585850	0.570792	0.550756	0.566924	0.566924
T4: ~H•~S⊂Y -Raw coverage	0.433866	0.444984	0.436043	0.458084	0.458084	0.458084	0.458084	0.502510	0.495574	0.493919	0.535422	0.535422
Solution path association result	Support	Ignore	Support	Support	Support	Support	Support	Ignore	Support	Support	Support	Support
Combined solution path unique coverage of same association result			0.244818						0.16741			
Overall association result	**Support**							**Support**				

5.8.8 Analysis of A2c: OS-EF

Four out of five solution paths pass the consistency threshold (Table 5.19), and can be categorised into two different groups: those that have either leadership (S3 (~ct*ol)) or organisational structure (S4 (os*op)), or both (S5 (os*ol*~op)); and those that have both leadership and organisational structure as "don't care" conditions (S1 (~ct*op)). Obviously, all paths are consistent with A2c at different levels of support. Among the former group, S5 is a dominant combination with the highest unique coverage of 0.043, suggesting that having both leadership and organisational structure covers more cases of high ef1 than having only one of them, which in turn indicates combination between these two OFs. This path also shows strong support for the proposed association, while the rest suggest only medium support. Therefore, in combination, the overall association is supported. Moreover, comparing the unique coverage of S3 and S4 suggests that, if one focuses only on core conditions, organisational structure has more causal relevance than leadership in generating ef1.

Likewise, analysis of the questionnaire data provides a mirror image of that of the survey data. All paths are exactly the same, which reconfirms the support result. S2 (ct*os*~ol) passes the consistency threshold, which further reinforces the argument that organisational structure is more relevant than leadership in generating ef1f. Analysis of ef2 (Table 5.20) provides only one path (~ct*~ol*op) which is a superset of S1 from the ef1 analysis, and hence also supports

A2c. However, analysis of ef2f reveals three different paths which, although supporting A2c, suggest slightly different messages. When focusing only on two conditions proposed in A2c, either leadership or organisational structure or neither, but not both, are exhibited as core conditions in these solution paths and the other is a “don’t care” condition, suggesting that they are not complementary but substitutes for each other.

Table 5.19 fsQCA findings for A2c: OS-EF1/EF1F

	A2c: OS-EF1					**A2c: OS-EF1F**				
Condition	S1	S2	S3	S4	S5	S1	S2	S3	S4	S5
Operations (OP)	●			•	ϴ	●			•	ϴ
Organisational Learning (OL)		ϴ	•		•		ϴ	•		•
Leadership (LP)			●	ϴ	•			●	ϴ	•
Organisational Structure (OS)		●		●	●		●		●	●
Culture (CT)	ϴ	•	ɵ			ϴ	•	ɵ		
Observed cases	10	4	5	3	5	10	4	5	3	5
Consistency	**0.810221**	0.630946	**0.794263**	**0.703823**	**0.720522**	**0.779445**	**0.787822**	**0.765779**	**0.801304**	**0.820539**
Raw coverage	0.246446	0.134989	0.137137	0.149149	0.123738	0.209755	0.149122	0.116978	0.150232	0.124671
Unique coverage	0.088958	0.017743	0.019238	0.034994	0.042879	0.070423	0.031882	0.014005	0.028619	0.049826
Solution consistency	0.682169					**0.755792**				
Solution coverage	0.393117					0.385337				
T1: H•S⊂Y- Consistency	**0.852770**	**0.737392**	**0.839997**	**0.793497**	**0.719166**	**0.814597**	**0.816997**	**0.830638**	**0.869343**	**0.821331**
T1: H•S⊂Y -Raw coverage	0.122140	0.096591	0.110706	0.086591	0.121758	0.103223	0.094682	0.096853	0.083932	0.123026
T2: ~H•S⊂Y - Consistency	***0.830457***	0.659127	***0.824492***	***0.703441***	0.658091	***0.779647***	***0.806163***	***0.756353***	***0.800525***	***0.853360***
T2: ~H•S⊂Y -Raw coverage	0.206736	0.118204	0.096258	0.147177	0.068250	0.171714	0.127907	0.078124	0.148182	0.078299
T3: H•~S⊂~Y - Consistency	0.509483	0.494303	0.509483	0.495242	0.519911	0.506156	0.495533	0.506156	0.488636	0.509209
T3: H•~S⊂~Y - Raw coverage	0.372022	0.370192	0.372022	0.385541	0.374997	0.416986	0.418702	0.416986	0.429177	0.414374

T4: ~H•~S⊂Y - Consistency	0.426150	0.445174	0.437796	0.428749	0.438237	0.554048	0.541307	0.548544	0.536385	0.537445
T4: ~H•~S⊂Y - Raw coverage	0.465722	0.521608	0.531317	0.494708	0.549523	0.535698	0.561133	0.588982	0.547558	0.596236
Solution path association result	Support	Ignore	Support	Support	Strong support	Support	Support	Support	Support	Support
Combined solution path unique coverage of same association result			0.14319		0.042879	0.194755				
Overall association result	**Support**					**Support**				

Table 5.20 fsQCA findings for A2c: OS-EF2/EF2F

	A2c: LP-EF2	A2c: LP-EF2F		
Condition	S1	S1	S2	S3
Operations (OP)	●	ɵ		ɵ
Organisational Learning (OL)	ɵ	ɵ	ɵ	•
Leadership (LP)				●
Organisational Structure (OS)			•	
Culture (CT)	ɵ	●	●	ɵ
Observed cases	4	3	4	1
Consistency	**0.732735**	**0.710499**	**0.757212**	**0.776710**
Raw coverage	0.142092	0.149561	0.157488	0.079930
Unique coverage	0.142092	0.050177	0.066607	0.031718
Solution consistency	**0.732735**	**0.764849**		
Solution coverage	0.142092	0.247886		
T1: H•S⊂Y-Consistency	**0.800540**	0.651014	**0.723364**	**0.737608**
T1: H•S⊂Y -Raw coverage	0.054945	0.056748	0.092113	0.046316
T2: ~H•S⊂Y -Consistency	***0.729397***	***0.741126***	***0.767807***	***0.768565***
T2: ~H•S⊂Y -Raw coverage	0.140281	0.146694	0.133857	0.076887
T3: H•~S⊂~Y - Consistency	0.607950	0.596473	0.610785	0.600480
T3: H•~S⊂~Y -Raw coverage	0.507264	0.469406	0.469159	0.478379
T4: ~H•~S⊂Y -Consistency	0.608108	0.544808	0.523172	0.527446
T4: ~H•~S⊂Y -Raw coverage	0.631034	0.596974	0.595916	0.622280
Solution path association result	Support	Reject	Support	Support
Combined solution path unique coverage of same association result	0.142092	0.050177	0.098325	
Overall association result	**Support**	**Support**		

5.8.9 Analysis of A2d: CT-AD

Three out of four solution paths of the ad1 analysis are above the consistency threshold (Table 5.21), and can be categorised into two different groups: those that have culture, in either core or peripheral conditions (S1 (ct*~lp*~ol*~op) and S3 (ct*os*~lp*op)); and those that do not have culture (S4 (~ct*~os*lp*ol*~op)). A combination S4 contradictory to the association probably exists because the business unit needs strong organisational learning capability to design new products to suit the changing customer needs that are observed and reported in its

operations. However, its unique coverage is quite low at 0.032. S1, which has the presence of culture as a core condition, is a dominant combination with 0.064 unique coverage; therefore, A2d is supported. Moreover, S3 also suggests combination between culture and organisational structure in generating ad1. The analysis of ad2 is very similar to that of ad1 in that its S1 and S2 are exactly the same as S1 and S2 of the ad1 analysis respectively, and its S3 is quite similar to S3 of the ad1 analysis, thereby reconfirming the support result for A2d with no major contradiction.

Table 5.21 fsQCA findings for A2d: CT-AD1/AD2

	A2d: CT-AD1				**A2d: CT-AD2**		
Condition	S1	S2	S3	S4	S1	S2	S3
Operations (OP)	⊖	•	•	⊖	⊖	•	•
Organisational Learning (OL)	Θ	Θ		•	Θ	Θ	•
Leadership (LP)	⊖		Θ	●	⊖		Θ
Organisational Structure (OS)		•	●	⊖		•	●
Culture (CT)	●	●	•	Θ	●	●	
Observed cases	3	2	2	1	3	2	2
Consistency	**0.778090**	0.685793	**0.717131**	**0.863319**	**0.834968**	**0.707299**	**0.736667**
Raw coverage	0.140467	0.113759	0.113980	0.079466	0.173370	0.134946	0.118139
Unique coverage	0.063863	0.023117	0.023786	0.031932	0.095228	0.042382	0.036761
Solution consistency	**0.726515**				**0.737450**		
Solution coverage	0.243319				0.266934		
T1: H•S⊂Y-Consistency	**0.780527**	0.687665	**0.717971**	**0.852982**	**0.835743**	**0.706701**	**0.817127**
T1: H•S⊂Y -Raw coverage	0.141212	0.113158	0.112662	0.053353	0.173907	0.133754	0.114837
T2: ~H•S⊂Y -Consistency	***0.869145***	***0.852866***	***0.859074***	***0.862612***	***0.899974***	***0.849789***	***0.719493***
T2: ~H•S⊂Y -Raw coverage	0.127850	0.077847	0.078258	0.078580	0.152265	0.089215	0.070871
T3: H•~S⊂~Y - Consistency	0.510259	0.512996	0.515814	0.513359	0.500944	0.501170	0.513012
T3: H•~S⊂~Y -Raw coverage	0.538882	0.520367	0.527292	0.560519	0.464858	0.446691	0.467474
T4: ~H•~S⊂Y -Consistency	0.544917	0.544917	0.544917	0.548205	0.385775	0.385775	0.389300
T4: ~H•~S⊂Y -Raw coverage	0.497584	0.497584	0.497584	0.484937	0.405165	0.405165	0.402029
Solution path association result	Support	Ignore	Support	Support	Support	Support	Support
Combined solution path unique coverage of same association result			0.119581		0.174371		
Overall association result	**Support**				**Support**		

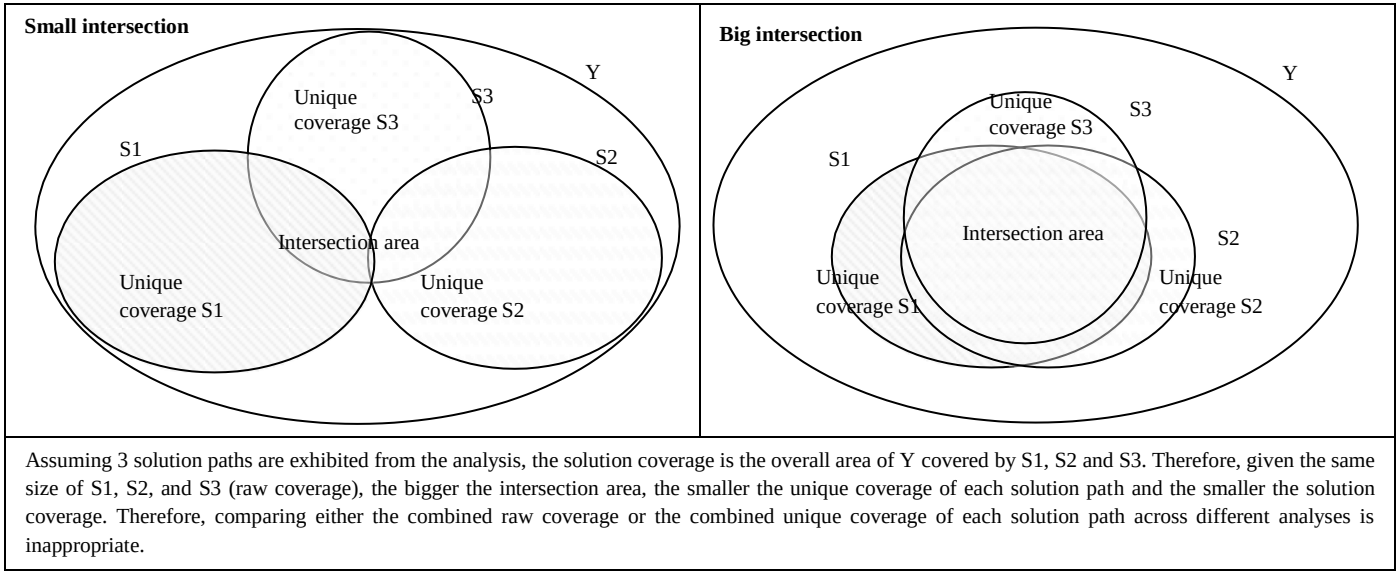
5.8.10 Post-data analysis

This section considers all sub-associations within each of the two main associations tested in this chapter to identify patterns and further implications of the relationship between causal conditions and outcomes. For A1, ten out of twelve sub-association tests are supported. This answers the first research question that the equivocal empirical evidence of previous research can be improved, if not fully resolved, by selecting an appropriate performance dimension to

measure business units with different KSs. However, A1a and A1c are both rejected, suggesting that ie and ef2 are likely to have causal factors other than those proposed in this study. In this regard, A2a and A2c, for which there is strong and medium support respectively, show that the proposed related OFs (op, lp and os, respectively) are sufficient to explain the variation of ie and ef2, suggesting that they may be either substitutes for or complementary to the proposed KS integrations. To answer this question, A3 is a necessary next step.

For A2, all sub-association tests are supported, except A2a which is strongly supported, thus, further strengthening A2. To answer the second research question about whether OFs better explain performance than KSs, as claimed by Barney and Hoskisson (1990), this study compares solution coverages, which portrays their explanatory power, between all sub-associations of A1 and A2 tested against the same performance dimension with a consistency level above 0.7 (passing the consistency threshold).

The rationale behind this comparison is as follows. Firstly, although combined unique coverage could be used in the prior analyses of this research to compare within the same association test because it is based on the same outcome and the intersection is the same area, it cannot be compared across different analyses because the intersection areas are different, which may result in an incorrect interpretation. For example, it is not necessary for ie to be covered more by KS (as in A1a (KS-IE), in which the combined unique coverage is 0.314) than by OF (as in A2a (OF-IE), in which the combined unique coverage is 0.114) because the commonly covered area of the A1a analysis may be less than that of the A2a analysis. Figure 5.1 illustrates this issue in a Venn diagram. Likewise, the combined raw coverage of all single solution paths cannot be used for the same reason.



Assuming 3 solution paths are exhibited from the analysis, the solution coverage is the overall area of Y covered by S1, S2 and S3. Therefore, given the same size of S1, S2, and S3 (raw coverage), the bigger the intersection area, the smaller the unique coverage of each solution path and the smaller the solution coverage. Therefore, comparing either the combined raw coverage or the combined unique coverage of each solution path across different analyses is inappropriate.

Figure 5.2 Intersection area problem when comparing combined unique coverage across different analyses

Secondly, while two parameters can be compared across different analyses based on the same outcome, only one provides a meaningful implication. It is possible to compare the raw coverage between each single solution path from different analyses (e.g. to compare S1 of A1a with S1 of A2a); however, each solution path is not a good representative for the whole solution, thus this option is inappropriate. The only suitable alternative is to compare the solution coverage of each analysis with each other (e.g. to compare the A1a solution with the A2a solution). The intersection size problem is solved since it considers the amount of outcome covered by all solution paths within the same analysis, rather than by a single path. However, like other previous analyses, this study considers solution coverage only when the solution consistency is above the 0.7 consistency threshold.

The results of the solution coverage comparison are mixed (Table 5.22). The empirical evidence shows that six out of twelve performance dimensions are better explained by A1 (KS), shown in orange, while only four performance dimensions are better explained by A2 (OF), shown in purple, and two performance dimensions (oe1f and oe2) are not applicable since both A1 and A2 sub-associations have a solution consistency lower than the 0.7 consistency threshold. It can be inferred that neither is always a better performance predictor. In fact, it raises concern about potential improvement through the use of a combination of both to explain performance (A3).

Table 5.22 Comparison of solution coverage of all sub-associations testing A1 and A2

Association testing		Solution consistency	Solution coverage	Association testing		Solution consistency	Solution coverage	Max coverage (of A: that has above consistency threshold)	Perf
A1	**A1a**	**0.71802**	**0.437901**	A2	**A2a**	**0.73687**	0.149705	A1	IE
	A1af	**0.90041**	0.022014		**A2af**	**0.82108**	**0.191247**	A2	IEF
	A1b1	0.602613	0.554164		**A2b1**	**0.76007**	**0.430462**	A2	OE1
	A1b1f	0.6882	0.242285		A2b1f	0.669155	0.377785	n/a	OE1F
	A1b2	0.660851	0.47716		A2b2	0.688993	0.410388	n/a	OE2
	A1b2f	**0.80211**	**0.395919**		A2b2f	0.699581	0.322408	A1	OE2F
	A1c1	**0.71815**	**0.326723**		A2c1	0.682169	0.393117	A1	EF1
	A1c1f	0.668564	0.525807		**A2c1f**	**0.75579**	**0.385337**	A2	EF1F
	A1c2	**0.71082**	**0.161335**		**A2c2**	**0.73274**	0.142092	A1	EF2

	A1c2f	**0.7688**	**0.281429**		**A2c2f**	**0.76485**	0.247886	A1	EF2F
	A1d1	0.686555	0.665239		**A2d1**	**0.72652**	**0.243319**	A2	AD1
	A1d2	**0.71655**	**0.455806**		**A2d2**	**0.73745**	0.266934	A1	AD2

- The colour of the association heading is the result of previous (standalone) analysis (red = reject, blue = support, green = strong support)
- Bold indicates those that have a solution consistency above the 0.7 consistency threshold.
- The colour in the last column indicates which sub-association with the same outcome has the larger solution coverage. (orange = A1, supporting KS; light purple = A2, supporting OF)

It should be noted that the results of the previous association testing and of this analysis are not directly related. Supporting or rejecting the association does not affect the interpretation of the comparison of solution coverage. The former tests whether the proposed specific type of research construct is sufficient to generate the corresponding performance dimension by feeding all types of the research construct into fsQCA and then interpreting the results, while the latter compares a by-product of the former analysis, which is the overall solution consistency and coverage that are combined values of all solution paths shown, without restricting them only to the proposed specific type of research construct, meaning that these numbers do not take the research associations into consideration. Rather, all possible combinations of all types of research construct are considered. Consequently, it is unsurprising that ie and ef2 (from A1a and A1c, respectively), which were previously rejected, are among the group of performance dimensions in which A1 has more solution coverage than A2, suggesting that KS better explains related performance than OF. In other words, although the proposed KS (KAD, S) is insufficient to generate the related performance dimension, other KS integrations displayed in the solution paths still provide a better performance explanation than that of OF.

5.8.11 Analysis of A3a: KAD-OP-IE

Five out of six solution paths pass the consistency threshold (Table 5.23). Four have systems as either a core condition (S3 (op*~bp*~d*s*~c), S5 (~ka*bp*~d*s*~c) and S6

(~op*~bp*d*s*~c)) or a peripheral condition (S4 (ka*~bp*~d*s*~c)) and another attribute present (either operations, business processes, decision or knowledge asset), suggesting a trade-off relationship between them. Moreover, their unique coverages are quite similar, raising a concern that high input efficiency may be achieved through a variety of causal conditions, not just operations and low cost as proposed in the association. Furthermore, like S1 of the A1a analysis (~ka·~bp·~d·~s·~c), S2 (~op*~bp*~d*~s*~c) of this analysis, which can also be categorised as a stuck in the middle reactor, is the dominant condition with the highest unique coverage (0.12), reconfirming that other OF attributes should be considered to better explain or predict input efficiency. The association testing section also endorses such a conclusion. T1 displays low consistency for most paths, while T2 and T3 show high consistency for all paths, all of which suggests that A3a is weakly supported.

The data analysis (ief) displays quite a different pattern. While systems are present in most paths in the survey analysis, its absence is a core condition in two out of three paths (S1 (~op*bp*~d*~s*~c) and S3 (~op*ka*bp*~d*~s)) and is a "don't care" condition for the other path (S2 (~op*~bp*d*~c)). Moreover, the absence of operations is a core condition for all paths. It can be inferred that the proposed association regarding combination between knowledge asset and operations is not strongly supported and more types of OF should be added to improve explanatory power. The association testing section reconfirms this argument, showing high consistency levels in T1, T2 and T3 of all paths, resulting in an overall support result.

Deviation from A3a (KAD-OP-IE) probably arises only from alternative theory. In order to understand the A3a findings clearly, it is necessary to refer to the validity of A1a and A2a because these are the tests of the two research constructs examined in A3a and also share the same outcome as A3a. Since A1a has already been discussed, this study will not repeat it here. On careful examination of the combination of OFs for each solution of A2a, this study finds

that operations capability (OP) by itself is insufficient to generate high input efficiency (ie). In fact, OP is only displayed as a peripheral or a "don't care" condition. It needs culture and organisational learning as a core part of the combination to generate high ie.

Therefore, it is not beyond expectation that A3a, which considers all types of KS as in A1a (which is rejected) and only OP from A2a (which is shown as a peripheral or "don't care" condition in the solution), is weakly supported because of the weak explanatory power of each research construct examined in this test. Consequently, according to fsQCA practice (Schneider and Wagemann, 2012), this deviant A3a finding suggests that the researcher should add other OFs (in this case, culture and organisational learning) in order to refine and improve the explanatory power of the current sub-association for performance.

In order to understand clearly whether A3a provides an improvement over each of its two research constructs alone (an argument for combination), the A1a and A2a findings must be considered and compared. The fact that A1a is rejected while A2a is strongly supported merely suggests that, when comparing two proposed causal factors under sub- associations A1a and A2a, OP is a better predictor than knowledge asset decision (KAD) for high ie. This means that having only the intention to pursue a knowledge asset and decision strategy is insufficient to achieve high ie, whereas having OP is sufficient for a business unit to achieve

high ie. However, since all types of KS and OF, rather than only a proposed type, are examined in A1a and A2a respectively (all KS integrations, not just KAD, are investigated in A1a), comparing their solution coverages will indicate whether KS or OF as a whole better explains the outcome, irrespective of each of their proposed types alone.

In other words, which research construct is better is another question that cannot be answered on the basis of the validity of the two sub-associations. Rather, comparison between the overall solution coverage of each sub-association is required. The fact that the solution coverage of

H1a (0.44) is greater than that of H2a (0.15) – both have a solution consistency above the 0.7 threshold – suggests that considering a combination of KS (all integrations) provides greater explanatory power than that of OF (all types).

Essentially, although a proposed KS integration in A1a (KAD) is not supported, other KS integrations tested at the same time (those not proposed in sub-association A1a) still provide better explanatory power (as shown in higher coverage) for ie than considering all types of OF as in A2a, which in turn casts doubt on Barney and Hoskisson's (1990) claim that OF is better than KS in explaining performance, and on their suggestion that KS should be replaced with OF. Moreover, this study finds that considering all KSs and OP simultaneously (A3a) provides the highest solution coverage (0.54), compared with that of A1a (0.44) and A2a (0.15), supporting my argument for combination.

Table 5.23 fsQCA findings for A3a: KAD-OP-IE/IEF

	A3a: KS-OP-IE						**A3a: KS-OP-IEF**		
Condition	S1	S2	S3	S4	S5	S6	S1	S2	S3
Collaboration (C)	Θ*	⊖*	⊖*	⊖*	Θ*	Θ*	⊖*	Θ*	
Systems (S)	⊖	Θ	●	•	●	●	Θ		Θ
Decision (D)	●	Θ	Θ	Θ	⊖	●	Θ	●	Θ
Business Processes (BP)	●	Θ	Θ	Θ	●	⊖	•	⊖	•
Knowledge Asset (KA)				●	Θ				•
Operations (OP)		Θ	●			Θ	Θ	Θ	Θ
Observed cases	1	6	10	5	4	1	5	7	4
Consistency	0.541017	**0.809458**	**0.738754**	**0.713514**	**0.704821**	**0.832197**	**0.752608**	**0.750066**	**0.741754**
Raw coverage	0.058826	0.226452	0.256795	0.209680	0.183706	0.067485	0.170743	0.153932	0.129075
Unique coverage	0.016973	0.120518	0.052179	0.000233	0.054643	0.023382	0.053508	0.124083	0.019507
Solution consistency	**0.720577**						**0.759119**		
Solution coverage	0.535373						0.314333		
T1: H•S⊂Y-Consistency	0.466552	**0.745894**	0.523277	0.523277	0.563929	**0.852646**	**0.706112**	**0.804982**	**0.706112**
T1: H•S⊂Y -Raw coverage	0.037132	0.028298	0.039813	0.039813	0.028720	0.029535	0.026172	0.033658	0.026172
T2: ~H•S⊂Y -Consistency	0.557338	***0.808985***	***0.738073***	***0.713185***	***0.703511***	***0.833603***	***0.754514***	***0.750571***	***0.744141***
T2: ~H•S⊂Y -Raw coverage	0.060791	0.224518	0.257189	0.210136	0.183932	0.069439	0.170138	0.154996	0.128397
T3: H•~S⊂~Y - Consistency	***0.883664***	***0.885203***	***0.885203***	***0.885203***	***0.885203***	***0.885203***	***0.711670***	***0.711670***	***0.711670***

T3: H•~S⊂~Y -Raw coverage	0.101355	0.102894	0.102894	0.102894	0.102894	0.102894	0.092653	0.092653	0.092653
T4: ~H•~S⊂Y -Consistency	0.474977	0.466305	0.463463	0.480596	0.485694	0.484881	0.528534	0.521645	0.529742
T4: ~H•~S⊂Y -Raw coverage	0.966423	0.851670	0.831285	0.887879	0.901204	0.978176	0.867366	0.868442	0.897398
Solution path association result	Ignore	Weak support	Reject	Reject	Reject	Weak support	Weak support	Support	Weak support
Combined solution path unique coverage of same association result		0.1439	0.107055				0.073015	0.124083	
Overall association result	**Weak support**						**Support**		

5.8.12 Analysis of A3b: BPD-OL-OE

Only two of four paths pass the consistency threshold (Table 5.24). Both seem to support the association in that at least one of the proposed causal conditions (BP and OL) is presented and the other is a "don't care" condition (S3 (ol*d*~c) and S4 (~ka*bp*~d*~s*~c)). Their T1 and T2 consistencies are high, while those for T3 and T4 are low, showing a support result. The data analysis exhibits five paths (out of six) that pass the consistency threshold, two of which (S1 (ol*d*~c) and S2 (~ka*bp*~d*~s*~c)) are exactly the same as S3 and S4 of the previous test. Another two paths (S3 (ka*~bp*~d*~s*~c) and S5 (~ol*bp*~d*s*~c)) are a subset of S1 (ka*~s*~c) and S2 (~ka*s*~c) of the previous analysis respectively, which also somewhat supports the association owing to the "don't care" condition for organisational learning and the presence of business processes. Finally, S6 (~ol*ka*bp*~d*~s*c), which can be categorised as knowledge collaboration, also corresponds with the association in the presence of business processes. Consequently, the data analysis also supports A3a.

In the oe2 analysis, six out of seven paths pass the consistency threshold (Table 5.25). These can be classified into three groups. The first group comprises those that show combination by the presence of both organisational learning and business processes (S7 (ol*~ka*bp*s*~c)). The second group is those that exhibit the presence of one of the proposed causal conditions (S2 (ol*ka*~bp*~c), S4 (~ol*~ka*bp*~d*~s*~c) and S6 (~ol*ka*bp*~d*~s)), suggesting a trade-off relationship between them. This group is the dominant group with a combined unique coverage of 0.166. The third group comprises those that have a "don't care" condition for one

of the proposed causal conditions (S1 (ka*~bp*~s*~c), S3 (~ka*d*s*~c) and S4 (~ol*~ka*bp*~d*~s*~c)), which may still support this association. The association testing section also supports this pattern, suggesting support for A3a. The analysis for oe2f also shows the same pattern as the second group (S2 (bp*~s*~c), S4 (~ol*bp*~d*~c) and S5 (ka*bp*~d*~s)) and third group (S1 (ka*~s*~c)) of the previous test, as well as providing the same support result.

Table 5.24 fsQCA findings for A3b: BPD-OL-OE1/OE1F

	A3b: KS-OL-OE1				**A3b: KS-OL-OE1F**					
Condition	S1	S2	S3	S4	S1	S2	S3	S4	S5	S6
Collaboration (C)	⊖*	⊖*	⊖*	⊖*	⊖*	⊖*	⊖*	⊖*	●	
Systems (S)	⊖	●		⊖		⊖	⊖	●	●	⊖
Decision (D)			●	⊖	●	⊖	⊖	⊖	⊖	⊖
Business Processes (BP)				•		●	⊖		•	•
Knowledge Asset (KA)	●	⊖		⊖		⊖	●	⊖		•
Organisational Learning (OL)			●		●			⊖	⊖	⊖
Observed cases	9	24	6	5	6	5	1	13	3	1
Consistency	0.648344	0.663247	**0.782438**	**0.772698**	**0.707672**	**0.724664**	**0.794016**	0.697460	**0.773250**	**0.778194**
Raw coverage	0.196212	0.374276	0.115329	0.172121	0.102809	0.159101	0.110858	0.250632	0.153986	0.033637
Unique coverage	0.054184	0.241412	0.037515	0.032313	0.032455	0.058696	0.016003	0.120965	0.028882	0.010464
Solution consistency	0.635798				**0.714627**					
Solution coverage	0.538797				0.454133					
T1: H•S⊂Y-Consistency	**0.791743**	**0.954857**	**0.796242**	**0.875266**	**0.748266**	**0.776939**	**0.833337**	0.672732	0.688173	**0.865103**
T1: H•S⊂Y -Raw coverage	0.054777	0.042356	0.059158	0.046974	0.054794	0.041098	0.039283	0.016219	0.018201	0.005915
T2: ~H•S⊂Y -Consistency	0.645642	0.663392	***0.774616***	***0.771952***	***0.721813***	***0.723961***	***0.793858***	0.697353	***0.772928***	***0.780676***
T2: ~H•S⊂Y -Raw coverage	0.192817	0.375529	0.111991	0.171354	0.102856	0.158391	0.109838	0.250811	0.154502	0.033991
T3: H•~S⊂~Y - Consistency	0.615825	0.600694	0.643375	0.600694	0.596100	0.600781	0.600781	0.600781	0.600781	0.600781
T3: H•~S⊂~Y -Raw coverage	0.046819	0.046819	0.046819	0.046819	0.044053	0.047553	0.047553	0.047553	0.047553	0.047553
T4: ~H•~S⊂Y -Consistency	0.544902	0.542449	0.517564	0.524309	0.525862	0.532296	0.532542	0.526383	0.539682	0.528046
T4: ~H•~S⊂Y -Raw coverage	0.897811	0.736226	0.933547	0.896900	0.934876	0.897471	0.937648	0.798192	0.905846	0.958520
Solution path association result	Ignore	Ignore	Support	Support	Support	Support	Support	Ignore	Reject	Support
Combined solution path unique coverage of same association result			0.069828		0.117618				0.028882	
Overall association result	**Support**				**Support**					

Table 5.25 fsQCA findings for A3b: BPD-OL-OE2/OE2F

	A3b: KS-OL-OE2							A3b: KS-OL-OE2F				
Condition	S1	S2	S3	S4	S5	S6	S7	S1	S2	S3	S4	S5
Collaboration (C)	Θ*	Θ*	Θ*	ɵ*	ɵ*		Θ*	Θ*	ɵ*	Θ*	Θ*	
Systems (S)	ɵ		●	Θ		Θ	•	Θ	Θ			Θ
Decision (D)			●	Θ*	Θ*	Θ*				ɵ	ɵ	Θ
Business Processes (BP)	Θ	Θ		●	•	●	●		●	●	●	●
Knowledge Asset (KA)	●	●	ɵ	ɵ	●	•	Θ	●		Θ		•
Organisational Learning (OL)		•		Θ	Θ	Θ	●				Θ	
Observed cases	3	9	2	5	2	6	2	9	11	8	12	10
Consistency	**0.787646**	**0.755536**	**0.767557**	**0.743361**	0.688015	**0.734725**	**0.702059**	**0.821701**	**0.769282**	0.669804	**0.731773**	**0.849219**
Raw coverage	0.148281	0.240705	0.102530	0.163666	0.170731	0.140549	0.132670	0.259547	0.284802	0.228601	0.261149	0.266998
Unique coverage	0.014541	0.102085	0.037641	0.051884	0.020881	0.011608	0.021251	0.051003	0.021670	0.013007	0.030008	0.060114
Solution consistency	0.684780							**0.755821**				
Solution coverage	0.483686							0.483687				
T1: H•S⊂Y - Consistency	**0.907640**	**0.913392**	**0.817749**	**0.732503**	**0.722283**	**0.722283**	**0.817749**	**0.887499**	**0.877538**	**0.847579**	**0.943977**	**0.884763**
T1: H•S⊂Y - Raw coverage	0.052365	0.056197	0.042304	0.027134	0.027986	0.027986	0.042304	0.064085	0.065038	0.047477	0.034352	0.062371
T2: ~H•S⊂Y - Consistency	***0.786262***	***0.756616***	***0.768671***	***0.741886***	0.688755	***0.734261***	***0.701126***	***0.821572***	***0.766990***	0.668632	***0.730965***	***0.849751***
T2: ~H•S⊂Y - Raw coverage	0.146633	0.241133	0.104896	0.162522	0.170091	0.139749	0.132994	0.256083	0.279841	0.227903	0.260290	0.266000
T3: H•~S⊂~Y - Consistency	***0.939062***	***0.939062***	***0.939062***	***0.939062***	***0.939062***	***0.939062***	***0.939062***	0.576488	0.594456	0.562324	0.562324	0.562324
T3: H•~S⊂~Y -Raw coverage	0.063670	0.063670	0.063670	0.063670	0.063670	0.063670	0.063670	0.041983	0.041983	0.041983	0.041983	0.041983
T4: ~H•~S⊂Y -Consistency	0.473974	0.462183	0.470280	0.468264	0.474937	0.459873	0.471612	0.481693	0.473723	0.504682	0.499662	0.466358
T4: ~H•~S⊂Y -Raw coverage	0.977570	0.893918	0.990675	0.940870	0.941842	0.938010	0.968382	0.828358	0.789290	0.845968	0.820131	0.801454
Solution path association result	Support	Support	Support	Support	Ignore	Support	Support	Support	Support	Ignore	Support	Support
Combined solution path unique coverage of same association result	0.23901							0.162795				
Overall association result	**Support**							**Support**				

5.8.13 Analysis of A3c: S-LP-OS-EF

Out of seven paths (Table 5.26), only three are above the consistency threshold, and can be categorised into two groups. The first comprises those that display a "don't care" condition for OF attributes (S1 (ka*~bp*~s*~c) and S2 (~ka*bp*~d*~s*~c)); this group does not reject A3c. Since both have only one KS attribute present, they suggest a trade-off relationship between knowledge asset and business processes in order to achieve ef1. The second group comprises those that display attributes of both KS and OF (S6 (os*lp*~bp*d*~c)), which quite support the combination of A3c. Likewise, the association testing section also suggests overall support for A3c. The data analysis reveals five paths (out of seven) exceeding the consistency

threshold, which can be grouped in the same way as those in the previous test with one additional group. Regarding the similarity, for the first group, S1 (~bp*~s*~c) is a superset of the previous test's S1. S2 (~ka*bp*~d*~s*~c) and S4 (ka*bp*~d*~s) are exactly the same as the previous test's S2 and S4 respectively. For the second group, S6 (os*lp*~bp*d*~c) and S7 (os*lp*ka*bp*~d) are exactly the same as the previous test's S6 and S7 respectively. The additional group comprises those that display attributes of OF and have no attribute of KS present (S5 (lp*~ka*~bp*~d*~c)). This group is also coherent with A3c, resulting in overall support.

However, the analysis of ef2 (Table 5.27) shows only one group that has one KS attribute present and either a "don't care" condition or the absence of OF attributes (S1 (~ka*bp*~d*~s*~c)), which is exactly the same as S2 of the ef1 test (S2 (~lp*~ka*~bp*d*~c)). By itself, this group does not provide strong support for the association, though it does not reject it. Thus, to find a finer grained association validity, the association testing section is necessary and it rejects A3c because T1 of S1 (a dominant combination) is below the consistency threshold. The data for ef2 indicate the same direction as the survey analysis. Two groups can be classified from all six paths, four of which are similar to the pattern of ef2 analysis (S1 (~ka*lp*~d*~c), S2 (~ka*bp*~c), S3 (~lp*ka*~bp*~c) and S4 (~os*ka*~bp*~c)). This group shows a potential trade-off relationship between business processes and knowledge asset in generating ef2f. Another group is one supporting combination between organisational structure and either business processes or knowledge asset (S5 (os*bp*~d*~s*~c) and S6 (os*~lp*ka*~d*~c)). Nevertheless, the latter, which is a dominant group with a combined unique coverage of 0.08, has a T1 consistency below the consistency threshold, resulting in overall rejection of A3c.

Similarly, to the discussion of A3a above, deviation from A3c (S-LP-OS-EF2/EF2F) also arises only from alternative theory, for which the validity of A1c and A2c must be referred to

because they are the tests of the two research constructs examined in A3c and also share the same outcome as A3c. This study will not repeat A1c as it has been discussed earlier. Careful examination of the combination of OFs for each solution of A2c reveals that LP and organisational structure (OS) by themselves are insufficient to generate high performance (ef2). In fact, they are often displayed as a peripheral or a "don't care" condition (apart from one solution path in which LP is exhibited as a core condition, while OS is displayed as a "don't care" condition). Clearly, culture and operations are required to be a core parts of the combination to generate high ef2.

Therefore, it is not beyond expectation that A3c, which considers all types of KS as in A1c (which is rejected) and only LP and OS from A2c (which are often shown as peripheral or "don't care" conditions) are rejected because of the weak explanatory power of each research construct examined in this test. Consequently, according to fsQCA practice (Schneider and Wagemann, 2012), this deviant A3c finding suggests that the researcher should add other OFs (in this case, culture and operations) to refine and improve the explanatory power of the current sub-association for performance.

In order to understand clearly whether A3c provides an improvement over each of its two research constructs alone (an argument for combination), the findings of A1c and A2c must be considered and compared. The fact that A1c is rejected while A2c is supported merely

suggests that, when comparing two proposed causal factors under sub-associations A1c and A2c, LP and OS are better predictors than systems of high performance. This means that having only the intention to pursue the systems strategy is insufficient to gain high performance, whereas having LP and OS is sufficient for a business unit to achieve high performance.

However, since all types of KS and OF, rather than only a proposed type, are examined in A1c and A2c respectively (all KS integrations, not just systems, are investigated in A1c), comparing their solution coverages will indicate whether KS or OF as a whole group better explains the outcome, irrespective of each of their proposed types alone. In other words, which research construct is better is another question that cannot be answered on the basis of the validity of the two sub-associations. Rather, comparison of the overall solution coverage of each sub-association is required.

The fact that the solution coverage of A1c (0.16 for ef2 and 0.28 for ef2f) is greater than that of A2c (0.14 for ef2 and 0.25 for ef2f) – all have a solution consistency above the 0.7 threshold suggests that considering a combination of KSs (all integrations) provides more explanatory power for knowledge sharing than a combination of OFs (all types). Essentially, although a proposed KS integration in A1c (systems) is not supported, other KS integrations tested at the same time (those not proposed in sub-association A1c) still provide better explanatory power (as shown in higher coverage) for knowledge sharing than considering all types of OF as in A2c, which in turn again casts doubt on Barney and Hoskisson's (1990) claim that OF is better than KS in explaining performance, and on their suggestion that KS should be replaced with OF. Moreover, this study finds that considering all KSs and OP simultaneously (A3c) provides the highest solution coverage (0.27 for ef2 and 0.43 for ef2f) compared with that of A1c (0.16 for ef2 and 0.28 for ef2f) and A2c (0.14 for ef2 and 0.25 for ef2f), supporting this study argument for combination.

Table 5.26 fsQCA findings for A3c: S-LP-OS-EF1/EF1F

	A3c: KS-LP-OS-EF1						
Condition	S1	S2	S3	S4	S5	S6	S7
Collaboration (C)	ϴ*	ɵ*	ϴ*		ϴ*	ϴ*	
Systems (S)	ϴ	ϴ		ϴ	●		
Decision (D)		ϴ	ϴ	ϴ	●	●	ϴ
Business processes (BP)	ɵ	●	●	●	ɵ	ɵ	●
Knowledge Asset (KA)	●	ɵ		•	ɵ		•
Leadership (LP)						•	•
Organisational Structure (OS)			●			●	●
Observed cases	3	5	30	9	2	6	28
Consistency	**0.770447**	**0.756489**	0.691651	0.695848	0.682610	**0.772270**	0.676070
Raw coverage	0.136668	0.185175	0.461778	0.230345	0.080959	0.090902	0.398668
Unique coverage	0.028184	0.043180	0.048283	0.037023	0.020250	0.024377	0.000000
Solution consistency	0.673365						
Solution coverage	0.692684						
T1: H•S⊂Y-Consistency	**0.748419**	**0.910834**	**0.718837**	**0.840547**	**0.739235**	**0.738335**	**0.712783**
T1: H•S⊂Y -Raw coverage	0.066208	0.063584	0.346939	0.098132	0.050418	0.065612	0.344732
T2: ~H•S⊂Y -Consistency	***0.767797***	***0.754910***	0.679861	0.694787	***0.721060***	***0.842208***	0.664079
T2: ~H•S⊂Y -Raw coverage	0.134921	0.184143	0.221752	0.228990	0.083170	0.082614	0.170646
T3: H•~S⊂~Y - Consistency	0.526228	0.526228	0.741027	0.526228	0.522128	0.525249	***0.714871***
T3: H•~S⊂~Y -Raw coverage	0.322003	0.322003	0.234046	0.322003	0.316754	0.312029	0.231289
T4: ~H•~S⊂Y -Consistency	0.464312	0.455414	0.448308	0.453566	0.477883	0.457350	0.456913
T4: ~H•~S⊂Y -Raw coverage	0.630372	0.578735	0.565748	0.558827	0.665093	0.647251	0.612720
Solution path association result	Support	Support	Ignore	Ignore	Ignore	Support	Ignore
Combined solution path unique coverage of same association result	0.095741						
Overall association result	**Support**						

Table 5.27 fsQCA findings for A3c: S-LP-OS-EF2/EF2F

	A3c: KS-LP-OS-EF1F						
Condition	S1	S2	S3	S4	S5	S6	S7
Collaboration (C)	ϴ*	ɵ*	ϴ*		ϴ*	ϴ*	
Systems (S)	ϴ	ϴ		ϴ			
Decision (D)		ϴ	ɵ	ϴ	ɵ	●	ϴ
Business processes (BP)	ϴ	•	●	•	ϴ	ɵ	●
Knowledge Asset (KA)		ɵ		•	ϴ		•
Leadership (LP)					●	•	•
Organisational Structure (OS)			●			●	●
Observed cases	20	4	30	9	5	6	28
Consistency	**0.735369**	**0.762059**	0.681173	**0.752217**	**0.738033**	**0.803126**	0.673230
Raw coverage	0.338897	0.165036	0.402357	0.220300	0.154973	0.083637	0.351230
Unique coverage	0.163257	0.009004	0.035479	0.028725	0.060011	0.007472	0.000000
Solution consistency	0.659029						
Solution coverage	0.799455						
T1: H•S⊂Y-Consistency	**0.881385**	**0.921763**	**0.701861**	**0.925860**	**0.787913**	**0.758613**	0.688025
T1: H•S⊂Y -Raw coverage	0.075240	0.056929	0.299697	0.095632	0.114804	0.059643	0.294399
T2: ~H•S⊂Y -Consistency	***0.735216***	***0.761716***	***0.800584***	***0.750830***	***0.746818***	***0.883570***	***0.828801***
T2: ~H•S⊂Y -Raw coverage	0.337426	0.164385	0.231027	0.218935	0.120745	0.076680	0.188423
T3: H•~S⊂~Y - Consistency	0.543262	0.543262	0.646449	0.543262	0.563360	0.541911	0.628340
T3: H•~S⊂~Y -Raw coverage	0.375054	0.375054	0.230356	0.375054	0.359345	0.363209	0.229361
T4: ~H•~S⊂Y -Consistency	0.588322	0.592421	0.559641	0.576523	0.573292	0.553283	0.559987
T4: ~H•~S⊂Y -Raw coverage	0.532292	0.666058	0.624833	0.628436	0.696644	0.692755	0.664377
Solution path association result	Support	Support	Ignore	Support	Support	Support	Ignore
Combined solution path unique coverage of same association result	0.268469						
Overall association result	**Support**						

Table 5.27b fsQCA findings for A3c: KS-LP-OS-EF2/EF2F

	A3c: KS-LP-OS-EF2		**A3c: KS-LP-OS-EF2F**					
Condition	S1	S2	S1	S2	S3	S4	S5	S6
Collaboration (C)	ɵ*	Ɵ*	Ɵ*	Ɵ*	Ɵ*	Ɵ*	Ɵ*	Ɵ*
Systems (S)	Ɵ						Ɵ	
Decision (D)	Ɵ	●	Ɵ				ɵ	ɵ
Business processes (BP)	•	ɵ	●	●	Ɵ	Ɵ	●	
Knowledge Asset (KA)	Ɵ	ɵ	Ɵ	Ɵ	●	●		•
Leadership (LP)		Ɵ			Ɵ			Ɵ
Organisational Structure (OS)						Ɵ	●	●
Observed cases	5	10	9	9	2	2	5	2
Consistency	**0.710821**	**0.707768**	**0.765686**	**0.765449**	**0.744607**	**0.721643**	**0.752359**	**0.724879**
Raw coverage	0.161335	0.141693	0.271478	0.276201	0.122971	0.135516	0.176421	0.122943
Unique coverage	0.133212	0.113569	0.005228	0.009829	0.000000	0.014413	0.059603	0.020313
Solution consistency	0.698729		**0.737556**					
Solution coverage	0.274904		0.433273					
T1: H•S⊂Y-Consistency	0.577474	**0.885895**	**0.741731**	**0.742281**	**0.738684**	**0.741347**	0.661336	0.632467
T1: H•S⊂Y -Raw coverage	0.037379	0.019773	0.067693	0.067888	0.036445	0.060719	0.076477	0.052048
T2: ~H•S⊂Y -Consistency	***0.707803***	***0.707659***	***0.758817***	***0.758912***	***0.741195***	***0.720002***	***0.751887***	***0.721963***
T2: ~H•S⊂Y -Raw coverage	0.160089	0.142945	0.261769	0.266685	0.121413	0.135352	0.174923	0.121360
T3: H•~S⊂~Y - Consistency	0.592729	0.592729	0.646881	0.646881	0.638187	0.638187	0.638187	0.638187
T3: H•~S⊂~Y -Raw coverage	0.389349	0.389349	0.400526	0.400526	0.400526	0.400526	0.400526	0.400526
T4: ~H•~S⊂Y -Consistency	0.555285	0.560079	0.532188	0.529617	0.539168	0.545114	0.523206	0.528620
T4: ~H•~S⊂Y -Raw coverage	0.654301	0.649741	0.607637	0.601397	0.695621	0.707863	0.673700	0.697165
Solution path association result	Reject	Support	Support	Support	Support	Support	Reject	Reject
Combined solution path unique coverage of same association result	0.133212	0.113569	0.02947				0.079916	
Overall association result	**Reject**		**Reject**					

5.8.14 Analysis of A3d: C-CT-AD

Five out of six paths pass the consistency threshold (Table 5.28), all of which have the same pattern in that they display either a "don't care" condition or the absence of OF attributes with one or two KS attributes present. S2 (~ks*bp*~d*~s), S4 (~ka*bp*~s*~c) and S5 (~ka*bp*~d*~c), which is a dominant combination, are very similar in that they display the presence of business processes and absence of the other conditions. They provide good support

for A3d. On the other hand, S3 (ka*~bp*~s*~c), displaying the presence of knowledge asset, and S6 (~ct*~bp*d*s*~c), exhibiting the absence of culture and the presence of two KS attributes, provide less support for A3d. However, S3 and S6 have low unique coverage; therefore, their effect is low. The association testing section also suggests a support result.

Analysis of ad2 provides three paths, all of which display the presence of business processes, suggesting the importance of this attribute in generating ad2. S2 (ct*ka*bp*~d*~c), which is a dominant combination with a sizable unique coverage of 0.44, is a good match with A3d. Moreover, since S2 and S3 (~ct*ka*bp*~d*~s*c) are different only between collaboration and culture (two conditions proposed in A3d), the two conditions can be treated as substitutes. S1 (~ka*bp*~d*~s) is also consistent with A3d owing to its "don't care" condition for both conditions proposed in A3d. Therefore, the overall association is supported, as also suggested by the association testing section.

Table 5.28 fsQCA findings for A3d: C-CT-AD1/AD2

	A3d: KS-CT-AD1						**A3d: KS-CT-AD2**		
Condition	S1	S2	S3	S4	S5	S6	S1	S2	S3
Collaboration (C)			⊖*	⊖*	⊖*	⊖*		⊖*	●
Systems (S)	⊖	⊖	⊖	⊖		●	⊖		⊖
Decision (D)	⊖	⊖			⊖	●	⊖*	⊖*	⊖*
Business Processes (BP)	●	●	⊖	●	●	⊖	•	●	•
Knowledge Asset (KA)		⊖	●	⊖	⊖		⊖	•	•
Culture (CT)						⊖		●	⊖
Observed cases	10	3	3	3	3	4	1	29	1
Consistency	0.686327	**0.734068**	**0.762409**	**0.733449**	**0.769484**	**0.851297**	**0.970090**	**0.720484**	**0.821792**
Raw coverage	0.280026	0.167176	0.122587	0.167030	0.250633	0.088057	0.027005	0.476571	0.046173
Unique coverage	0.105196	0.002648	0.020246	0.005280	0.089036	0.035288	0.015458	0.443178	0.018686
Solution consistency	0.693129						**0.728978**		
Solution coverage	0.443688						0.511286		
T1: H•S⊂Y-Consistency	**0.729945**	**0.740807**	**0.861210**	**0.801838**	**0.801838**	**0.985291**	**0.990466**	**0.834103**	**0.822977**
T1: H•S⊂Y -Raw coverage	0.071538	0.022629	0.017538	0.020266	0.020266	0.006270	0.005593	0.062100	0.029947

T2: ~H•S⊂Y -Consistency	0.691858	***0.740586***	***0.760692***	***0.731484***	***0.768836***	***0.851061***	***0.959823***	***0.720516***	***0.819252***
T2: ~H•S⊂Y -Raw coverage	0.244050	0.166304	0.121164	0.166122	0.250094	0.090217	0.027701	0.476310	0.046260
T3: H•~S⊂~Y - Consistency	***0.774825***	0.560471	0.569823	0.569823	0.569823	0.569823	0.643419	0.643419	0.643419
T3: H•~S⊂~Y -Raw coverage	0.047083	0.064451	0.066951	0.066951	0.066951	0.066951	0.066426	0.066426	0.066426
T4: ~H•~S⊂Y -Consistency	0.530683	0.537898	0.534615	0.539583	0.531241	0.524059	0.452218	0.394305	0.449468
T4: ~H•~S⊂Y -Raw coverage	0.809864	0.881122	0.906462	0.880940	0.815159	0.909147	0.943653	0.600654	0.939324
Solution path association result	Ignore	Support	Support	Support	Support	Support	Support	Support	Support
Combined solution path unique coverage of same association result		0.152498					0.477322		
Overall association result	**Support**						**Support**		

Table 5.29 Comparison of solution coverage for all sub-associations of A1, A2 and A3

Association testing		Solution consistency	Solution coverage	Association testing		Solution consistency	Solution coverage	Association testing		Solution consistency	Solution coverage	Max coverage (of H: that has above consistency threshold)	Perf	Agree result?
A1	**A1a**	**0.71802**	0.437901	A2	**A2a**	**0.73687**	0.149705	A3	**A3a**	**0.72058**	0.535373	A3	IE	N
	A1af	**0.90041**	0.022014		**A2af**	**0.82108**	0.191247		**A3af**	**0.75912**	0.314333	A3	IEF	Y
	A1b1	0.602613	0.554164		**A2b1**	**0.76007**	0.430462		A3b1	0.635798	0.538797	A2	OE1	N
	A1b1f	0.6882	0.242285		A2b1f	0.669155	0.377785		**A3b1f**	**0.71463**	0.454133	A3	OE1F	Y
	A1b2	0.660851	0.47716		A2b2	0.688993	0.410388		A3b2	0.68478	0.483686	n/a	OE2	n/a
	A1b2f	**0.80211**	0.395919		A2b2f	0.699581	0.322408		**A3b2f**	**0.75582**	0.483687	A3	OE2F	Y
	A1c1	**0.71815**	0.326723		A2c1	0.682169	0.393117		A3c1	0.673365	0.692684	A1	EF1	N
	A1c1f	0.668564	0.525807		**A2c1f**	**0.75579**	0.385337		A3c1f	0.659029	0.799455	A2	EF1F	N
	A1c2	**0.71082**	0.161335		**A2c2**	**0.73274**	0.142092		A3c2	0.698729	0.274904	A1	EF2	N
	A1c2f	**0.7688**	0.281429		**A2c2f**	**0.76485**	0.247886		**A3c2f**	**0.73756**	0.433273	A3	EF2F	N
	A1d1	0.686555	0.665239		**A2d1**	**0.72652**	0.243319		A3d1	0.693129	0.443688	A2	AD1	N
	A1d2	**0.71655**	0.455806		**A2d2**	**0.73745**	0.266934		**A3d2**	**0.72898**	0.511286	A3	AD2	Y

- The colour of the association heading is the result of previous (standalone) analysis (red = reject, yellow = weak support, blue = support, green = strong support)
- Bold indicates those that have a solution consistency above the 0.7 consistency threshold.
- The colour in the third from last column indicates which sub-association with the same outcome has the maximum solution coverage. (orange = A1, supporting KS; light purple = A2, supporting OF; light green = A3, supporting combination)
- The colour in the last column indicates whether standalone analysis (A3) and comparative analysis (Max (A1, A2, A3)) are consistent with each other in supporting combination. (green = consistent, red = inconsistent)

5.8.15 Post- data analysis 2

The results of the solution coverage comparison are mixed but still exhibit a dominant theme (Table 5.29). The empirical evidence shows that six out of twelve performance dimensions are better explained by A3 (by combination), shown in light green, while the rest are split almost equally in that three are better explained by H2 (OF), shown in light purple, while two are better explained by A1 (KS), shown in orange, and one (oe2) is not applicable because all related sub-associations (A1b, A2b and A3b) have a solution consistency lower than the 0.7 consistency threshold. Obviously, performance is better explained by considering combination, rather than one research construct at a time.

It can be inferred that, usually if not always, the proposed combination of KS and OF is a better performance predictor. Interestingly, the financial data lend greater support to the combination argument (four out of five cases) than the survey data. The latter provide mixed results in that KS, OF and combination are equally supported by only two out of seven cases (as shown in orange, light purple and light green, respectively) and one not applicable case (white) is found. This is probably due to external validity issues, especially measurement difficulty, as previously discussed.

Note that testing whether combination is a better performance predictor by identifying the maximum solution coverage of the sub-associations of A1, A2 and A3 is independent of the results for the validity of the a3 sub-association that examines whether a proposed combination leads to a high corresponding performance. For example, a weakly supported A3a, as a standalone analysis, means that the proposed combination (KA, D, OP) is insufficient to generate ie (yellow). However, when comparing the A3a solution coverage with that of A1a and A2a, the argument that combination better predicts performance than either KS or OF alone still holds (lime green). Paradoxically, the two analysis dimensions seem to go against

each other (shown in red, otherwise green). The former supports substitution between the proposed KS and OF while the latter supports combination between them.

Nevertheless, the validity of a particular A3 sub-association depends only on a proposed combination between KS and OF, but does not cover combination between all integrations of KS and all types of OF in general. In fact, other KS integrations tested at the same time (those not proposed in each of the A3 sub-associations), together with a proposed FC, still provide better explanatory power (as shown in higher coverage) for a particular performance dimension than considering all integrations of KS without any OF, as in A1a, or all types of OF without any KS, as in A2a. According to fsQCA practice (Schneider and Wagemann, 2012), the deviant findings of the A3 sub-associations suggest that the researcher should take other OFs into consideration to refine and improve the explanatory power of the sub-association for performance.

Considering all performance dimensions, this study finds that cases supporting the argument that combination is a better performance predictor are in the majority, regardless of the level of support for the A3 sub-associations.

Table 5.30 Summary test findings for A1, A2 and A3

Association	Sub-association	Sub-association result	Sum of unique coverage for paths supporting classification	Dominant result for each association
A1	A1a: KAD-IE	Reject	0.314327	Rejected
	A1a: KAD-IEF	Support	0.022014	
	A1b: BPD-OE1	Support	0.005109	Supported
	A1b: BPD-OE1F	Support	0.096447	
	A1b: BPD-OE2	Support	0.183199	
	A1b: BPD-OE2F	Support	0.187376	
	A1c: S-EF1	Support	0.103302	Supported
	A1c: S-EF1F	Support	0.116708	
	A1c: S-EF2	Reject	0.161335	
	A1c: S-EF2F	Support	0.015179	
	A1d: C-AD1	Support	0.039827	Supported
	A1d: C-AD2	Support	0.439398	
A2	A2a: OP-IE	Strong support	0.064702	Strong supported
	A2a: OP-IEF	Support	0.058673	
	A2b: OL-OE1	Support	0.267766	Supported
	A2b: OL-OE1F	Support	0.176479	
	A2b: OL-OE2	Support	0.244818	
	A2b: OL-OE2F	Support	0.16741	
	A2c: LP-OS-EF1	Support	0.14319	Supported
	A2c: LP-OS-EF1F	Support	0.194755	
	A2c: LP-OS-EF2	Support	0.142092	
	A2c: LP-OS-EF2F	Support	0.098325	
	A2d: CT-AD1	Support	0.119581	Supported
	A2d: CT-AD2	Support	0.174371	

Association	Sub-association	Sub-association result	Sum of unique coverage for paths supporting classification	Dominant result for each association
A3	A3a: KAD-OP-IE	Weak support	0.1439	Weak supported
	A3a: KAD-OP-IEF	Support	0.124083	
	A3b: BPD-OL-OE1	Support	0.069828	Supported
	A3b: BPD-OL-OE1F	Support	0.117618	
	A3b: BPD-OL-OE2	Support	0.23901	
	A3b: BPD-OL-OE2F	Support	0.162795	
	A3c: S-LP-OS-EF1	Support	0.095741	Supported
	A3c: S-LP-OS-EF1F	Support	0.268469	
	A3c: S-LP-OS-EF2	Reject	0.133212	
	A3c: S-LP-OS-EF2F	Reject	0.079916	
	A3d: C-CT-AD1	Support	0.152498	Supported
	A3d: C-CT-AD2	Support	0.477322	

Out of nine cases that support the proposed combination between KS and OF (blue), four display A3 as a maximum solution coverage (light green) while three display A2 (light purple) and one displays either A1 (orange) or not applicable (white). Likewise, out of three cases that do not support the proposed combination between KS and OF (either yellow or red), A3 still has a maximum solution coverage (light green) for two cases, with only one case for A1 (orange). Thus, it can be inferred that no matter how strong the support for a proposed combination of KS and OF, combination tends to provide a better explanation of performance than considering only one research construct.

5.9 Analysis of necessary conditions

Following QCA good practice suggested by Schneider and Wagemann (2012), this study separately conducts necessary condition analysis before conducting sufficiency condition analysis to ensure that a statement of necessity is not automatically inferred from the results of the sufficiency analysis. Schneider and Wagemann's (2012: 278) recommended threshold consistency value of 0.9 for a necessary condition is adopted. This research also tests for a trivial necessary condition by calculating the relevance of necessity ratio (Schneider and Wagemann, 2012: 236) ranging between 0 (meaning x is a constant) and 1, for which a low value indicates low relevance (trivialness) while a high value indicates high relevance (non-trivialness). Essentially, this test checks whether:

[1] the causal condition is much larger than the outcome (relation between size of x and y), making it irrelevant as a good predictor of the outcome;

[2] and the causal condition is close to the constant (relation between size of x and ~x), resulting in it being a superset of any outcome (either y or ~y), also known as a simultaneous subset relation. I will declare a particular condition as a necessity only if it passes both the 0.9 consistency threshold and the trivialness test.

The necessity test results for the occurrence of ie are as follows:

Table 5.31 The necessity test

	c	~c	s	~s	D	~d	bp		ka	~ka
Consistency	0.11	**0.9**	0.65	0.48	0.21	0.86	0.47		0.47	0.64
Coverage	0.65	0.46	0.50	0.53	0.51	0.47	0.42		0.44	0.57

Both ~c has high consistency (> 0.9), supporting that they are necessary to (or a superset of) the occurrence of ie (which is also shown in the plot under the diagonal in the xy plot of Figure 5.3. However, to be certain of their relevance, this research calculates the relevance of necessity ratio (Schneider and Wagemann, 2012: 236), and finds that both have very low scores of 0.133353 for ~c. Thus, the trivial necessary conditions for outcome ie (which is also shown in the low coverage value and the concentrated plot at the far right under the diagonal in the xy plot of Figure 5.3). Since the same distribution characteristics, which present only that for ~c.

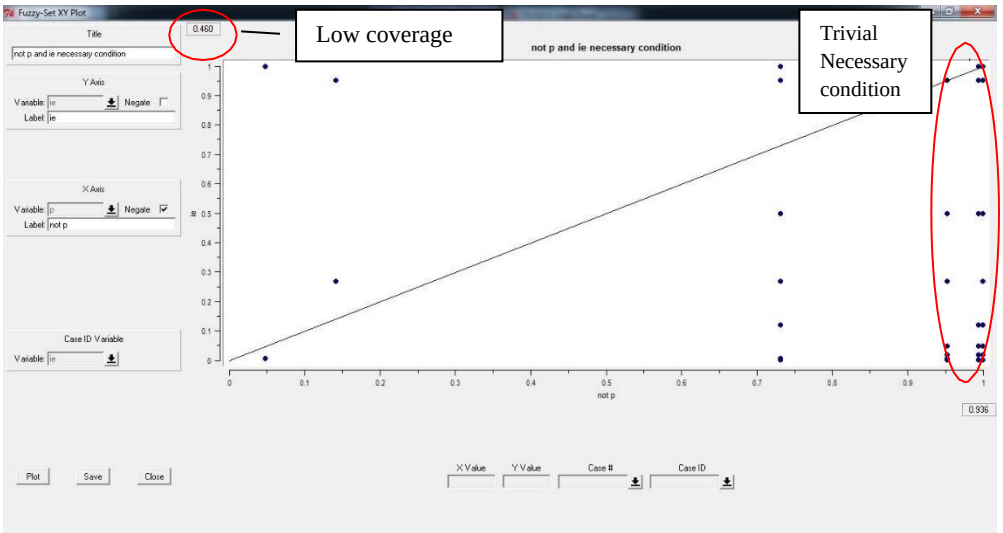


Figure 5.3 xy plot for ~c with ie as part of the necessary condition analysis

Moreover, in addition to testing for the occurrence of the outcome, this study also tests for the non-occurrence of the outcome to be even more certain of the trivialness. If a particular condition is shown as necessary in both tests, it is more likely that it is a trivial necessary condition because it is close to constant.

The necessary test for the non-occurrence of ie (~ie) is as follows:

Table 5.32 The necessity test

	c	~c	a	~a	d	~d	bp		ka	~ka
Consistency	0.09	**0.95**	0.65	0.46	0.21	0.84	0.60		0.59	0.50
Coverage	0.62	0.56	0.60	0.61	0.64	0.56	0.66		0.67	0.53

~c has a high consistency (> 0.9), supporting that they are necessary to (or a superset of) the non-occurrence of ie (which is also shown in the plot under the diagonal in the xy plot of Figure 5.3). However, since ~c has a very low relevance of necessity ratio (Schneider and Wagemann, 2012: 236), of 0.159904 for ~c, it is a trivial necessary condition for outcome ~ie (which is also shown in the low coverage value and the concentrated plot in the far right under the diagonal in the xy plot of Figure 5.3). This situation helps reconfirm that ~c is a trivial necessary condition because it is close to constant, resulting in ~c being a superset of both ie and ~ie. This is due to the high skew toward non-membership of c.

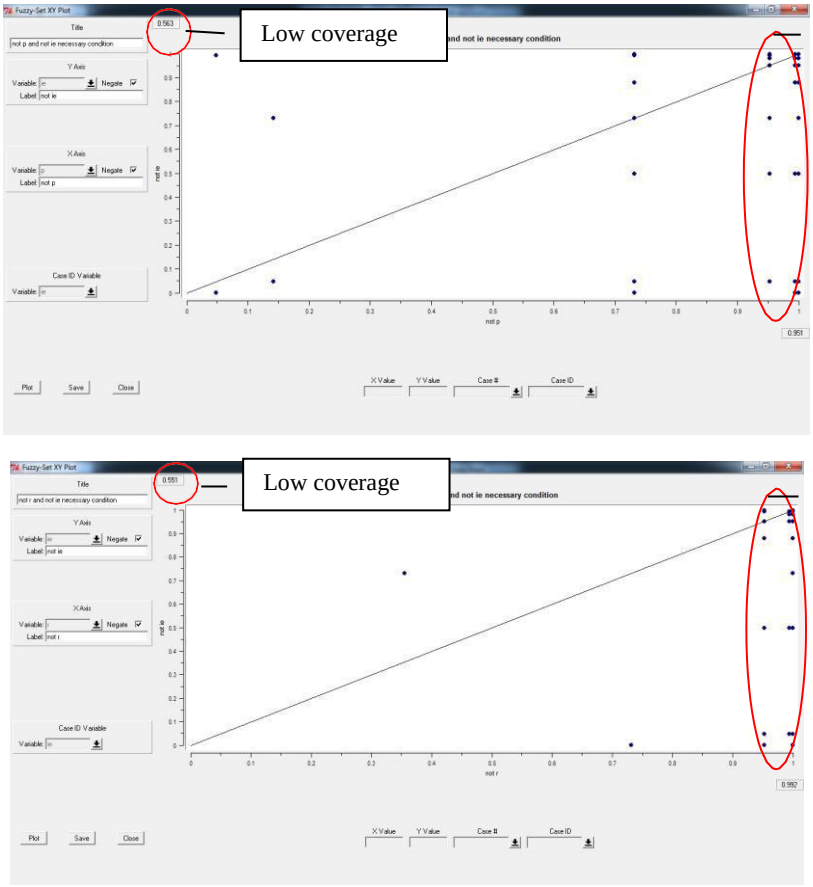


Figure 5.4 xy plots for ~c with ~ie as part of the necessary condition analysis

In summary, no necessary condition is exhibited in the test for A1a: KS-IE. This study finds only one trivial necessary conditions, ~c, which should not be mistakenly inferred to be necessary conditions from the results of a sufficiency analysis.

5.10 Truth table analysis for sufficiency condition

To create a truth table, this study sets ie as an outcome with the remaining factors (c, s, d, bp, l) present (not absent according to previous theoretically-grounded assumptions) as causal conditions. Then, adopting Schneider and Wagemann's (2012: 200) recommendation of conducting enhanced standard analysis (ESA) rather than standard analysis (SA) in order to avoid the risk of producing results (both most parsimonious and intermediate solutions) based on untenable assumptions (implausible or contradictory assumptions), this study codes "0" in the ie column for 24 rows containing impossible logical remainders. These comprise 20 rows that have "1" in three or four of any of c, s, or d, because these combinations cannot exist

according to the utilised operationalisation of Miles and Snow's (1978) typologies, in which only two characters may be simultaneously shown as dominant characters; and 4 rows that have "1" in both p and d, because these combinations contradict the definition by having strong characters of both collaboration and decision simultaneously but not exhibiting a strong character of systems. This ensures that these combinations of causal conditions will not be used in the Boolean minimisation (simplification) process for both the most parsimonious and the intermediate solutions. (For A3 tests which have either one or two OFs as part of causal conditions, the total numbers of impossible logical remainders are covered by 48 and 96 rows respectively.)

As suggested by Ragin (2000), this study sets the minimum acceptable solution frequency at 1 by deleting all other logical remainders (any row for which the number of observed data is less than 1, except the impossible logical remainders in the previous step) and set the lowest acceptable consistency for solutions at > 0.7 by sorting the raw consistencies into descending order and coding "1" for any row that has a raw consistency greater than 0.7. These two criteria are applied to all tests in this research for purposes of comparability.

There is a supporting reason for using 0.7 as the consistency threshold for this research. Ragin (2000: 109) originally asserts that "it is possible to assess the quasi-sufficiency of causal combinations using linguistic qualifiers such as 'more often than not' (0.5), 'usually' (0.65), and 'almost always' (0.8)". Later, he starts to recommend a minimum threshold of 0.75 (Ragin, 2006, 2008). However, the threshold frequently employed in Boolean comparative analysis studies is only 0.65 (Grandori and Furnari, 2008). This is probably because social science data are far from perfectly consistent and, most importantly, if the consistency threshold is set too high (above the raw consistency level displayed in all observed data), the truth table analysis cannot be conducted further as all observed data will be considered to be inconsistent according to this conservative threshold. This is also the case for the current study. The highest

raw consistency levels of the observed data of most of the 56 tests are lower than 0.75. Therefore, to make all tests computable and also comparable, this study lowers the threshold to 0.7, which is the highest level possible that is achieved by all tests.

To run a standard analysis, this study selects ~c*s*bp*~ka and ~c*s*~d*~bp*ka as prime implicants that are consistent with the proposed association. Prime implicants are product terms that cover many primitive Boolean expressions using minimisation rules to reduce the truth table until no further simplification is possible. Prime implicants must be included in the solution. However, there are often more reduced prime implicants than are needed to cover all of the original primitive expression; therefore, the user has the option to choose from those that are "logically tied" based on theoretical and substantive knowledge (Ragin, 2006: 64). Again, further truth table analysis cannot be conducted without the selection of sufficient prime implicants. Currently, there is no agreed rule for selecting prime implicants other than basing the choice on relevant theoretical and substantive knowledge. Therefore, for consistency within this research, my rules for selecting prime implicants for subsequent tests are as follows:

[1] The selected terms must be as consistent as possible with the proposed association in terms of the presence and absence of the proposed causal condition (select prime implicants with a proposed condition being present, or without a proposed condition being absent, or with more proposed conditions present than absent).

[2] If there are no terms having a proposed condition both present and absent:

a. the selected terms must have other conditions that can be theoretically inferred to support the occurrence of the outcome (second-best explanation). For example, apart from organisational learning, culture may theoretically be inferred to support the occurrence of output efficiency (profit margin) because

business processes may also come from perception, not just from process innovation.

b. selected terms that contain trivial necessary conditions are preferred because, although less relevant, they are still necessary conditions that lead to the outcome.

c. For testing of associations that have more than one proposed condition and for which the prime implicants display many alternatives with different proposed conditions, all will be selected to give the same weight to each proposed condition, supporting that one of any proposed condition is equally sufficient to lead to the outcome.

Once prime implicants have been selected, then select "ka" to be present, which should contribute to ie (as in the proposed association), for the intermediate solution.

The resulting truth table as computed by the software is provided below.

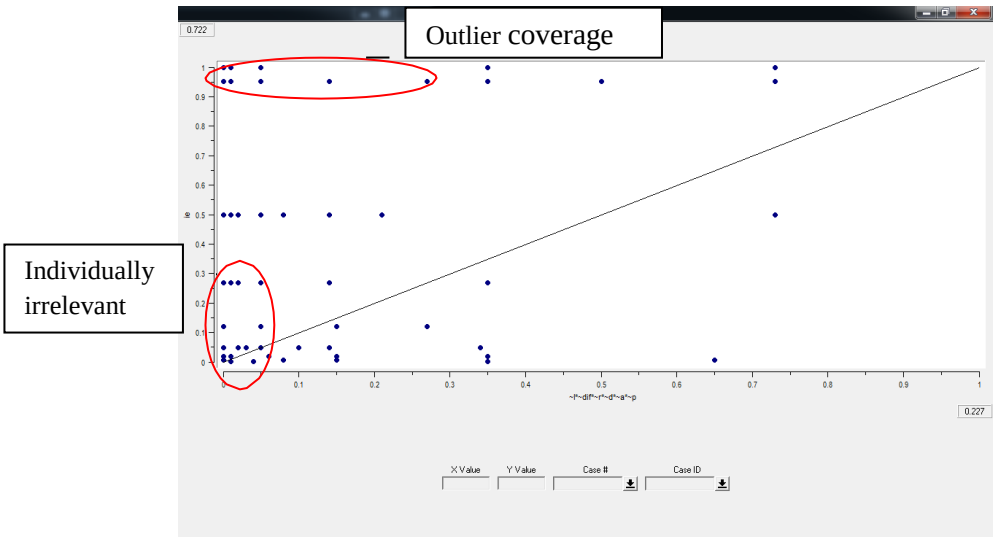
Table 5.33 The truth table

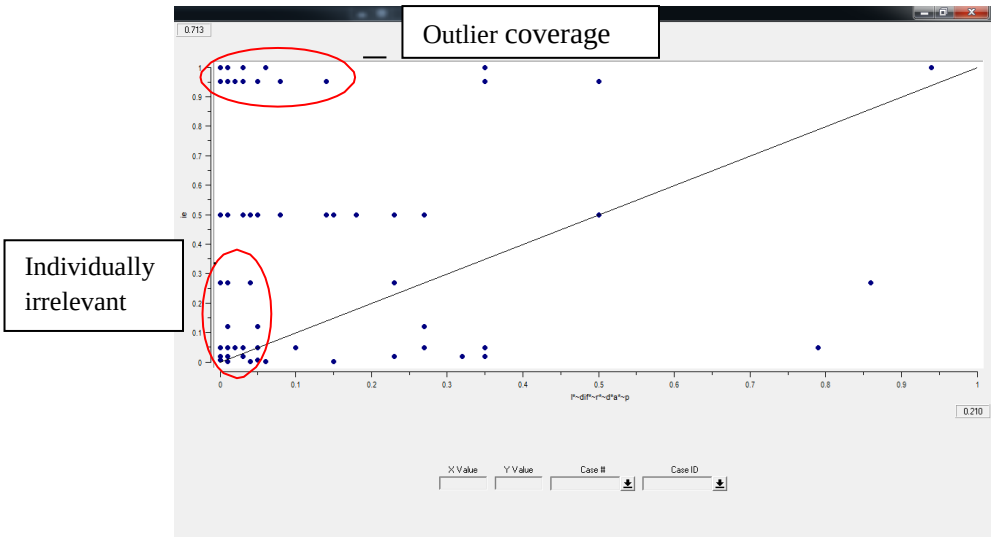
c	s	d	bp	ka	Number of cases	ie	raw consist.
1	1	1	1	1	0	0	1
1	1	1	1	0	0	0	1
1	1	1	0	1	0	0	1
1	1	1	0	0	0	0	1
1	0	1	1	1	0	0	1
1	0	1	1	0	0	0	1
1	0	1	0	1	0	0	1
1	0	1	0	0	0	0	1
0	1	1	1	0	0	0	1
0	1	1	1	1	0	0	1

0	1	1	0	0	0	0	1
0	1	1	0	1	0	0	1
1	0	1	0	0	0	0	0.884519
1	0	1	1	0	0	0	0.841738
1	1	0	1	0	0	0	0.837137
1	1	0	1	1	0	0	0.835604
1	1	0	0	0	0	0	0.816455
1	1	1	0	0	0	0	0.815924
1	1	0	0	1	0	0	0.814506
1	0	1	1	1	0	0	0.809141
1	0	1	0	1	0	0	0.793854
1	1	1	0	1	0	0	0.782308
1	1	1	1	0	0	0	0.775011
1	1	1	1	1	0	0	0.763873
0	**0**	**0**	**0**	**0**	**7**	**1**	**0.724529**
0	**1**	**0**	**0**	**1**	**5**	**1**	**0.713514**
0	**1**	**0**	**1**	**0**	**4**	**1**	**0.704821**
0	**0**	**0**	**1**	**0**	**1**	**0**	**0.698678**
0	**1**	**1**	**0**	**0**	**2**	**0**	**0.675603**
0	**1**	**0**	**0**	**0**	**18**	**0**	**0.616515**
1	**0**	**0**	**1**	**1**	**4**	**0**	**0.601415**
0	**0**	**0**	**0**	**1**	**1**	**0**	**0.590736**
0	**0**	**1**	**0**	**0**	**10**	**0**	**0.573731**
0	**0**	**1**	**1**	**0**	**1**	**0**	**0.571207**
0	**0**	**0**	**1**	**0**	**4**	**0**	**0.548607**
0	**0**	**1**	**0**	**1**	**2**	**0**	**0.530728**
0	**1**	**1**	**0**	**1**	**3**	**0**	**0.475697**
0	**1**	**0**	**1**	**1**	**26**	**0**	**0.45831**
0	**0**	**0**	**1**	**1**	**6**	**0**	**0.440544**

This study then plots the cases' membership scores for each intermediate solution path and their ie in an xy plot to discern the distribution of the covered cases (shown in the area above

the diagonal line) in Figure 5.5. However, apart from highly consistent cases (shown in the upper right corner), this research also observes a similar pattern of some outlier coverage cases (which have a low membership score for a solution path but a high membership score for an outcome, meaning they are outliers that still cover the outcome) and some individually irrelevant cases (which have a low membership score for both a solution path and an outcome, and are irrelevant to, albeit not against, the sufficiency analysis).





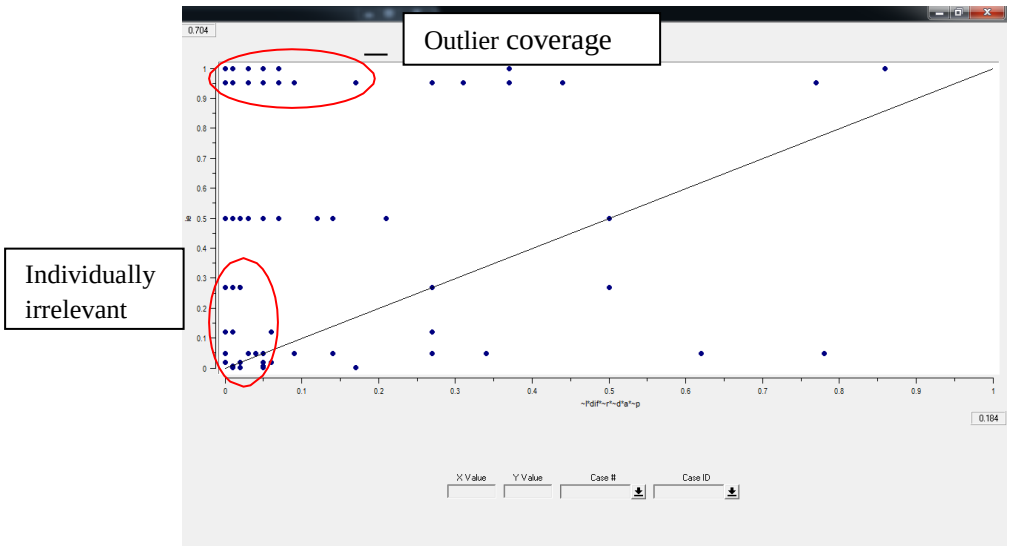


Figure 5.5 xy plots for each intermediate solution and ie

5.11 Subset/superset analysis of association testing

Although Ragin (1987: 118-121) and Schneider and Wagemann (2012: 297) suggest an approach to evaluating theory using a set-theoretic method (association testing, which is a deductive approach in a positivist paradigm), it has not been frequently used in the literature so far. This is probably because fsQCA was originally designed as an inductive reasoning tool, aimed at inferring general principles or rules from specific facts. Hence, like those of other qualitative research tools, fsQCA's analyses are grounded in the data once the data have been collected and analysed. Therefore, previous fsQCA researchers have tended not to adopt a deductive approach, though the number doing so is growing (Grandori and Furnari, 2008; Fiss, 2011).

This study proposes a series of eight tests (Figure 5.6 shows this process in a flowchart.), comprising one Straw-in-the-Wind test (shown in single thin line diamond), four Hoop tests (shown in double line diamond), and three Smoking-Gun tests (shown in single bold line diamond), in which subsequent tests are built on the results of the preceding ones. The details are as follows.

[1] A Hoop test for a statement that a "solution path is not unreliable" is whether the consistency of the solution path from the sufficiency analysis is greater than 0.7 (the consistency threshold of this research). Those that fail this test will not be considered for further association testing because they do not have an acceptable reliability to generate a meaningful association test result.

[2] A Hoop test for a statement that a "association is not rejected" is whether the consistency of T1 is greater than 0.7. It is suggested that those that fail this test have a below acceptable proportion of observed cases supporting that the association matches the solution path in terms of outcome generation. Thus, such an association must be rejected (red).

[3] A Smoking-Gun test for a statement that a "association is strongly supported" is whether the consistency of all of T2, T3 and T4 is less than or equal to 0.7. It is suggested that those that pass this test have no significant contradictory evidence, suggesting a strong support classification (green).

[4] A Straw-in-the-Wind test, which cannot prove anything by itself but is beneficial for subsequent tests, is whether the consistency of T3 is less than or equal to 0.7. Since T3 represents a type I error, the lower the consistency, the higher the level of support for the association.

[5] A Hoop test for a statement that a "association is not weakly supported" is whether the absolute value of coverage (actual number of cases) of T1 is greater than that of T3. It is suggested that for those that fail this test their type I errors are relatively larger than their supporting cases; hence, this is significant and suggests a weak support classification (yellow). T1's and T3's coverage cannot be compared directly because the former is calculated against Y, whereas the latter is calculated against ~Y. The

adjustment for comparison is based on the calibration criteria of all performance measurements. In this regard, this study uses quartile 1 of the dataset as the anchor point for fully out of the group of high performance (Y, membership score = 0) to prevent all performance data from skewing toward high membership; thus, the range for ~Y is smaller, from percentile 0 to percentile 25, while the range for Y is larger, from percentile 25 to percentile 100. Consequently, the proportion of the number of observations of ~Y to Y for this research is 1 to 3 (which adds up to four portions). Hence, T3 coverage, which is based on ~Y, must be divided by three to be comparable with T1 coverage, which is based on Y.

[6] A Smoking-Gun test for a statement that an "association is supported" is whether the consistency of T4 is less than or equal to 0.7. It is suggested that those that pass this test have no significant error term that cannot be captured by the current analysis, suggesting a support classification (blue).

[7] A Hoop test for a statement that an "association is not weakly supported" is whether the consistency of T2 is greater than 0.7. It is suggested that those that fail this test have a significant area of improvement displayed in the solution path, suggesting a weak support classification (yellow).

[8] A Smoking-Gun test for a statement that an "association is supported" is whether the coverage of T2 is greater than that of T4. It is suggested that those that pass this test have type II errors larger than the error terms that cannot be captured by the current analysis, suggesting a support classification (blue). Conversely, for those that fail this test the error term is quite significant and significantly challenges the association, suggesting a weak support classification (yellow). Regarding comparison, since coverage of both T2 and T4 are calculated against Y, they can be compared directly.

Once association validity classification has been conducted for each significant solution path within an association test, the unique coverage of the solution paths (from sufficiency analysis) that share the same association validity classification will be added up to show the significant level of all paths within the same validity category. Using unique coverage is appropriate since it avoids the problem of overlapping paths and is also comparable. (However, this technique cannot capture the coverage of the overlap area; thus, only solution paths within the same sufficiency analysis can be compared.) Lastly, the group of the same association validity category that has the maximum sum of unique coverage will be represented as the overall validity result of the association.

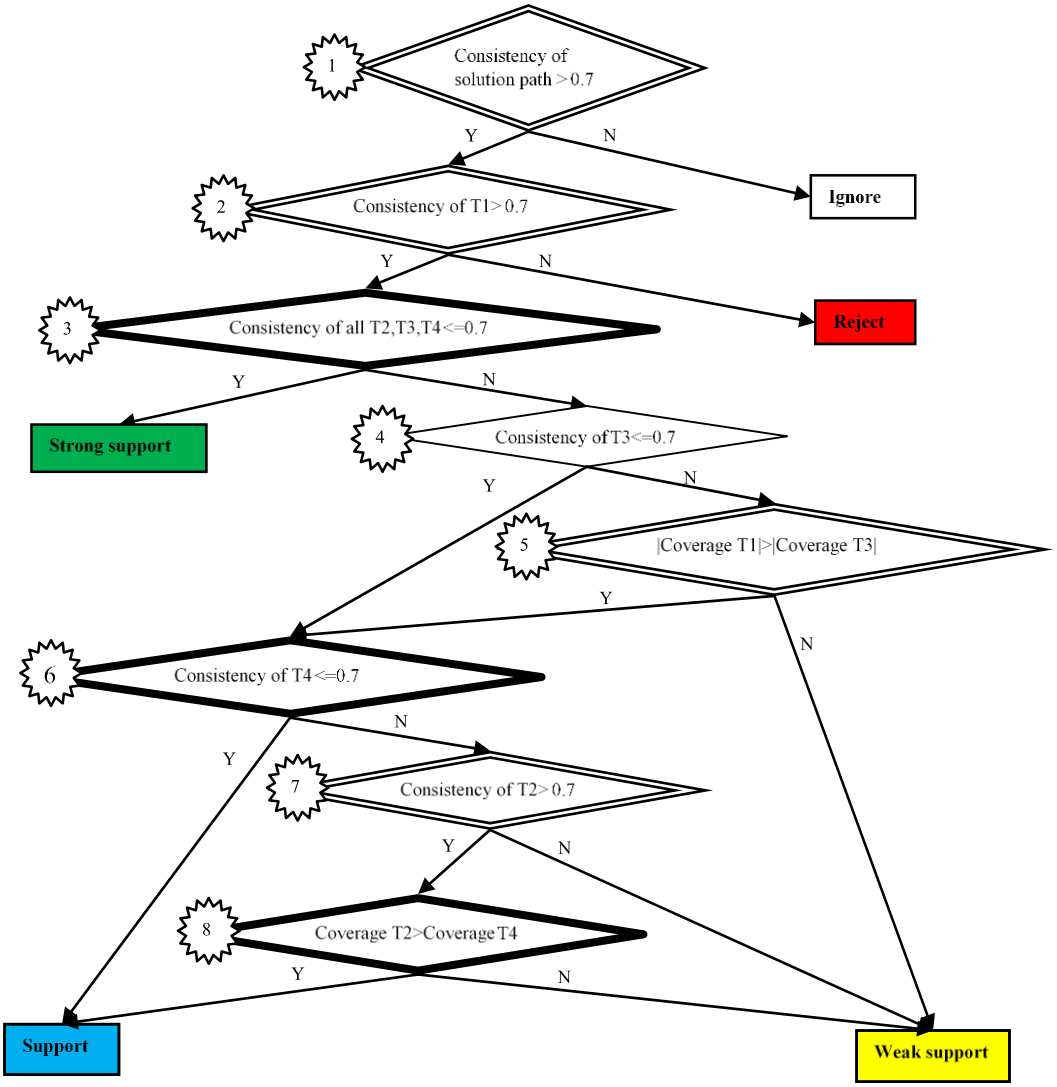


Figure 5.6 Flow chart of process tracing for association validity classification

5.12 Summary

This chapter has reported the findings from testing the three main associations regarding the relationship of each separate proposed research construct with different performance dimensions. In summary (Table 5.30), all sub-associations of A1 and A2, except A1a and A2a, are supported. Thus, it can be inferred that either KS or OF is a "usually" sufficient condition to generate high corresponding performance, except input efficiency. A rejected A1a and a strongly supported A2a suggest that KS (especially knowledge asset decision) is not a "usually" sufficient condition for input efficiency, but OF (especially operations) is a "usually" sufficient condition for input efficiency.

For the necessity test, collaboration, decision and systems are found to be trivial necessary conditions for some solutions. However, they are shown as necessary only because of the skewness of the data, as suggested by Schneider and Wagemann (2012), and can be disregarded for inference purposes.

However, since a sufficient condition can be expressed in terms of a necessary condition when applying De Morgan's laws, the previous summary can also be expressed as follows; The absence of a high intensity level of either KS or OF is a "usually" necessary condition for a business unit not to achieve the high performance that corresponds with that KS or OF, except input efficiency. A rejected A1a and a strongly supported A2a suggest that the absence of a high intensity level of KS (especially knowledge asset decision) is not a "usually" necessary condition for a business unit not to achieve high input efficiency, while the absence of a high intensity level of OF (especially operations) is a "usually" necessary condition for a business unit not to achieve high input efficiency.

Chapter six: Discussion

6.1 Introduction

This chapter will discuss important issues related to the whole PhD project including the KSP conceptual framework, KSP implementation model and the findings as well as the links to all parts of this study. As shown in Figure 6.1, the flow of information started with the construct and definitions of the three key areas and their components, which follows from the understanding of the literature on KS, OF and PERF. These contructs were futher developed into KSP conceptual framework as shown in Figure 2.9 by identifying research gaps. Hence, this study takes a step forward by developing KSP implementation model as illustrated in Figure 4.3, as the components of KS, OF and PERF were identified for testing. Associations of these components were designed to show in the findings report as shown in Table (5.11, 5.30) if these associations were supported or rejected.

It can be deduced from the previous chapter that most associations are supported, suggesting that the proposed KS integration, OFs and the combination of them are "usually" sufficient to generate corresponding performance dimensions. In other words, each type of KS, OF and their proposed combination is better able to explain a particular type of performance.

In addition, the analysis of survey data for performance measurement is generally consistent, which may arise from the issue of external validity (respondents' inability to answer those questions accurately). The fact that more than one solution path is shown for each analysis does not mean that the proposed model is rejected because the association is merely tested for sufficient conditions, not simultaneously tested for both sufficient and necessary conditions as in correlation-based research.

The causal asymmetry concept adopted in this research is useful in enhancing our understanding of the phenomenon in question, in that it may resolve previous inconsistent

findings. However, some deviations suggest areas for association improvement, either by adding more causal conditions or by completely dropping an association, depending on the results shown in the association testing section mentioned earlier. For the necessity test, collaboration, decision and systems are found to be trivial necessary conditions for almost all association testing. They are shown as necessary only because of the data skewness, as suggested by Schneider and Wagemann (2012) and are hence of little relevance for inference.

Construct	Definition	Calibration 3 anchor points		
		0	0.5	1
KS: **Knowledge Sharing** is the process of social exchange that occurs between individuals, from individuals to organisations, and from organisation to organisation.				
D: Decision	Regarded as the cognitive process resulting in the selection of a belief or a course of action among several alternative possibilities.	3	4.5	7
*In this dissertation, this study proposed that D could be mixed with KA or BP or both into **KAD**: Knowledge Asset Decision, **BPD**: Business Process Decision respectively.				
S: Systems	Business units set of interacting or interdependent component parts forming a complex/intricate whole.			
C: Collaboration	Business units' process of two or more people or organisations working together to realise mutual goals.			
KA: Knowledge Asset	Business units the intangible value of a business, covering its people (human capital).	Q1	Q2	Q3
BP: Business Process	Business units collection of related, structured activities or tasks that produce a specific service or product (serve a particular goal) for customers.			
OF: Organisational Factors Complex bundles of conditions related to a particular type of day-to-day operational activity, especially the principal functional area of an organisation within line and staff activities, that enables organisation to coordinate activities and make use of their assets (or resources) to create economic value and sustain competitive advantage.				
OP: Operations	Capability that integrates logistics systems, controls costs, manages financial and human resources, forecasts revenues, and manages planning.	Q1	Q2	Q3
OL: Organisational Learning	Capability that pertains to process of creating, retaining, and transferring knowledge within an organisation.			
LP: Leadership	Capability that provides both a research area and a practical skill encompassing the ability of an individual or organisation to "lead" individuals or an organisation.			
OS: Organisational Structure	Capability that relates to divisions of activities such as task allocation, coordination and supervision are directed toward the achievement of organisational aims.			
CT: Culture	Capability that encompasses values and behaviours that "contribute to the unique social and psychological environment of an organisation.			
Perf: Performance Dimension (Walker & Ruekert, 1987; Grant, 2010): "f" after the acronym for each performance measurement, surveyed data.				
IE: Input Efficiency	Cost reduction advantage: **IE**: Expense ratio (equivalent to overhead cost ratio)	Q1	Q2	Q3
OE: Output Efficiency	Revenue expansion advantage: **OE1**: Loss ratio (equivalent to gross profit margin), **OE2**: Investment Yield.	Q1	Q2	Q3
EF: Effectiveness	Success of a business' products and programmes in relation to those of its competitors in the market.	Q1	Q2	Q3
AD: Adaptability	Success in responding to changing conditions and opportunities in the environment: **AD1**: Number of new products offered to the market within the past year, **AD2**: Percentage of net written premiums (equivalent to sales) of new products offered to the market within the past year	Q1	Q2	Q3
OA: Overall Performance Proxy	Increase in long-run profits with a view to maximizing the value of the firm: **OA1**: Combined ratio (equivalent to ROS), **OA2**: ROE	Q1	Q2	Q3

Figure 2.9

KSP conceptual framework

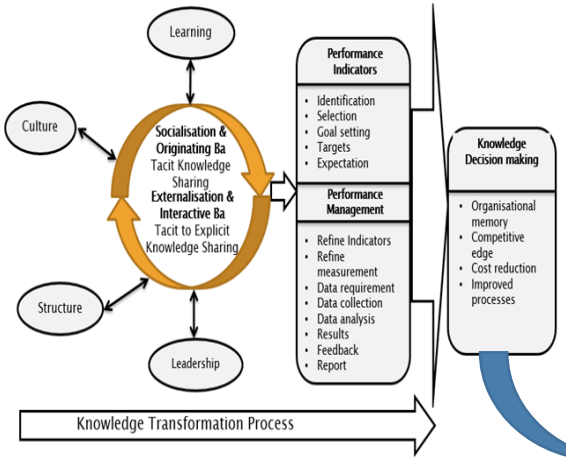


Figure 4.3

KSP implemantationmodel

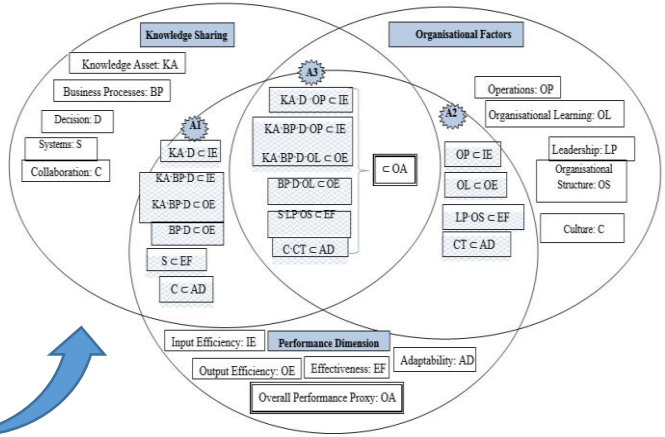


Figure (4.4, 5.6) and Table (5.11, 5.30)

Results

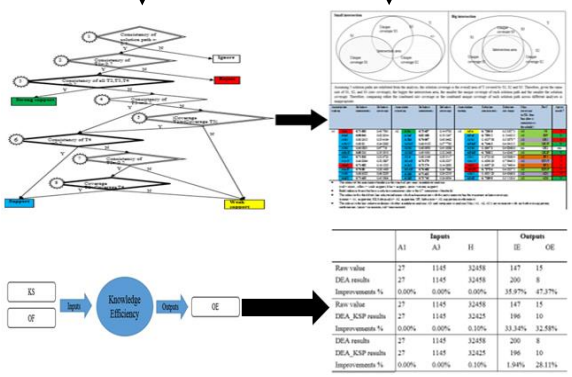


Figure 6.1 Holitic view of this study

6.2 KS for organisational performance

This thesis has two main implications for KS, one of which is a foundation for the other.

[1] This study explore a new dimension from existing research, confirming Ketchen et al.'s (1997) meta-analysis regarding the existence of a KS-performance relationship both by correcting the long-held but mistaken assumption that this relationship is symmetrical, whereas it is actually an asymmetrical causal relationship, by using the business unit rather than the firm as the unit of analysis, and also by testing different performance dimensions commensurate with each KS.

[2] Building on appropriate assumptions and research criteria, this study provides a more refined understanding of compatibility between KS and performance dimensions and the relationship between KS. Considering other conditions in the solution path (contexuality) also sheds light on hybrid types and has direct implications for the organisational competitiveness, especially with a hybrid type and a stuck in the middle strategy (Porter, 1980) because contextuality is a factor differentiating the two. These theoretical implications will be discussed in turn.

Unlike most previous KM and organisation research studies that have implied a linear (or curvilinear) relationship between their theoretical constructs, this study is among the first (Fiss, 2007, 2011; Grandori and Furnari, 2008) to investigate measurement by utilising DEA and fsQCA, which is based on asymmetrical causal relationships. DEA and fsQCA avoid the mismatch of previous research between assumed symmetrical theoretical relationships and actual underlying asymmetrical causal relationships (Ragin, 1987, 2000; Fiss, 2011), which in turn may be mistakenly critised for being inconsistent empirical findings (Rajagopalan and Spreitzer, 1997; Daily et al., 2003).

For instance, if high business processes (bp) is in fact a sufficient though not necessary condition for high output efficiency (oe), then high bp by itself will guarantee high oe. However, business units are not limited only to having high bp to achieve high oe. Rather, other strategies (knowledge asset, leadership or systems) may also lead to such an outcome, supporting the equifinality notion. Although perfectly consistent with the set-theoretic method, such a data pattern would result in weak or no correlation between bp and oe. In other words, apart from the KSs suggested in the associations, other KSs are also sufficient for the outcome concerned, depending on their contextual combination.

These findings do not go against the associations because, unlike correlation-based research that relies on causal symmetry (which argues for both sufficient and necessary conditions simultaneously), this research only claims a sufficient condition for the proposed KSP model owing to the concept of causal asymmetry. Therefore, methodology-wise, DEA and fsQCA holds considerable promise for resolving previous inconsistent findings.

It is also important to reiterate two other chosen research criteria (unit of analysis and performance dimension) before discussing the findings because different choices yield substantial differences in empirical results (Dess et al., 1993), which in turn may be further reasons for the inconsistency of previous research. In line with previous research (Gupta and Govindarajan, 1984; Govindarajan, 1986a; Miller, 1988; Govindarajan and Fisher, 1990), this study examines KS separately, rather than conducting corporate-level research, in order to reduce the potential off-setting effect between different organisations within business units which may pursue different strategies, which in turn may reveal a clearer relationship with a particular strategic orientation.

As raised by Hambrick (1983a) and Donaldson (1984) and highlighted by Walker and Ruekert (1987: 20), "different strategies are expected to perform well on different performance dimensions". Similarly, the present study has revealed that only a few of the proposed KS

integrations are shown to be sufficient to accomplish a particular performance dimension and, at the same time, only few of them are found to achieve more than one (but not all) performance dimension. Furthermore, even if few integrations are shown as solution paths, a single (rather than many) dominant combination usually prevails, i.e. a solution path with the highest unique coverage, representing the combination most empirically relevant to generating the outcome. Thus, consistent with Walker and Ruekert (1987), it can be inferred that a particular KS is best suited to explain a few but definitely not all performance dimensions.

Furthermore, since the solution paths from the analysis of the survey data are quite similar in many analyses. The choices of the current study mentioned above play a part in contributing to the existing theories of previous research, as can be seen from the findings for A1 (except A1a) which support the existence of a KS-performance relationship, reconfirming Ketchen et al. (1997), Nair and Kotha (2001), Leask and Parker (2007) and Short et al. (2007). The solution coverage of A4 for oa2f, representing KS's explanatory power, for which a possible explanation is provided, conveys the same message as the average effect size (0.276) of Ketchen et al.'s (1997) meta-analysis, in that organisational knowledge sharing capacities for approximately 20-30% of the utility available if one were able to perfectly predict differences in organisational performance. By the same token, this current finding argues against previous challenges to this research scheme regarding its lack of empirical rigour (McGee and Thomas, 1986; Thomas and Venkatraman, 1988: 548; Barney and Hoskisson, 1990), supporting the appropriateness of the chosen approach for future research in this field.

Regarding proposed KS integrations, by taking both Miles and Snow's (1978) and Porter's (1980) integrations as causal conditions in the analysis, the present finding is not only comparable with the results of previous research (Walker and Ruekert, 1987; Fiss, 2011) but also provides a more refined understanding of compatibility between KS and the performance dimension. Walker and Ruekert (1987) investigate neither systems nor decision, nor

effectiveness and different types of efficiency, while Fiss (2011) examines only Porter's (1980) integration.

As mentioned earlier, a supported association (A1) under a sufficient test does not mean that other integrations cannot exist as other sufficient solution paths (causal asymmetry). Thus, a closer look at solution paths offers an in-depth understanding of the relationship between the causal conditions examined because one condition may be required either to be present or absent in tandem with a particular condition (also with different levels of importance, core or peripheral), while still others may have no impact in any direction on such a condition ("don't care" condition). No solution path in this test has a single KS integration present and the rest as "don't care" conditions, meaning that no KS integration is a sufficient condition on its own; rather, all of them can only be an INUS condition. Likewise, the absence of a particular KS integration is also an INUS condition and is a requirement for a pure type of KS to be sufficient. Clearly, contextuality, which is how KS attributes are arranged within the solution path (as present, absent or "don't care" conditions) as well as their levels of importance (as core or peripheral condition), is essential to determine the sufficiency of the solution path to which those KS attributes belong.

When contextuality is taken into account, the current findings reconfirm Walker and Ruekert's (1987) argument that differentiated decisions and collaborations will outperform other integrations in efficiency and adaptability respectively (as shown in support for A1b and A1d) but refute their claim that knowledge asset decisions will outperform other integrations in (input) efficiency. It also provides an additional argument beyond their study that systems will not outperform other integrations in performance (as shown in the rejection of A1a and A1c for ef2, for which possible explanations are provided earlier). The rejection of these two sub-associations suggests the need for further within-case and comparative studies of cases

identified as typical and deviant by DEA and fsQCA (Schneider and Wagemann, 2012) to refine the proposed associations regarding ie and ef2.

With in-depth investigation of contextuality regarding Porter's (1980) integration, the findings of the present study shed light on a hybrid type (the presence of both knowledge asset and business processes, which is called best practice in research) which is evidenced in real life (Gilbert and Strebel, 1988; Miller, 1988; Baden-Fuller and Stopford, 1992; Cronshaw et al., 1994; Dess et al., 1997) yet under-researched. Apart from a pure type consistent with Walker and Ruekert's (1987) findings, the current study also reveals a hybrid, which is in line with Fiss' (2011) findings. For instance, while some solution paths generating ef1 (in A1c) are pure types, for example either ka (in S1 and S4) or bp (in S2 and S3), still others, although rarely, are hybrids (ka•bp in S5), suggesting that either pure or hybrid types may achieve high performance.

Like that of Fiss (2011), the present study provides further supporting evidence in addition to the relatively limited previous research which has established the efficiency viability of a combined cost leadership and business processes strategy (Hall, 1980; Dess and Davis, 1984; White, 1986; Kim and Lim, 1988; Miller and Dess, 1993) to challenge Porter's (1980) stuck in the middle claim, as well as other research supporting his argument (Hambrick, 1983b; Murray, 1988; Miller, 1989) that only ideal pure types of KS can achieve high performance and that deviation from pure types usually results in lower performance. To make sense of this example, it is possible that the presence of collaboration and the absence of other Miles and Snow (1978) integrations (except systems as a "don't care" condition) as parts of a combination in the solution path are essential to support the hybrid type in Porter's (1980) integration because, with the objective of continually searching for new knowledge opportunities, a collaboration must focus on innovation and product features, and these same features, as well as not yet having any direct competitor in the newly-created competitive

market, allow it to perform well with a leadership strategy (Miller, 1986; Segev, 1989; Parnell, 1997; Fiss, 2011).

Unlike previous studies that have used variable-based approaches (Doty et al., 1993; Ketchen et al., 1993), which disaggregate cases into independent, analytically separate aspects, the current study applies set-theoretic methods, which treat combinations of attributes (different KS integrations) as different types of cases. Thus, in this study, a variety of combinations give cases their uniqueness (Fiss, 2011). Consequently, considering other conditions in a solution path has direct implications for the organisational knowledge sharing (Tushman and O'Reilly, 1996), especially with a hybrid type and a stuck in the middle strategy (Porter, 1980), because solution tables only list KS that consistently lead to the outcome of interest, but do not include KS that do not lead to high performance (stuck in the middle), that do not pass the frequency threshold, or that show no consistent pattern and thus do not pass the consistency threshold (unreliable combination).

This research shows that contextuality is a factor differentiating the two and may improve understanding in this literature. However, discovering the holistic context would be an exercise in itself, and not one this study currently undertaking. A review of the findings of all A1 sub-associations suggests that best KS will generate high ef1 (A1c) and ad2 (A1d) only if the business unit pursues either a collaboration or systems but not a decision strategy. This is probably because, unlike the latter two, the former two either fully or partly aim to expand to new opportunities, which both supports business processes and allows for a cost leadership position, as mentioned earlier.

Interestingly, best KS is a dominant combination in both analyses, meaning that best KS is the most empirically relevant in generating ef1 and ad2. However, the result of repeating sufficiency analysis for higher levels of ef1 than the current test supports finding and argument that, it may be possible to achieve high performance using a hybrid type, but as one approaches

very high performance, trade-offs between business processes and leadership as well as their associated characteristics of organisational structure appear to make hybrid types such as the systems infeasible: the very high performers appear to rely on pure types.

To further test for causal asymmetry to establish whether or not the hybrid type of KS is still a sufficient condition and to reconfirm Fiss (2011), future research should repeat the current analytical framework with two more performance criteria (not high performance and low performance), rather than only the high performance and very high performance tested here. This additional test might resolve some of the mixed findings regarding the relationship between KS and OF (Oyemomi et al., 2016).

Unlike Porter's (1980) integration, the notion of hybrids is not new to Miles and Snow's (1978) integration because they perceive systems as a hybrid along a continuum between collaboration and decision. Therefore, the systems found in the study provides no new insight into this integration, but simply reconfirms it. The finding shows that pure types always prevail except in only one solution path that comprises both systems and decision, none of which are dominant combinations. This finding could be interpreted as the systems with a strategy more inclined toward decision than collaboration characteristics, and hence also does not contradict previous research. The new anchor points for fully in, most ambiguous point, and fully out of the set of very high ef1 (vef1) are the 87.5, 75 and 50 percentiles, respectively.

Comparing these two integrations, this study also finds that the presence of Porter's (1978) integration appears to dominate that of Miles and Snow (1980) in terms of sufficiency to generate high performance dimensions. Out of 33 solution paths for all A1 sub-associations, 26 have at least one of integrations present as an INUS condition to generate high performance dimensions, while only 13 require at least one of Miles and Snow's integrations to be present as an INUS condition to generate high performance dimensions. According to Miller (1989) and Kumar, Subramanian and Strandholm (2001), this may be because Porter's (1978)

integration appears to integrate the central concepts of the other integrations (Miles and Snow, 1980; Hambrick, 1983b; Miller and Friesen, 1986) and hence covers more aspects of causal factors. Consequently, Porter's (1980) integration appears to be the most popular paradigm in the literature (Dess et al., 1995; Hill, 1988; Lee and Miller, 1999; Miller, 1989; Miller and Dess, 1993).

6.3 Impact of OFs on knowledge processes

This thesis raises three main implications for OF. The first two is similar to the previously-mentioned implications for KS.

[1] By applying a set-theoretic approach in organisational theory and separately testing different performance dimensions commensurate with each FC, this study is likely to solve previous OF research inconsistencies, which in turn provides a solid foundation for subsequent implications.

[2] This study also provides a more refined understanding of the OF-performance relationship by suggesting a holistic combination of OF-performance dimension as well as careful consideration of the contexuality of solution paths, especially compatibility between OF types and the existence of core and peripheral conditions. This research finding suggests a shift in the understanding of the OF-performance relationship from the original association (A2) of one-to-one (one OF to one performance dimension) to many-to-one, although at different levels of importance (core and peripheral), and, in a rare case, to many-to-many. Moreover, consideration of core and peripheral conditions also raises another implication regarding a substitution relationship between peripheral conditions of different solution paths that share the same core condition,

and a "true" combination between core conditions that are displayed within the same solution path.

[3] By using the same research technique, which allows for a direct comparison of the explanatory power of two research constructs, the empirical findings challenge the argument of previous criticisms of the KS literature, that organisational factors characteristics (OF) are better performance predictors (Barney and Hoskisson, 1990), by arguing that neither KS nor OF provides a "universally better" explanation.

These theoretical implications will be discussed in turn.

The current study is, to the best of this study knowledge, the first to apply a set-theoretic approach to measure the impact of organisational factor OF on knowledge sharing performance in an organisation. As previously mentioned, DEA and fsQCA, based on asymmetrical causal relationships, is more appropriate to describe social science relationships than correlational tests that assume both sufficient and necessary conditions simultaneously (Ragin, 1987, 2000; Fiss, 2011). Moreover, the separate tests for different performance dimensions in this study are likely to resolve previous research inconsistencies because each performance dimension should be more commensurate with some (but not all) objectives of different OFs. Therefore, support for all proposed sub-associations in this study addresses Godfrey and Hill's (1995) challenge of OF regarding the accuracy of performance prediction and Newbert's (2007) claim that OF offers "only modest support overall" by providing even more reliable evidence supporting previous claims that OF leads to high performance (Barney and Arikan, 2001; Crook et al., 2008), especially with a more refined understanding of the relationship by suggesting a holistic combination of OF performance dimension in addition to previous research. Moreover, using the same technique allows for a direct comparison of the explanatory power of KS and OF, as in the meta-analyses of organisational KS and OF.

As in the previous section, the theoretical implication arises from considering the contexuality of solution paths. No solution path in this test has a single OF present and the rest as "don't care" conditions, meaning that no OF is a sufficient condition on its own; rather, each can only be an INUS condition. Similarly, the absence of a particular OF is also an INUS condition, which when required suggests that there are some OFs that work against each other. By the same token, the study also shows that each solution path of the A2 analysis usually displays the presence of more than one OF, apart from the suggested OF in the sub-associations (only 25% of all A2 solution paths display one OF attribute present and the rest absent or as a "don't care" condition), suggesting that OFs often work in combination, rather than alone.

Challenging Skinner (1969, 1974), who defends a trade-off between manufacturing capabilities and the need to focus on a single competitive priority, this finding is consistent with the more recent works of Ferdows and De Meyer (1990), Noble (1995) and González-Benito and Suárez-González (2010), which suggest compatibilities between different manufacturing capabilities, especially those with opposing competitive priorities such as flexibility and cost reduction (De Meyer et al., 1989; Rosenzweig and Roth, 2004). In other words, this study suggests combination between OF types, which raises the importance of contexuality in this analysis.

Consideration of core and peripheral conditions raises another implication for the literature. When considering solution paths that have more than one OF present, while most have only one OF present as a core condition, pointing to the potential substitutability of OFs present as peripheral conditions, still others, although quite rarely, have two OF attributes present as core conditions, suggesting a potential "true" combination between different types of OF because both are required with the same level of importance. Therefore, this study suggests a novel concept to refine the current association (A2), in that actually multiple OFs rather than a single

OF are sufficient for the outcome, although at different levels of importance (core and peripheral).

Moreover, a holistic view of the dominant (core) and subordinate (peripheral) OFs within a combination provides better insight into the relationship between OFs within a combination. Solution paths with different core conditions illustrate different unique types of business units that equally achieve a particular performance dimension (first-order/across-group equifinality); yet the proposed OF under each sub-association tends to be a core condition more often than others in most analyses, consistent with support for all A2 sub-associations. Different constellations of peripheral conditions surrounding core conditions in the same analysis provide a finer-grained understanding of which OFs are substitutes for each other (other peripheral OFs) under second-order (within-group) equifinality.

Paradoxically, the reverse of the notion that multiple OFs are a sufficient combination for a particular performance dimension is also true, though quite rare. This study occasionally observes that some OF combinations achieve more than one, though not all, performance dimension. This is possibly either because these OF combinations allow business units to perform particular activities that enhance many performance dimensions or because they fit well with many strategic choices, or both. This calls for future research to investigate this phenomenon.

This result is also in line with Noble's (1995) cumulative model and González-Benito and Suárez-González's (2010) finding that a combination of different manufacturing capabilities achieves both commercial and financial performance. Therefore, another theoretical implication of this study is a shift in our understanding of the OF-performance relationship from the original association of one-to-one (one OF to one performance dimension) to many-to-one and, for a rare case, to many-to-many.

Thus, although the emphasis on a single OF as proposed in my sub-associations cannot by itself explain business performance (since they are INUS conditions), it appears to facilitate a better alignment with other OFs and contribute to one or a few performance dimensions (but not all), in so far as combination between OFs is achieved (as displayed in this analysis). Although this argument requires additional empirical support for full validation, because this study sample is quite distinctive and the results leave several questions open to subjective interpretation, this research draws attention to combinations of OFs (contexuality) as a relevant element in explaining high performance.

Another main implication is that the empirical findings counter the arguments of previous challenges to the KS literature, especially those of McGee and Thomas (1986) and Thomas and Venkatraman (1988) regarding KS's weak explanatory power for performance and that of Barney and Hoskisson (1990) claiming that OF characteristics are better performance predictors.

When considering only solution paths that pass the 0.7 consistency threshold of this research, the solution coverage of A1 (explanatory power of KS) is higher than that of A2 (explanatory power of FC) for six performance dimensions tested (out of ten), while the findings for the remaining four performance dimensions support the opposite. In other words, the combination of KS and OF provides a "universally better" explanation. Which matters more may also be contextually dependent; discovering that context would be an exercise in itself, and not one this study currently undertaking as the aim to argue that considering both will provide a better explanation than selecting either one. This empirical result is consistent with the results of Ketchen et al.'s (1997) and Crook et al.'s (2008) meta-analyses, which show no significant differences between the explanatory power of KS and OF for performance, implying that both are of equal importance in explaining performance differences between firms.

6.4 KSP model for organisations

This thesis raises two main theoretical implications for the combination of notion, the latter of which offers a detailed understanding of the former.

[1] This study suggests combination of KS and OF as a proposed theory to improve explanatory power for performance by linking both current theories that have not previously been considered together. Careful consideration of complex causality in the empirical findings (an increasing number of solution paths in A3 sub-associations compared with those of A1 for the same performance dimension, the presence of both components of proposed combinations as core INUS conditions and a high consistency level of almost all solution paths with both components of proposed combinations) contributes further new evidence to endorse this argument.

[2] This study provides a finer-grained understanding of the aforementioned combination of KS and OF in explaining performance by offering a holistic examination of all possible combinations to test a proposed compatible combination, and by presenting evidence that raises concern about the importance of having KS combined with having OF.

These theoretical implications will be discussed in turn. Combination is built on the previous implication that KS and OF provides a "universally better" performance explanation, as well as on the deviations found in some of the A1 sub-associations that also support the addition of other potential factors, raising a theoretical implication for both current theories in that it suggests a potential additional factor to improve explanatory power for performance that has never been considered before. (Just as OF is introduced to KS, so too KS is recommended for OF). In addition to support from most A3 sub-associations (except A3c), the empirical results of the survey data also support the existence of combination by showing that the solution

coverage (explanatory power for performance) of the combination of KS and OF (A3) is often higher than that of either KS or OF alone (A1 and A2).

Although the survey data show mixed results, when comparing solution coverage across analyses with the same performance dimension, combination still displays an improvement over each research construct individually, in that six out of twelve performance dimensions are better explained by combination while others are split between KS and OF for two and three performance dimensions. (Another performance dimension (oe2) shows "not applicable" because all related solution consistencies are lower than the 0.7 threshold.) This research, therefore, addresses Priem and Butler's (2001) call for further development of organisational theory to investigate conditions under which different resources and capabilities are and are not valuable, and Crook et al.'s (2008) call for an inquiry that considers how strategic resources and organisational KS (two competing sources of competitive advantage) interact by providing a holistic view of combinations of KS and OF that generate high levels of different performance dimensions. Most importantly, because DEA and fsQCA highlights the complex causality notion in the empirical findings, this study provides a finer-grained understanding of the relationship between KS and OF in explaining performance.

In addition to receiving support from association testing (A3), the combination argument is also endorsed by inferences drawn from careful consideration and comparison of causal conditions within solution paths. It is noticeable that the number of solution paths in the sub-associations of A3 is greater than in those of A1 for the same performance dimension, suggesting that an additional OF for a sufficient analysis of all integrations of KS assists in identifying more successful cases for a particular performance dimension that have not previously been covered by KS. This is probably because OF provides an internal competitive advantage for a business unit in addition to an external one covered by KS, resulting in the character of the business unit being taken into consideration in finer detail. This is consistent

with Spanos and Lioukas' (2001) argument that KS and OF jointly supply full-dimension explanations for organisational performance (both internal and external domains) regarding sources of competitive advantage.

Moreover, the majority of solution paths (25 out of 62 solution paths for A3 sub-associations) that comprise the presence of either a proposed KS or a proposed OF (but not both) as a core INUS condition for the outcome under consideration, with the other as a "don't care" condition or absent, is consistent with the previous tests (A1, A2) which show that each (on its own) is a necessary part of a combination that is sufficient to generate high performance, which in turn seems to suggest a trade-off relationship between KS and OF.

However, the presence of both components of proposed combinations as core INUS conditions, even as a minority of solution paths (3 out of 62 solution paths for A3 sub-associations), implies that both are necessary parts of a conjunction that is sufficient, although rare, to produce the outcome, which in turn helps support the existence of combination between KS and OF.

Furthermore, when considering the tests for combination (A3), unlike other solution paths with only one research construct present that sometimes fail to meet the 0.7 consistency threshold, solution paths with both components of a proposed combination pass the 0.7 consistency threshold almost every time. Therefore, it can be inferred that the proposed combinations are more reliable predictors of high performance dimensions because the higher the consistency value, the more accurately such a condition predicts the outcome (higher predictive power). Since consistency and coverage are inversely related (when one is high, the other will be low.), it is unsurprising that the proposed combinations have lower coverage than their counterparts. This implies that, although combination provides a more accurate prediction, it covers fewer cases of high performance (lower explanatory power).

Furthermore, the proposed combinations are found more frequently in A3 (performance dimension).

This is probably because these combinations achieve more than one performance dimension, resulting in better overall performance proxies. Therefore, this research finding contributes new evidence to confirm the arguments of research that both KS and OF play essential roles in achieving business performance and that ignoring one may hinder or blur important implications (Wernerfelt, 1984; Cool and Schendel, 1988; Conner, 1991; Barney, 1992; Barney and Griffin, 1992, Mahoney and Pandian, 1992; Amit and Schoemaker, 1993; Peteraf, 1993; Barney and Zajac, 1994; Henderson and Cockburn, 1994; Spanos and Lioukas, 2001; Short et al., 2007; Sirmon, Hitt and Ireland, 2007; González-Benito and Suárez-González, 2010).

Apart from support for the existence of combination, another main theoretical implication of this study is compatibility between the research constructs tested. No empirical research has jointly considered KS and OF in all possible combinations. In fact, even a specific alignment between a particular pair such as Porter's (1980) integrations and manufacturing strategy (equivalent to the operations capacity of the current research) has received limited empirical attention (Ward and Duray, 2000). In this regard, González-Benito and Suárez-González's (2010) work seems to be a closely comparable study for KS and operations capability (A3a). The current finding is also consistent with their claim that "an appropriate alignment of the manufacturing function with a business strategy emerges as a crucial circumstance that explains a significant part of the success of that strategy" (González-Benito and Suárez-González, 2010: 1039).

Therefore, this thesis provides offers possibilities of testing the compatible combination by examining all integrations of KS (to allow testing for a hybrid type) and one or two types of OF at a time. Further research should complement this by including additional OFs that are

also hypothetically justified or retesting the current analysis with all types of OF and one or two integrations of KS at a time (up to the level that the total number of causal conditions still comply with the limiting ratio of explanatory cases to characteristics (Marx, 2010) in order to gain an understanding from a different perspective regarding which KS is compatible with a particular combination of OFs and whether one OF is compatible with more than one KS-OF integration.

Furthermore, some solution paths in the A3 sub-associations still have some KS integrations present and have OF as either absent or "don't care" conditions, and no solution path has OF present and has the remaining KS integrations as either absent or "don't care" conditions, suggesting that it may be possible for business units to achieve high performance by having only KS integrations but they are less likely to do so by having only one or two OF types without any clear direction of KS.

The contributions of this study, therefore, strengthen Hofer and Schendel's (1978) argument about the intervening role played by consistent functional strategies in a business strategy's positive impact on performance by confirming the evidence of previous research regarding the relevance of functional strategies for the efficacy of a business strategy (Miles and Snow, 1984; Lengnick-Hall and Lengnick-Hall, 1988; Slater and Olson, 2001). In addition, building on the previous analysis (A2) that OF often works in combination rather than alone, it raises concern over whether, to be successful, business units without any clear KS should have more than one or two OF types, as proposed in the sub-associations. Further research might address this by repeating the A3 sub-associations with the additional OFs found in the A2 sub-associations for the same performance dimension.

Although this combination argument requires additional empirical support for full validation (for example, because my sample has a specific characteristic) and the results leave several questions open to further analysis (whether combination always outperforms one causal factor

and, if not, what is the required condition), this research draws attention to compatibility between KS and OF as relevant in explaining high performance.

In this regard, this study would like to mention one possible future test as follows; Given that a calibration in fsQCA predetermines a certain level of performance as an anchor point for a high level of a particular performance dimension (any organisation that passes this anchor point will be considered as a high performer in that dimension, no matter how high its performance really is), it is impossible to compare the level of performance between solution paths by considering only the results of the current analysis. Therefore, it would be possible to establish indirectly whether complementary combinations outperform a single research construct by conducting a separate sufficiency analysis with an even higher level of anchor point for the performance dimension and then drawing inferences from a comparison of the observed results. This is similar to testing whether it is feasible for hybrid types to achieve very high performance, as suggested in the previous section.

6.5 Integrating DEA and fsQCA

This thesis raises two main theoretical implications for the notion of equifinality. Like that of combination, the latter offers a detailed understanding of the former.

[1] This study provides holistic evidence supporting the existence of equifinality, which in turn lends support to the validity of the KS-performance relationship because it offers an alternative explanation for challenges regarding the equivocality of KS by arguing that these are based on the notion of causal symmetry whereas the actual nature of this social science relationship is asymmetrical.

[2] This study explicitly displays the existence of equifinality at all levels of analysis, comprising equifinality within each research construct, between KS and OF, among proposed combinations of KS and OF, and among performance dimensions, each of

which provides a finer-grained understanding of the field, such as the first-order (across-group) and second-order (within-group) equifinality exhibited between different solution paths within a particular association test.

These theoretical implications will be discussed in turn.

Although equifinality is an implicit assumption of the performance concept, particularly in both Miles and Snow's (1978) and Porter's (1980) integrations (Marlin, Ketchen and Lamont, 2007), it has received less attention in the literature. Only a handful of previous research studies in the performance literature have explicitly tested the existence of equifinality (Doty, Glick and Huber, 1993; Gresov and Drazin, 1997; Fiss, 2011), though not exhaustively in terms of the variety of KS integrations, other potential causal factors (OFs) and different performance dimensions. Hence, equifinality has become a weak link in performance and has been subject to challenges by other research paradigms.

In response to this concern, the current study reconfirms the empirical studies of Doty, Glick and Huber, (1993), Gresov and Drazin (1997) and Fiss (2011) by providing holistic evidence supporting the existence of equifinality, which in turn lends further support to the validity of the KS-performance relationship because it provides an alternative explanation for the challenges regarding KS's "weak evidence of performance variations across groups" (McGee and Thomas, 1986; Thomas and Venkatraman, 1988: 548). To address the challenge that empirical evidence for the KS-performance relationship is equivocal, this study argue that the challenges are based on the notion of causal symmetry whereas the actual nature of this social science relationship is asymmetrical, providing holistic empirical evidence on many dimensions. Thus, the claim of equivocality is essentially a normal characteristic of equifinality and these assertions cannot falsify the KS-performance relationship.

This research finding is consistent with Fiss (2007, 2011) in that it also suggests a new perspective on the causal asymmetry relationship for the performance literature. In addition, because equifinality is a condition that supports the KSP concept, the attempt of this study to measure the existence of performance for different KS integrations fosters the validity not only of the equifinality notion (Tushman and Nadler, 1978; Scott, 1981; Van de Ven and Drazin, 1985; Hrebiniak and Joyce, 1985; Nadler and Tushman, 1988; Pennings, 1992; Galunic and Eisenhardt, 1994; Gresov and Drazin, 1997) but also of the KSP model (Miles and Snow 1978; Miller and Friesen, 1978; Snow and Hrebiniak, 1980; Segev et al., 1999). If equifinality exists, then one of the implicit assumptions of KS is empirically supported. Likewise, this theoretical implication also applies to OF and the combination literature.

Furthermore, the argument for the existence of equifinality is endorsed by inference from a careful consideration of the findings of this research in many dimensions, each of which has further theoretical implications as follows.

Equifinality within each research construct: The finding for A1 elaborates the concept of equifinality in KS, raised by Doty, Glick and Huber (1993) and tested empirically by Gresov and Drazin (1997) and Fiss (2011), by providing new empirical support in a holistic manner in terms of a variety of performance dimensions that seem to match better with different KSs. Unlike the KS literature, the OF literature has not previously raised the issue of equifinality. Therefore, the finding for A2 is among the first to raise this concern in the OF field in the same manner as that of KS.

As in Fiss' (2011) analysis, the use of DEA and fsQCA in this research allows us to infer the existence of efficiency in many ways. Unobserved necessary conditions suggest that there is no one best way to achieve any performance dimension, indirectly supporting the equifinality concept. Sufficiency analysis directly displays equifinality at two levels through several solution paths with different core and peripheral conditions for each analysis. In a broader

sense, the fact that there is no single solution path for each performance dimension in the analysis (i.e. no one best way) supports the existence of equifinality. In detail, when considering these solution paths, those that have different core characteristics exhibit first-order (across-group) equifinality while those that share the same core attributes but have different peripheral conditions reveal second-order (within-group) equifinality. The presence of first-order equifinality suggests a trade-off (substitution) in a broader sense, which is across different groups based on their unique combination of core conditions, to achieve a same level of desired outcome while the presence of second-order equifinality suggests a trade-off (substitution) in a narrow sense, which is between different combinations of peripheral conditions within a group that shares the same combination of core conditions, to also achieve a same level of desired outcome. Therefore, different constellations of peripheral conditions surrounding core conditions in the same analysis provide a finer-grained understanding of which conditions are substitutes for each other (other peripheral conditions) under second-order (within-group) equifinality.

Equifinality between KS and OF: Since this study test different research constructs with the same performance dimensions in A1 and A2, their different solution paths for a particular performance dimension also prove the existence of equifinality. Equifinality between proposed combinations of KS and OF: In considering overall performance proxies (A4), allowing comparability between different proposed combinations, this study finds that the presence of conditions under proposed combinations are often displayed as core conditions and that different proposed combinations, except that of collaboration and culture capability, are sufficient to generate high overall performance proxies. This supports the existence of equifinality between proposed complementary combinations. The deviation found not only suggests the addition of a causal condition to improve the current sub-association but also raises a concern to adopt long-term achievement as another performance measure in addition to the proposed overall performance proxies that provide only a snapshot assessment. Future

research might repeat this study over a period of time (longitudinal test) in order to perceive the dynamic of this relationship.

Equifinality between performance dimensions: Although A3 sub-associations exhibit proposed combinations, the number of solution paths for a particular proposed combination are different, suggesting that there are other possible solution paths, apart from those that achieve a particular performance dimension, that also achieve the overall performance proxy (this also means that some solution paths achieve more than one overall performance proxy); and that some solution paths that achieve a particular performance dimension may not be able to achieve the overall performance proxy. This is confirmed by the solution paths in the A3 sub-associations that require at least one performance dimensions to be present, suggesting that achieving one performance dimension is usually sufficient on its own to achieve the overall performance proxy. Therefore, each performance dimension is merely a component of the overall performance proxy. This conclusion supports the claim by Walker and Ruekert (1987), Dye (2004) and Van der Stede, Chow and Lin (2006).

6.6 Summary

This chapter discussed in-depth the efficiency measurement of the KSP model using two techniques (DEA and fsQCA) to show the alignment of this study literature with the empirical findings of the current study. In this thesis, this study has argued that the concept of KS may benefit both conceptually and empirically from reorientation toward joint consideration with OF through the concepts of causal asymmetry, neutral permutation, and causal core and periphery. Also, a case for implementation of this research to extend this approach and show its utility in developing the proposed KSP model of integrating and equifinality in KM research. This research can be developed further to studies regrouping the currently available causal conditions and/or add more causal conditions that are also hypothetically justified but have not yet been tested in this research or include attributes that include time patterns to this

model up to the level that the total number of causal conditions still comply with the limiting ratio of explanatory cases to characteristics or readjust the calibration criteria of the concerned outcome to develop a more holistic view.

Chapter seven: Conclusions

7.1 Introduction

This research has aimed at measuring the efficiency of the knowledge sharing performance by providing empirical evidence to how KS and OF, either alone or in combination, affect different performance dimensions' challenge regarding the lack of theoretical and empirical rigour of this relationship. In order to do so, this study has developed three main research questions, each of which is addressed by one association developed within the KSP model.

This chapter describes conclusions across all stages of this study, therefore shows how the research questions were answered through empirical findings of deductive analysis, and how the knowledge sharing relationship with organisational factors was filled through key contributions of this study by adopting an integration of two deductive measuring techniques DEA and fsQCA. Moreover, it discusses recap of the study and makes suggestions for further research.

7.2 How the research questions were answered?

This research has been undertaken using a structured approach to measure knowledge sharing efficiency, which has led to the development of an empirically evaluated KSP model from the original conceptual framework derived from literature. Also, this research addresses the limitations of traditional performance analysis techniques. The work undertaken stems out from the association introduced in Figure 4.3. Figure 7.1 diagramatically illustrates the main research activities and the links across different stages of the research process which have provided answers to the research questions.

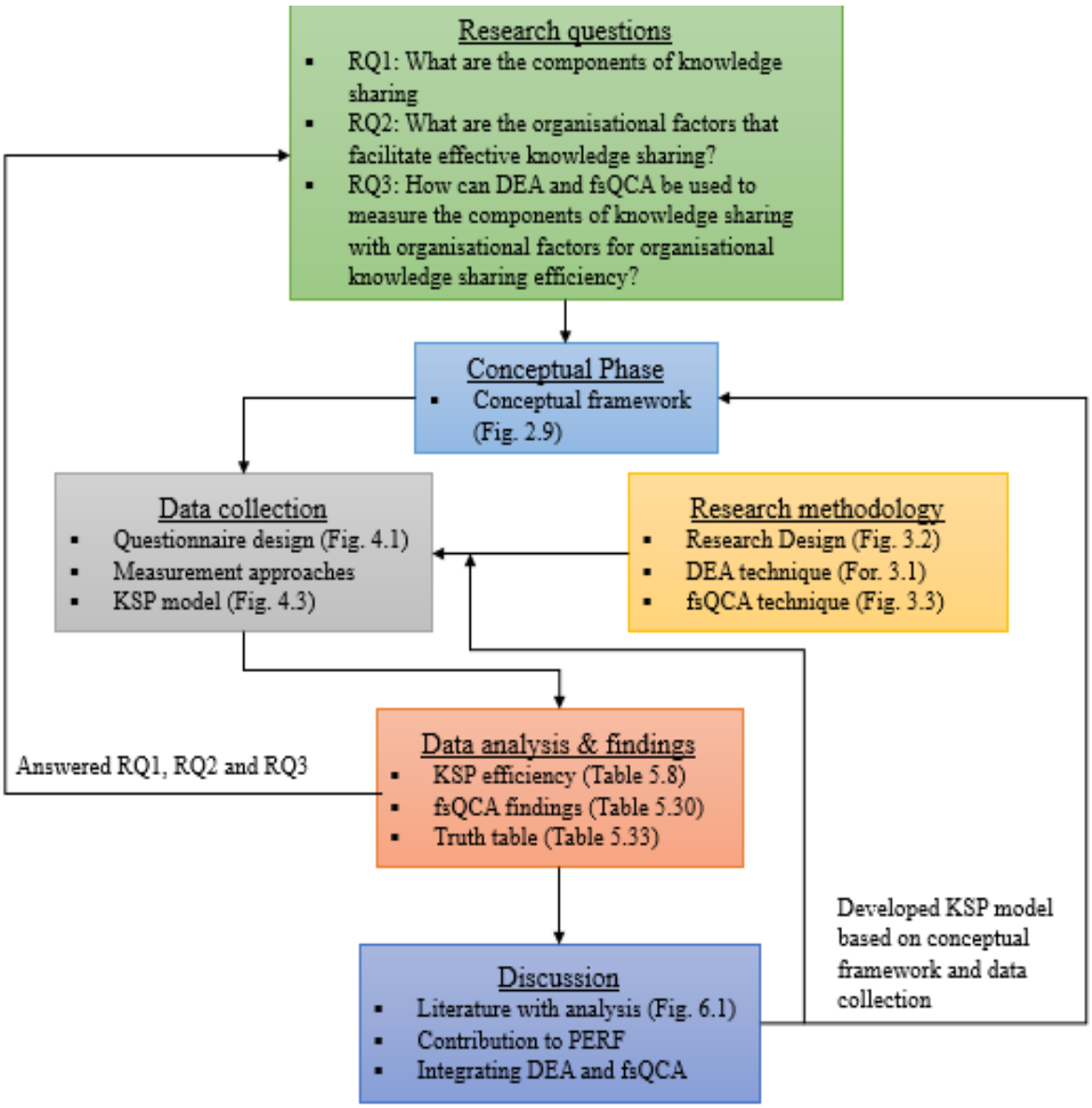


Figure 7.1 An overview and links across different stages of the research project

To address the first research question, "**What are the key components of knowledge sharing in an organisation?**", this study has developed the first association (i.e.A1): "having a high intensity level of at least one particular components of proposed KS is a sufficient condition for an organisation to achieve a high level of performance dimension corresponding with that component". This research has then tested this association, using DEA and fsQCA to contribute a new approach to the KM research that has assumed the causal relationship to be symmetrical rather than asymmetrical (Ragin, 1987, 2000; Fiss, 2011), and has found that ten

out of twelve A1 sub-association tests are supported. This has answered the first research question that the equivocal empirical evidence of previous research can be improved, if not resolved, by selecting an appropriate performance dimension to measure a business unit with different KSs. To highlight, the five key components are:

- Knowledge asset
- Business processes
- Decision
- Systems
- Collaboration.

In addition, as a by-product of the findings from DEA and fsQCA, considering other conditions in the solution path carries direct implications for the organisational KS literature (Tushman and O'Reilly, 1996). Apart from a pure type, which is consistent with Walker and Ruekert's (1987) finding, the current study also reveals the rare occurrence of a hybrid type (the presence of both knowledge asset and business processes), which is in line with Fiss' (2011) finding, suggesting that either pure or hybrid types can achieve high performance dimension. This challenges Porter's (1980) claim and those of other supporting research (Hambrick, 1983b; Miller, 1989) regarding the stuck in the middle components.

In order to address the second research question, "**What are the organisational factors that facilitate effective knowledge sharing in an organisation**?", this study has developed the second association (i.e. A2): "being part of an organisation that has a high intensity level of at least one particular type of proposed OF is a sufficient condition for a business unit to achieve a high level of performance dimension corresponding with that type of OF". This research has found that all sub-association tests are supported, and that one even gained strong support,

thereby addressing a previous challenge of resource-based theory, a root of OF, regarding the accuracy of performance prediction (Cullinane et al., 2006).

Again, DEA and fsQCA allows for an even more refined understanding of compatibility between OFs through consideration of the contextuality of each solution path. This study has found that each solution path of the A2 analysis usually displays the presence of more than one OF apart from the proposed OF in the sub-associations, suggesting that OFs often work in combination, which is consistent with De Meyer et al. (1989), rather than alone as suggested by Skinner (1969, 1974). Therefore, this thesis suggests a novel model to refine the current association (A2) in that multiple OFs, rather than a single OF, may in fact be sufficient for the outcome, although at different levels of importance (core and peripheral). Paradoxically, the reverse of this notion is also true, although quite rarely. Therefore, another theoretical implication of this study is a shift in our understanding of the OF performance relationship from the original association of one-to-one (one OF to one performance dimension) to many-to-one and then, for a rare case, to many-to-many.

However, considering A2 alone only answers the first part of the second research question. This study has compared solution coverages (which portray explanatory power) between all sub-associations of A1 and A2 tested against the same performance dimension and have found that the results of solution coverage comparison are mixed, from which it can be inferred that KS and FC provides a "universally better" explanation. This empirical result is consistent with a comparison of the results of Ketchen et al.'s (1997) and Crook et al.'s (2008) meta-analyses, which suggest that both are of equal importance in explaining performance differences between organisations. Hence, rather than trying to determine which one matters more, this raises a concern for potential improvement through the use of a combination of both to explain performance (A3).

In order to address the third research question, "**How can DEA and fsQCA be used to measure the impact of organisational factors on knowledge sharing efficiency?**", this research has developed the third association (i.e. A3): "being part of an organisation that has a high intensity level of at least one type of proposed OF and having a high intensity level of a particular components of proposed KS that is compatible with its organisations' OF is a sufficient combination of conditions for a business unit to achieve a high level of performance dimension corresponding with that combination". This study has found that nine out of twelve sub- association tests are supported, suggesting another potential improvement to previous research in explaining performance variance by:

1. combining a matching pair of KS and OF, as proposed in this research according to similarity (or practices "of the same kind") (only for those that are supported).

2. and selecting an appropriate performance dimension to measure a business unit with those different combinations.

To answer the third research question, this study has again compared the solution coverages of all sub-associations of A1, A2 and A3 tested against the same performance dimension. The results of solution coverage comparison are mixed but still exhibit the dominant theme. The empirical evidence shows that six out of twelve performance dimensions are better explained by A3 (proposed combination), while the rest are split almost equally between A1 (KS) and A2 (OF). It can be inferred that usually, though not always, the proposed combination between KS and OF is a better performance predictor, raising a theoretical implication for both current theories in that it suggests a potential additional factor to improve explanatory power for performance that has never been considered before. (Just as OF is introduced to KS, so too KS is recommended for OF.)

Once more, careful consideration of the findings from DEA and fsQCA strengthens this argument still further (for example, an increasing number of solution paths in the A3 sub-associations compared with those of A1 for the same performance dimension, the presence of both components of proposed combinations as core INUS conditions, and a high consistency level for almost all solution paths with both components of proposed combinations).

Furthermore, this study finds that nine out of sixteen sub-association tests are supported, and one even receives strong support, suggesting that the combination of the proposed combinations tested earlier (A3) and their corresponding performance dimensions support the existence of equifinality. With finer consideration of the DEA and fsQCA findings (e.g. similar solution coverage level of at least two sub-associations based on the same overall performance proxy), the equifinality argument is further reinforced. In fact, equifinality is explicitly displayed at all levels of analysis in this study, comprising equifinality within each research construct, between KS and OF, between proposed combinations of KS and OF, and between performance dimensions, each of which provides a finer-grained understanding of this field, such as a finer-grained understanding of which conditions are substitutes for each other under first-order and second-order equifinality exhibited in different solution paths within a particular association test.

This dissertation not only addresses Crook et al.'s (2008) call for an inquiry that considers how KS (knowledge power) and OF (impactful) interact, but also contributes new evidence to confirm the arguments of previous research that both play essential roles in achieving organisational performance, and that ignoring one may hinder or blur important implications (Spanos and Lioukas, 2001; Short et al., 2007; González-Benito and Suárez-González, 2010). Most importantly, it suggests that researchers should take into account compatibility between KS and OF. This shifts the focus from falsifying and replacing the former with the latter to searching for matching combinations of the two.

7.3 Key contributions

The key contributions of the findings of this study are described separately as theoretical and managerial contributions as follows:

7.3.1 Theoretical contributions

Although knowledge efficiency remains attractive to organisation and business research, as shown by a number of recent studies, its promise is still far from fulfilled (Short et al., 2008; Fiss, 2011). In fact, it is being challenged because of a lack of empirical support (McGee and Thomas, 1986; Thomas and Venkatraman, 1988) and theoretical rigour (Bacharach, 1989), especially by its counterpart theory, the KM view (Barney and Hoskisson, 1990). This study argued that our understanding of the cause-effect relationship between KS and performance will become less equivocal if:

[1] Different performance dimensions are used;

[2] The analysis is based on causal asymmetry and the notion of complex causality;

[3] KS and OF are considered simultaneously (the concept of combination);

[4] The contextualisation of other causal conditions is taken into consideration (the notion of equifinality).

This research has important theoretical contributions:

[1] This study developed a new conceptual framework KSP which integrated theories from knowledge management, organisation and performance. The knowledge sharing theoretical components are SECI model and Japanese Ba theory, these theories formulate the knowledge entity in the framework. The critical organisational factors

that can impact on the effectiveness of knowledge activities within an organisation for this study in the KSP framework are culture, learning, leadership and structure. The relationship of the KS and OF was measured with key performance indictors.

[2] The evolution of KSP model as a result of successful data collection on KSP conceptual framework through pilot study initiated the implementation of the associations of KS, OF and PERF. The KSP model testing verifies the theoretical contribution of this study and the emerging of new innovation to the knowledge management field.

[3] The comprehensive view of the complex causality between KS and OF in the research findings contributes to the theory that when organisation consider OF, they can select either a compatible business unit KS, as proposed in the association, or one that creates a combination similar to the solution path displayed in the findings. In doing so, they should prioritise their resources toward core conditions, high unique coverage and the knowledge assets related to acquiring or building such an option. Moreover, this knowledge also allows decision makers to review the potential impact of their policies.

[4] This study use DEA and fsQCA rather than a correlation-based technique as a suitable method to allow this research to test the proposed associations. In proposing an alternative theory and utilising novel methodology, the current study takes a step toward building a better understanding of the explanation of performance, a theme central to the literature of both KM and organisation, using both KS and OF rather than a single factor as antecedents. In this section, this study synthesises the findings and discuss the implications of this study, first for each current literature (KS and OF) individually, and then for both considered in combination according to this research proposed model to shed light on the complexity of the phenomena under study.

7.3.2 Managerial implications

The overall concepts of combination and equifinality may be applied to other studies, managers of these industries should bear in mind that this study is knowledge based-specific and is suitable for knowledge orientated organisations and industries motivated to improve their low innovation and performance across specific sections of operations. Therefore, they should not over-generalise, especially if their industries do not generate enough knowledge or are developing with a high potential for innovation.

This study gives managers a comprehensive view of the complex causality (contextuality, core and peripheral conditions) between KS and OF in generating a high level of a particular type of performance dimension. Therefore, it suggests that, although either KS or OF is likely to be related to a particular performance in general, when considered together they may not be of similar critical levels, depending on the context within the solution path. For instance, although D, BP and OL are sufficient to generate high oe2, as shown in A1b and A2b, they are displayed at different levels of importance as core, peripheral or even "don't care" conditions in A3b for oe2, depending on the context of the solution paths to which they belong. For example, in A3b for oe2 there is a trade-off relationship between OL in S2 and BP in S5 (both of which are peripheral conditions in a solution path that has KA as a core condition) as well as a substitute relationship between D in S3 and a combination of OL and BP in S7 (all of which are core conditions in a solution path that has S present). Hence, to be more certain about the expected result, all causal conditions must be taken into consideration.

In order to gain competitive advantage (high performance), managers should consider their organisations' strengths and weaknesses reflected in OF as a starting point (since OF is difficult to create or amend in the short term owing to path dependence), and then select a compatible KS (which is a positioning of their business units to take advantage of market opportunities and neutralise threats) that fosters the same objective as their OF, or select a KS

to create a combination that is similar to the solution path displayed in the findings. For example, to increase the likelihood of achieving a high oe2, if a firm has strong OL, its business unit should pursue either KA, as in S2, or both BP and S, as in S7. Moreover, managers should set incentives to motivate workers toward an appropriate performance target.

In addition, since a single causal factor, especially OF, is unlikely to be a sufficient condition on its own to generate high performance, managers should promote only compatible ones (as shown from my analyses). In doing so, managers should prioritise their resources toward a core condition exhibited in this study rather than a peripheral one, and toward those that have high unique coverage as they are more likely than others lead to the desired outcome. By understanding possible substitution relationships between these research constructs, they will be able to decide which choice is most economical for them.

Likewise, this study raises some concerns for implementation regarding the impact of OFs in that, although a particular policy may serve one objective well, it may have different effects on different business units. However, these very policies tend to jeopardise fair competition because they allow less efficient business units still to be viable in the industry while discouraging highly efficient business units from maximising their full potential. Thus, the managers must weigh the costs and benefits of each objective before making a decision. Nevertheless, the managers may do better to subsidise shared fundamental KM (back office services) that will enhance industry-wide OF, which in turn may increase a particular performance dimension for all business units, no matter what KS they pursue.

This study is very confident of the managerial implications within the sample because the dataset used (organisations from the top 25 companies in 2015 according to the knowledge asset capacities of each of their departmental resources) is a representative of the whole population owing to very high capacity concentration.

None of the research constructs used here are culturally-related; thus, these findings are not limited by socio-cultural issues and, ceteris paribus, should be applicable elsewhere. However, the main concern in applying the findings of this study to industry is whether that industry offers a knowledge driven or innovative product or services, whether it is developed or still in a growth period, and whether economies of scale are not only sufficient but also necessary conditions for the viability of the industry, because this will determine the feasibility of a differentiated strategy, which in turn will affect the solution paths for achieving input efficiency.

7.4 Limitations of the study

Naturally, this current study also has limitations, while using only survey questionnaire data collected from various organisations across seven countries in three continents, this thesis achieves the aim of enriching the study of the KS performance relationship by addressing an untapped dataset in manufacturing and service industries, and avoids the problem of market and environmental differences between datasets characteristic of single-industry research (Conant et al., 1990), in doing so it also has the drawback of having multi-industry characteristics, losing the advantage of specific-industry studies. As financial products, the costs and revenues of various organisations are two sides of the same coin, meaning that pursuing KS will simultaneously achieve both ie and oe. The multi-characteristics of numerous organisations may also spoil the results, as mentioned earlier in the discussion of a possible explanation for the deviation found in the current findings.

Although the findings of the current study are quite limited in the specific-organisational data, the logic of its conclusions is context-specific and offers ample opportunity for further research. Thus, in order to test the individuality of the associations of this research, especially

concern about the deviations found in the current findings, future research should repeat the analytical framework of this research with a different dataset, for example a dataset from a specific industry that is either a service or manufacturing organisation with KS and OF characteristics, a dataset from a specific industry in a specific country of operation.

The multi-organisational data were selected because of its relatively large number of players compared with specific-industry in one country, and because it is large data, with available, reliable and comparable data.

7.5 Future research

A number of recommendations for further research have been emerged from the findings of this study. The KSP model could be compared in two or more specific industries. This could contribute to the knowledge and provide new insights into the impact of OFs on PERF through the mediating role of KS and the potential innovation opportunities that these new relationships contribute to growth of the specified industries.

The measures of KS with OFs used in this study were developed from two techniques studies. Although these studies have strong reliability and validity, and strong construct validity was obtained in this study, some variables showed low magnitude (less than 0.5) in the fsQCA and were omitted. Thus, future research could increase the number of items and test the constructs in a different environment for more robust results.

The study tested KS empirically as the core variable in the KS-OFs relationship as one dimension, in spite of the fact that factor analysis distinguished between knowledge donating and collecting. Also as indicated in this study that these KS components have different effects. Hence, future research could further carry out individuality testing of which knowledge components are more dominant in enhancing product and service performance in the specified industry. Further analysis could be conducted at the industrial or department level.

This study looked for the performance contribution of KS with regards to OFs in organisations across different countries. Although this distinction was useful for the purposes of this study in terms of understanding their systems, policies and procedures, future research should examine individuality/and management style inter- relationships of an organisation rather than the country of operation.

KS can result in other outcomes that can lead to competitive advantage (Nonaka, 2005). Examining the impact of KS on other outcomes such as organisational profitability, product quality, departmental performance, and staff satisfaction would be interesting themes for future research.

Additionally, organisational factors, as the dependent variable in this study, were studied as one dimension. This dimension can be divided into two elements, internal and external factors, and each element has different effects. Thus, future research should look into which type of organisational factor is more strongly influenced by KS.

The quantitative findings reveal that performance measurement is a critical element of KS success. So far, there is limited research in the KS literature to support this view, which offers another area for further research.

Last but not least, the literature review in Chapter 2 showed that there are few studies measuring the impact of the relationship between KS and OFs in the field of supply chain management across countries. This calls for more research to be conducted in this area.

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Appendices

Appendix A: Cover letter

Research title: The impact of organisational factors on knowledge sharing performance

Dear Sir or Madam,

My name is Oluwafemi Oyedele Oyemomi. I am a PhD student at Plymouth Business School, Plymouth University (www.plymouth.ac.uk) in the UK conducting research under the supervision of Professor Shaofeng Liu. I am researching the impact of organisational factors on knowledge sharing performance and aiming to use the data survey from your organisation as a research setting.

This research aims to increase the levels of explained performance measurement across business processes by suggesting an overall organisation's factors as a moderator supporting catalyse to the relationship between a knowledge sharing components and its performance. Through your kind cooperation and participation, I eventually hope to understand how best to match the factors within an organisation and the knowledge sharing activities of the organisational business processes.

Completion of the questionnaire would take around 10 minutes of your time. Participation in this project is completely voluntary. If there are any questions that you prefer not to answer, you may skip them. If you would like to write additional comments on the questionnaire, please feel free to do so.

Please be assured that all information you provide through your participation in this study will be kept strictly confidential. Further, you will not be identified in the thesis or in any report or publication based on this research. All results from this study will be reported as statistical summaries only. There are no known or anticipated risks to participation in this study. The data collected through this study will be kept for a period of three years (my PhD study period) in a secure location.

This research hopes to make contributions to both academia and practice. Not only will it improve the accuracy of prediction but will also offer suggestions for future emerging research. In addition, it will enhance managers' ability to predict the consequences of available decision choices and choose an appropriate performance goal suitable for the strategy used.

If, after receiving this letter, you have any questions about this study, or would like additional information to assist you in reaching a decision about participating, please feel free to contact myself, Oluwafemi Oyedele Oyemomi, by e-mail at oluwafemi.oyemomi@plymouth.ac.uk.

Thank you in advance for your co-operation in my research.

Kind regards,

Femi Oyemomi

PhD Research Student

Room 005 Desk 14 Mast House |

Plymouth University | 24 Sutton Road | Plymouth |PL4 0HJ | UK

Email: oluwafemi.oyemomi@plymouth.ac.uk

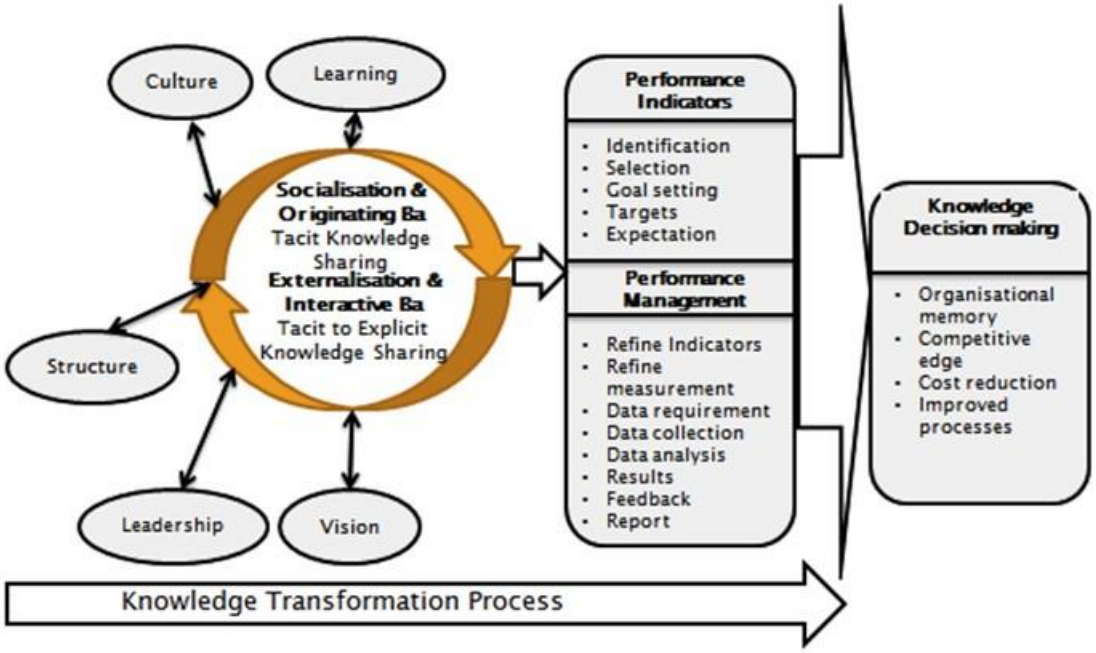
Appendix B: Questionnaire template

Questionnaire

The Contribution of Knowledge Sharing to Organisational Performance

This research questionnaire seeks to measure the contribution of knowledge sharing to organisational performance. Therefore, being an employee of an organisation, this questionnaire seeks your cooperation to give your valuable opinion which is contributing towards the success of this research.Most of the questions merely require you to tick the appropriate box. All the information given will be treated in the strictest confidence.

Your participation in this research is greatly appreciated. This questionnaire is aimed at providing answers to the research conceptual framework shown in the figure below.



General Instructions and Information

1. All individual responses to this questionnaire will be kept STRICTLY CONFIDENTIAL and for academic research purpose only

2. This questionnaire is divided into four parts:
   Part 1: Questions about work experience and projects
   Part 2: Questions on knowledge management
   Part 3: Questions on organisational factors
   Part 4: Questions on knowledge performance measurement
3. Please do not worry about questions that seemingly look alike. If you do not have the exact answer to a question, please provide your best judgement by ticking the appropriate boxes in the questions. Your answers are very important to the accuracy of the research
4. If you wish to make any comment, please feel free to use the space at the end of the questionnaire
5. It will take approximately 10 minutes to complete the survey.

Part One

How many years of work experience do you have?

- 1-3 (1)
- 4-5 (2)
- 6-10 (3)
- 11-above (4)

How many companies/organisations have you worked including your current employer?

- 1-3 (1)
- 4-5 (2)
- 6-10 (3)
- 11-above (4)

How many projects have you undertaken?

- 1-3 (1)
- 4-5 (2)
- 6-10 (3)
- 11-above (4)
- None (5)

What level are you in your organisation?

- Operational (1)
- Mid-Managerial (2)
- Managerial (3)
- Executive (4)
- Adminstrative (5)

Q1.2 Part 2

Employees at all levels in my organisation have a general understanding of the concept of 'knowledge sharing' (1)
Employees at all levels recognise knowledge as a key resource (2)
Employees in my organisation are aware of the need to proactively manage knowledge (3)
In my organisation, employees are encourage to use their know-how in everyday activities (4)
To make knowledge available to all employees, my organisation has a local network (manual or automated) for documenting knowledge activities (5)
Formal networks exist to facilitate dissemination of knowledge in my organisation (7)
Intellectual assets are legally protected in my organisation (8)
In my organisation, employees are encouraged to practice knowledge sharing rather than knowledge hoarding (11)
My organisation hones its skills for generating, aquiring and applying knowledge by learning from other organisation's learning processes (12)
In my organisation, When a team completes a task, it distils and documents what it has learned (13)
Top management recognises knowledge sharing as an important part of the business strategy in my organisation (14)

What are the current practices of knowledge sharing in your organisation?

Q1.3 Part 3

Team learning is an action strategy within my organisation for improving members technical skills (2)
The hierarchical structure of my organisation is a determinant for knowledge sharing initiative (3)
In my orgainsation, employees intellectual assets are recognised, valued and rewarded (4)
Internal staff rotation is actively encouraged to spread best practices and ideas (5)
Top management in my organisation actively get involved in knowledge sharing initiatives. (7)
In my organisation, employees are treated as shareholders (8)
Leadership structure of my organisation affect the way employees interact and promote knowledge sharing (9)
Training and development programs in knowledge management behaviour are undertaken from point of recruitment (10)
Knowledge activities are always in line with the vision of my organisation (12)
My organisation has a friendly work environment for employees to interact (13)
There are systems in place to facilitate effective communication across departments and units (14)

How can organisational factors facilitate effective knowledge sharing in your organisation?

Q1.4 Part 4

There is a process for identifying knowledge asset in my organisation (2)
Employees are committed to continual develop their skills and are constantly generating new ideas within the context of my organisation (5)
Resources are committed for training and development of employees in my organisation (6)
One of the benefits of knowledge sharing to my organisation is that it provide a competitive edge for us among our competitors (9)
There is participative knowledge goal setting (10)
There is participative knowledge goal measurement (11)
There is participative knowledge feedback (12)
Knowledge sharing improves employees know-how (13)
Continuous knowledge sharing practices improved my organisational processes (14)
Continuous knowledge sharing activities improved employees turnaround time (15)

What are the Key Performance Indicators (KPIs) used in measuring Knowledge contributions in your organisation?

If you wish to make any comment, please feel free. Your feedback will be highly useful for the research.

Thank you for taking the time to complete this questionnaire. Your assistance in providing this information is very much appreciated. If there is anything else you would like to tell us about this survey or other comments you wish to make that you think may help us to understand the contribution of knowledge sharing to organisational performance and issues arising thereof, please do so in the space (box) provided below.

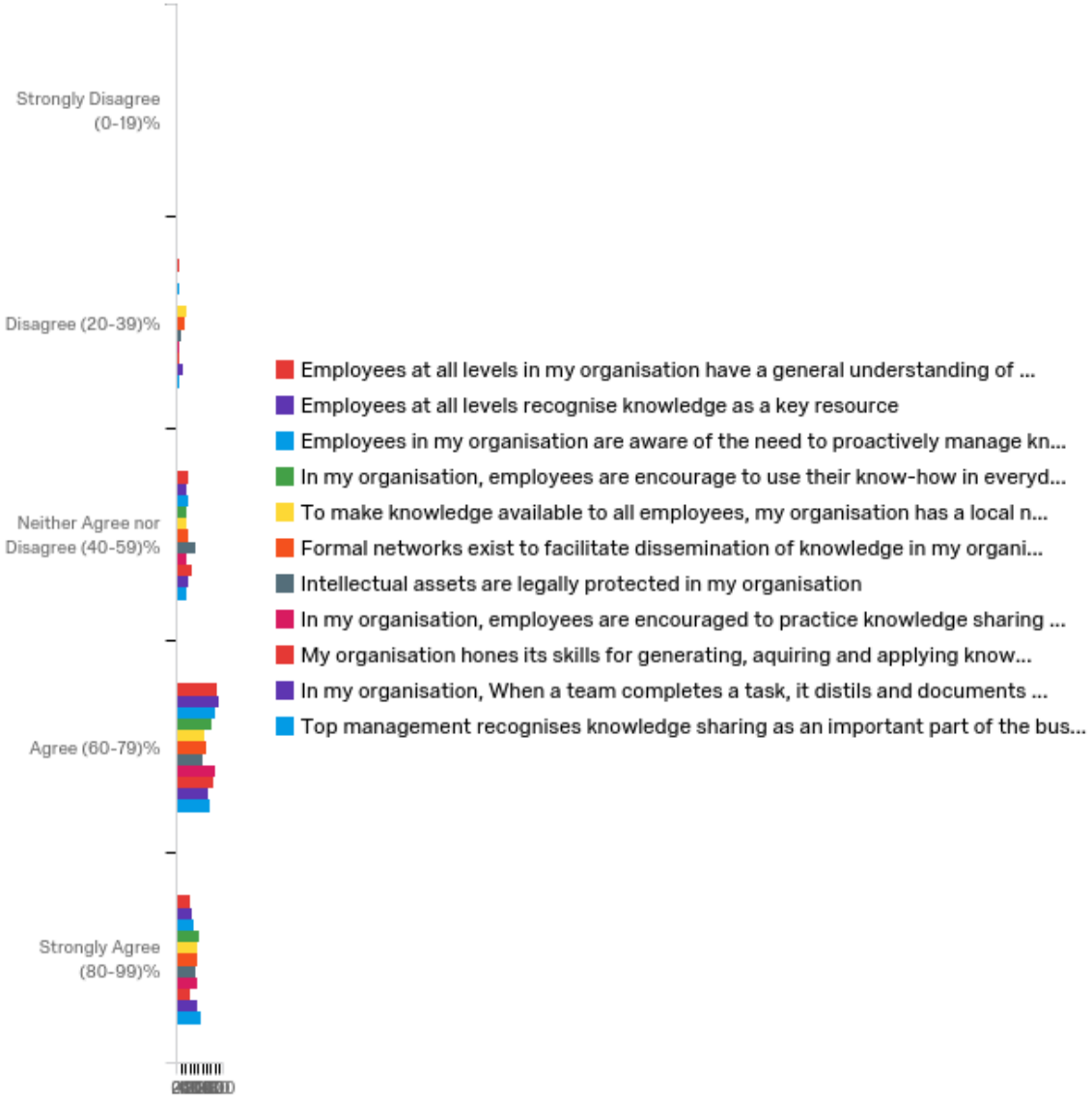
Appendix C: Data collection report

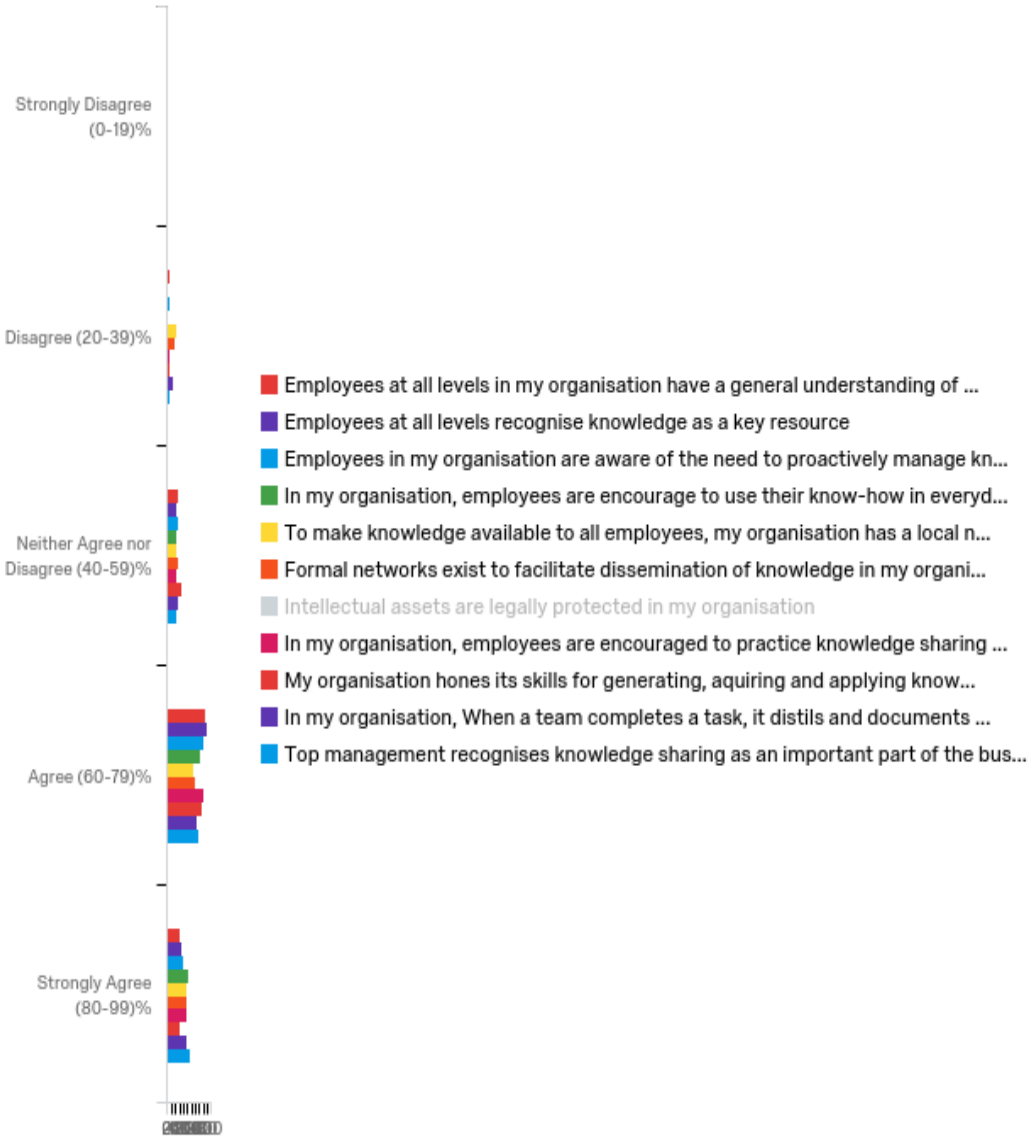
Q1.2 - Part 2

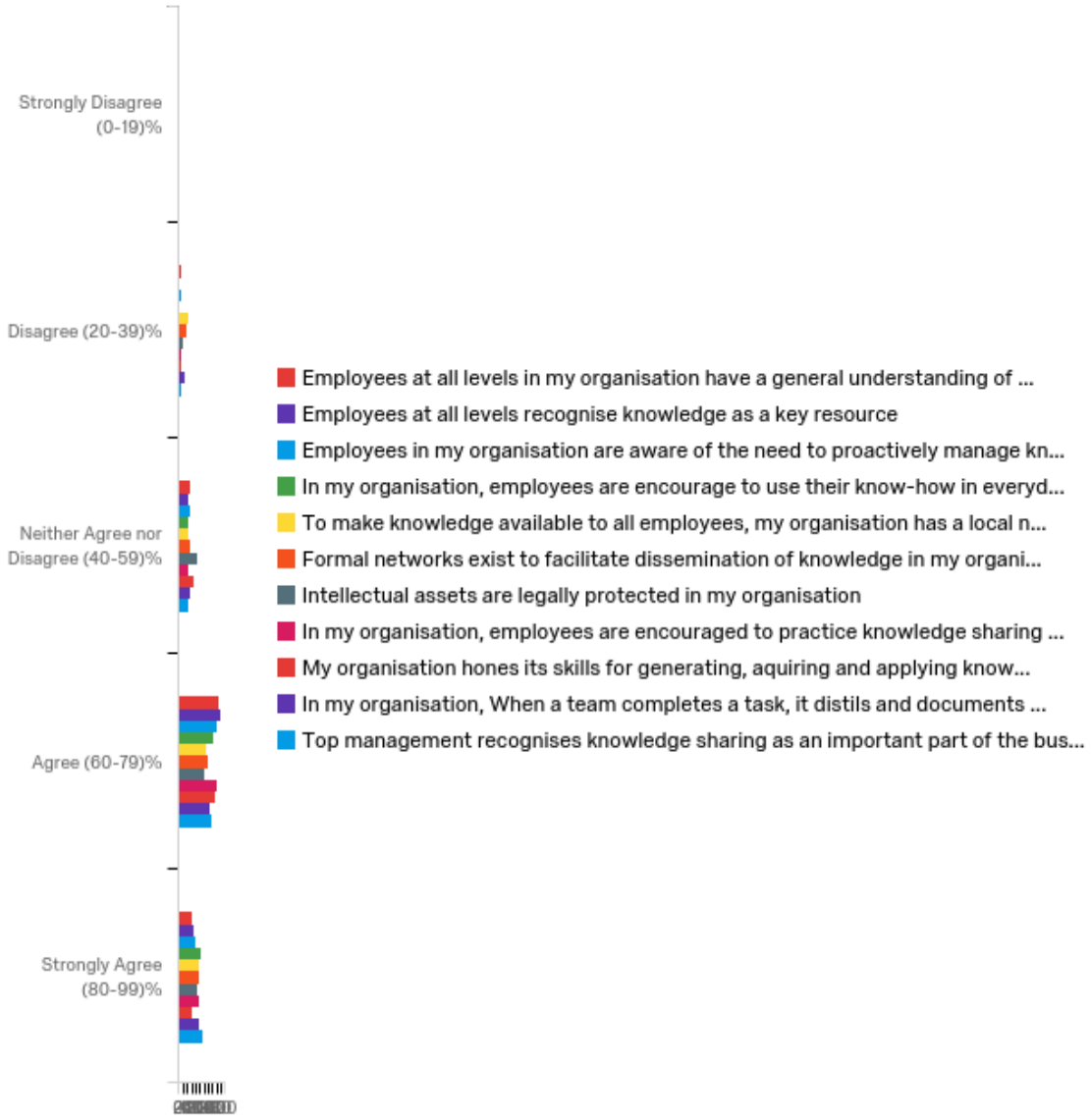
Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
Employees at all levels in my organisation have a general understanding of the concept of 'knowledge sharing'	1.00	5.00	3.90	0.78	0.62	329
Employees at all levels recognise knowledge as a key resource	1.00	5.00	4.02	0.73	0.53	329
Employees in my organisation are aware of the need to proactively manage knowledge	1.00	5.00	3.99	0.79	0.62	329
In my organisation, employees are encourage to use their know-how in everyday activities	1.00	5.00	4.12	0.79	0.62	329
To make knowledge available to all employees, my organisation has a local network (manual or automated) for documenting knowledge activities	1.00	5.00	3.85	1.03	1.06	329
Formal networks exist to facilitate dissemination of knowledge in my organisation	1.00	5.00	3.87	0.98	0.96	329
Intellectual assets are legally protected in my organisation	1.00	5.00	3.83	0.95	0.90	329
In my organisation, employees are encouraged to practice knowledge sharing rather than knowledge hoarding	2.00	5.00	4.10	0.72	0.53	329
My organisation hones its skills for generating, aquiring and applying knowledge by learning from other organisation's learning processes	1.00	5.00	3.89	0.77	0.60	329
In my organisation, When a team completes a task, it distils and documents what it has learned	1.00	5.00	3.93	0.93	0.87	329
Top management recognises knowledge sharing as an important part of the business strategy in my organization	1.00	5.00	4.11	0.83	0.69	329

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count	Bottom 3 Box	Top 3 Box
Employees at all levels in my organisation have a general understanding of the concept of 'knowledge sharing'	1.00	5.00	3.90	0.78	0.62	329	22.49 %	94.83 %
Employees at all levels recognise knowledge as a key resource	1.00	5.00	4.02	0.73	0.53	329	16.72 %	96.96 %
Employees in my organisation are aware of the need to proactively manage knowledge	1.00	5.00	3.99	0.79	0.62	329	20.67 %	95.44 %
In my organisation, employees are encourage to use their know-how in everyday activities	1.00	5.00	4.12	0.79	0.62	329	17.63 %	96.96 %
To make knowledge available to all employees, my organisation has a local network (manual or automated) for documenting knowledge activities	1.00	5.00	3.85	1.03	1.06	329	29.48 %	85.71 %
Formal networks exist to facilitate dissemination of knowledge in my organisation	1.00	5.00	3.87	0.98	0.96	329	28.88 %	87.54 %

Intellectual assets are legally protected in my organisation	1.00	5.00	3.83	0.95	0.90	329	34.65 %	92.71 %
In my organisation, employees are encouraged to practice knowledge sharing rather than knowledge hoarding	2.00	5.00	4.10	0.72	0.53	329	16.41 %	97.26 %
My organisation hones its skills for generating, aquiring and applying knowledge by learning from other organisation's learning processes	1.00	5.00	3.89	0.77	0.60	329	26.14 %	96.05 %
In my organisation, When a team completes a task, it distils and documents what it has learned	1.00	5.00	3.93	0.93	0.87	329	26.14 %	90.27 %
Top management recognises knowledge sharing as an important part of the business strategy in my organisation	1.00	5.00	4.11	0.83	0.69	329	17.63 %	95.44 %


Strongly Disagree (0-19)%
Disagree (20-39)%
Neither Agree nor Disagree (40-59)%
Agree (60-79)%
Strongly Agree (80-99)%
Employees at all levels in my organisation have a general understanding of ...
Employees at all levels recognise knowledge as a key resource
Employees in my organisation are aware of the need to proactively manage kn...
In my organisation, employees are encourage to use their know-how in everyd...
To make knowledge available to all employees, my organisation has a local n...
Formal networks exist to facilitate dissemination of knowledge in my organi...
Intellectual assets are legally protected in my organisation
In my organisation, employees are encouraged to practice knowledge sharing ...
My organisation hones its skills for generating, aquiring and applying know...
In my organisation, When a team completes a task, it distils and documents ...
Top management recognises knowledge sharing as an important part of the bus...


Strongly Disagree (0-19)%
Disagree (20-39)%
Neither Agree nor Disagree (40-59)%
Agree (60-79)%
Strongly Agree (80-99)%
Employees at all levels in my organisation have a general understanding of ...
Employees at all levels recognise knowledge as a key resource
Employees in my organisation are aware of the need to proactively manage kn...
In my organisation, employees are encourage to use their know-how in everyd...
To make knowledge available to all employees, my organisation has a local n...
Formal networks exist to facilitate dissemination of knowledge in my organi...
Intellectual assets are legally protected in my organisation
In my organisation, employees are encouraged to practice knowledge sharing ...
My organisation hones its skills for generating, aquiring and applying know...
In my organisation, When a team completes a task, it distils and documents ...
Top management recognises knowledge sharing as an important part of the bus...



Q1.3 - Part 3

Question	Strongly Disagree (0-19)%		Disagree (20-39)%		Neither Agree nor Disagree (40-59)%		Agree (60-79)%		Strongly Agree (80-99)%		Total
Team learning is an action strategy within my organisation for improving members technical skills	0.31%	1	2.15%	7	11.38%	37	57.23%	186	28.92%	94	325
The hierarchical structure of my organisation is a determinant for knowledge sharing initiative	2.15%	7	7.38%	24	24.92%	81	52.00%	169	13.54%	44	325
In my orgainsation,	3.08%	10	8.31%	27	19.08%	62	44.62%	145	24.92%	81	325

employees intellectual assets are recognised, valued and rewarded											
Internal staff rotation is actively encouraged to spread best practices and ideas	1.54%	5	9.23%	30	20.92%	68	47.08%	153	21.23%	69	325
Top management in my organisation actively get involved in knowledge sharing initiatives.	0.92%	3	5.54%	18	22.46%	73	49.23%	160	21.85%	71	325
In my organisation, employees are treated as shareholders	8.00%	26	19.69%	64	27.69%	90	31.69%	103	12.92%	42	325
Leadership structure of my organisation affect the way employees interact and promote knowledge sharing	1.54%	5	10.46%	34	25.23%	82	50.46%	164	12.31%	40	325
Training and development programs in knowledge management behaviour are undertaken from point of recruitment	1.85%	6	10.15%	33	14.15%	46	41.54%	135	32.31%	105	325
Knowledge activities are always in line with the vision of my organisation	1.54%	5	6.46%	21	18.77%	61	47.69%	155	25.54%	83	325
My organisation has a friendly work environment for employees to interact	0.31%	1	4.31%	14	14.15%	46	52.62%	171	28.62%	93	325
There are systems in place to facilitate effective communication across departments and units	0.00%	0	7.69%	25	18.15%	59	48.92%	159	25.23%	82	325

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count	Bottom 3 Box	Top 3 Box
Team learning is an action strategy within my organisation for improving members technical skills	1.00	5.00	4.12	0.71	0.50	325	13.85%	97.54%
The hierarchical structure of my organisation is a determinant for knowledge sharing initiative	1.00	5.00	3.67	0.88	0.77	325	34.46%	90.46%
In my orgainsation, employees intellectual assets are recognised, valued and rewarded	1.00	5.00	3.80	1.00	1.01	325	30.46%	88.62%
Internal staff rotation is actively encouraged to spread best practices and ideas	1.00	5.00	3.77	0.94	0.88	325	31.69%	89.23%
Top management in my organisation actively get involved in knowledge sharing initiatives.	1.00	5.00	3.86	0.85	0.73	325	28.92%	93.54%
In my organisation, employees are treated as shareholders	1.00	5.00	3.22	1.14	1.30	325	55.38%	72.31%
Leadership structure of my organisation affect the way employees interact and promote knowledge sharing	1.00	5.00	3.62	0.89	0.78	325	37.23%	88.00%
Training and development programs in knowledge management	1.00	5.00	3.92	1.02	1.03	325	26.15%	88.00%

behaviour are undertaken from point of recruitment								
Knowledge activities are always in line with the vision of my organisation	1.00	5.00	3.89	0.91	0.83	325	26.77%	92.00%
My organisation has a friendly work environment for employees to interact	1.00	5.00	4.05	0.79	0.63	325	18.77%	95.38%
There are systems in place to facilitate effective communication across departments and units	2.00	5.00	3.92	0.86	0.73	325	25.85%	92.31%

Q1.4 - Part 4

Question	Strongly Disagree (0-19)%		Disagree (20-39)%		Neither Agree nor Disagree (40-59)%		Agree (60-79)%		Strongly Agree (80-99)%		Total
There is a process for identifying knowledge asset in my organisation	1.25%	4	14.33%	46	18.69%	60	39.88%	128	25.86%	83	321
Employees are committed to continual develop their skills and are constantly generating new ideas within the context of my organisation	1.25%	4	4.67%	15	18.07%	58	55.14%	177	20.87%	67	321
Resources are committed for training and development of employees in my organisation	1.56%	5	10.59%	34	15.26%	49	42.37%	136	30.22%	97	321
One of the benefits of knowledge sharing to my organisation is that it provide a	1.25%	4	3.74%	12	14.95%	48	55.14%	177	24.92%	80	321

competitive edge for us among our competitors											
There is participative knowledge goal setting	2.18%	7	9.66%	31	27.41%	88	38.32%	123	22.43%	72	321
There is participative knowledge goal measurement	1.56%	5	9.66%	31	25.23%	81	43.61%	140	19.94%	64	321
There is participative knowledge feedback	1.25%	4	7.79%	25	23.05%	74	47.66%	153	20.25%	65	321
Knowledge sharing improves employees know-how	0.00%	0	1.56%	5	10.90%	35	55.45%	178	32.09%	103	321
Continuous knowledge sharing practices improved my organisational processes	0.31%	1	3.12%	10	18.38%	59	45.48%	146	32.71%	105	321
Continuous knowledge sharing activities improved employees turnaround time	0.93%	3	0.93%	3	13.08%	42	55.14%	177	29.91%	96	321

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count	Bottom 3 Box	Top 3 Box
There is a process for identifying knowledge asset in my organisation	1.00	5.00	3.75	1.03	1.07	321	34.27%	84.42%
Employees are committed to continual develop their skills and are constantly generating new ideas within the context of my organisation	1.00	5.00	3.90	0.82	0.68	321	23.99%	94.08%
Resources are committed for training and development of employees in my organisation	1.00	5.00	3.89	1.00	1.01	321	27.41%	87.85%
One of the benefits of	1.00	5.00	3.99	0.81	0.66	321	19.94%	95.02%

knowledge sharing to my organisation is that it provide a competitive edge for us among our competitors								
There is participative knowledge goal setting	1.00	5.00	3.69	0.99	0.99	321	39.25%	88.16%
There is participative knowledge goal measurement	1.00	5.00	3.71	0.94	0.89	321	36.45%	88.79%
There is participative knowledge feedback	1.00	5.00	3.78	0.90	0.81	321	32.09%	90.97%
Knowledge sharing improves employees know-how	2.00	5.00	4.18	0.68	0.46	321	12.46%	98.44%
Continuous knowledge sharing practices improved my organisational processes	1.00	5.00	4.07	0.81	0.66	321	21.81%	96.57%
Continuous knowledge sharing activities improved employees turnaround time	1.00	5.00	4.12	0.73	0.54	321	14.95%	98.13%

How many companies/organisations have you worked including your current employer?

Answer	%	Count
1-3	81.38%	271
4-5	15.62%	52
6-10	3.00%	10
11-above	0.00%	0
Total	100%	333

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count	Bottom 3 Box	Top 3 Box
How many companies/organisations have you worked including your current employer?	1.00	3.00	1.22	0.48	0.23	333	100.00%	18.62%

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count	Bottom 3 Box	Top 3 Box
How many companies/organisations have you worked including your current employer?	1.00	3.00	1.22	0.48	0.23	333	100.00%	18.62%

How many projects have you undertaken?

Answer	%	Count
1-3	50.60%	170
4-5	18.45%	62
6-10	10.42%	35
11-above	5.65%	19
None	14.88%	50
Total	100%	336

What level are you in your organisation?

Answer	%	Count
Operational	46.25%	154
Mid-Managerial	15.62%	52
Managerial	17.12%	57
Executive	6.91%	23
Adminstrative	14.11%	47
Total	100%	333

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count	Bottom 3 Box	Top 3 Box
How many projects have you undertaken?	1.00	5.00	2.16	1.47	2.15	336	79.46%	30.95%

What level are you in your organisation?

Answer	%	Count
Operational	46.25%	154
Mid-Managerial	15.62%	52
Managerial	17.12%	57
Executive	6.91%	23
Adminstrative	14.11%	47
Total	100%	333

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count	Bottom 3 Box	Top 3 Box
What level are you in your organisation?	1.00	5.00	2.27	1.45	2.11	333	78.98%	38.14%

Question	Strongly Disagree (0-19)%		Disagree (20-39)%		Neither Agree nor Disagree (40-59)%		Agree (60-79)%		Strongly Agree (80-99)%		Total
Employees at all levels in my organisation have a general understanding of the concept of 'knowledge sharing'	1.22%	4	3.95%	13	17.33%	57	58.97%	194	18.54%	61	329
Employees at all levels recognise knowledge as a key resource	0.91%	3	2.13%	7	13.68%	45	60.49%	199	22.80%	75	329
Employees in my organisation are aware of the need to proactively manage knowledge	0.61%	2	3.95%	13	16.11%	53	54.41%	179	24.92%	82	329
In my organisation, employees are encourage to use their know-how in everyday activities	0.61%	2	2.43%	8	14.59%	48	48.94%	161	33.43%	110	329
To make knowledge available to all employees, my organisation has a local network (manual or automated) for documenting knowledge activities	1.22%	4	13.07%	43	15.20%	50	40.73%	134	29.79%	98	329
Formal networks exist to facilitate dissemination of knowledge in	0.61%	2	11.85%	39	16.41%	54	42.55%	140	28.57%	94	329

my organisation											
Intellectual assets are legally protected in my organisation	1.82%	6	5.47%	18	27.36%	90	38.30%	126	27.05%	89	329
In my organisation, employees are encouraged to practice knowledge sharing rather than knowledge hoarding	0.00%	0	2.74%	9	13.68%	45	54.71%	180	28.88%	95	329
My organisation hones its skills for generating, aquiring and applying knowledge by learning from other organisation's learning processes	0.61%	2	3.34%	11	22.19%	73	53.80%	177	20.06%	66	329
In my organisation, When a team completes a task, it distils and documents what it has learned	0.61%	2	9.12%	30	16.41%	54	44.38%	146	29.48%	97	329
Top management recognises knowledge sharing as an important part of the business strategy in my organisation	0.91%	3	3.65%	12	13.07%	43	48.33%	159	34.04%	112	329

If you wish to make any comment, please feel free. Your feedback will be highly useful for the research.

How many years of work experience do you have?

Answer	%	Count
1-3	46.43%	156
4-5	24.70%	83
6-10	18.75%	63
11-above	10.12%	34

Total	100%	336

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count	Bottom 3 Box	Top 3 Box
How many years of work experience do you have?	1.00	4.00	1.93	1.03	1.05	336	89.88%	53.57%

What are the current practices of knowledge sharing in your organisation?

How can organisational factors facilitate effective knowledge sharing in your organisation?