Collaborating with Competitors: Pitfalls and Paybacks

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by

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I dedicated this thesis to my parents,

谨此论文献给我的父母

Xu Cuixia and Cai Hegen

徐翠霞 蔡和根

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ABSTRACT

Inter-firm collaborations have become an indispensable part of business strategy to deal with faster competitive dynamics and higher market and environmental uncertainties. Interestingly, research has found that around half of all cooperative relationships take place between competitors. Termed as ‘coopetition’, it refers to the simultaneous cooperation and competition between at least two actors. Over the past two decades, coopetition has become an important domain for industrial practice which has led to increasing research interest by scholars worldwide with a wide range of subjects studied within the extant body of literature. Despite the growing interest, coopetition research is still fragmented and is dominated by conceptual research. This entails limitations to knowledge and understanding reflected by heterogeneous uses of the coopetition concept (mixed definitions and a lack of clarity in how to apply coopetition successfully), a lack of generalisability, and a limited number of quantitative studies.

Coopetition scholars commonly argue that competitors rarely cooperate in activities that are close to customers, known as output activities (e.g., sales and marketing), but instead argue that they mostly cooperate in activities far from the customer, referred to as input activities (e.g., R&D, logistics, and NPD). However, it has been found in real world business examples that competitors also cooperate in output activities. In this study these two distinct types of coopetition are termed as ‘internally focused coopetition’ (cooperating with competitors in input activities) and ‘externally focused coopetition’ (cooperating with competitors in output activities). This is the first study synthesising these two types of coopetition in one conceptual model, and examining their individual paybacks and pitfalls.

After the development of the conceptual model based on the relevant literature, a cross-sectional research design is adopted and an online survey is implemented among Chief Operating Officers and Managing Directors in UK high-tech companies. A total of 148 completed questionnaires are collected. Data analysis employs a two-stage approach, which includes a measurement model assessment and a structural model assessment.

The results indicate that both internally and externally focused coopetition can help firms to develop new knowledge-based resources and capabilities. However, these two types of coopetition also have different paybacks and pitfalls. Even though the new innovation knowledge-based resources and capabilities gained from internally focused coopetition can lead to better business efficiency and effectiveness, firms also lose uniqueness in their existing knowledge-based resources and capabilities (a key tenet of competitive advantage in resource- and knowledge-based theories). In contrast, externally focused coopetition has no significant impact on uniqueness, but the new marketing knowledge-based resources and capabilities negatively influence business efficiency and effectiveness. It has also been found that when firms perceive that their competitors are behaving opportunistically, they tend to do the same and appropriate more knowledge-based resources and capabilities from the collective value created. Competitors' opportunism also renders more loss of uniqueness, which in turn worsens business performance.

This research provides greater clarity and understanding to scholars of the workings of coopetition for deriving new knowledge-based resources and capabilities and extrapolating performance benefits from this. This work also illuminates situations where coopetition does not result in the perceived win-win-win situations indicated in literature. Based on these results, a number of theoretical and managerial contributions are developed. Principally, (1) this is the first study that conceptualises and operationalises internally and externally focused coopetition, and their individual knowledge-based outcomes are analysed from a knowledge-based view; (2) how competitors' opportunism affects the dynamics of coopetition is better understood from a game theoretical perspective; (3) this study extends the understanding of business performance outcomes of coopetition.

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'The new Prince must strive to hold close his allies, but it is of more importance to hold close his enemies...'

Niccolò Machiavelli, *Il Principe* (1532)

'Keep your friends close; keep your enemy closer.'

Chapter 1: Introduction

In this chapter, the research background and the significance of the study are firstly presented. The research gaps are then identified, followed by research objectives that guide the study. Finally, anticipated contributions of the study are discussed and the chapter is concluded with an overview of the thesis structure.

1.1 Research Background

In a business environment characterised by competitive dynamism and uncertainty, many companies are turning to inter-organisational cooperation in order to improve their offerings, acquire key resources and capabilities, and share risk (Lavie, 2007; Renna and Argoneto, 2012; Ritala and Hurmelinna-Laukkanen, 2013; Bouncken et al., 2014). Among the different inter-organisational relationships, cooperating with competitors has been found most strategic (Powell et al., 1996). Interestingly, it has been argued that half of all cooperative relationships take place between competitors (Bouncken et al., 2015), indicating that cooperation and competition are not mutually exclusive (Bengtsson and Kock, 2000; Tsai, 2002; Luo, 2004). Coined *coopetition*, the phenomenon is defined as simultaneous cooperation and competition in inter-organisational relationships (Brandenburger and Nalebuff, 1996; Lado et al., 1997; Bengtsson and Kock, 1999, 2000; Eriksson, 2008; Bengtsson and Johansson, 2012). This paradox is prevalent when firms intend to cooperate to achieve a mutual objective, while also compete out of self-interest in order to satisfy individual objectives (Bengtsson and Kock, 2000). There is an increasing amount of evidence of coopetition in varied industries (such as information technology, healthcare, air transport, food and the auto-motive sector, see Ritala, 2012), and across different

company types (such as large enterprises, and small- and medium-sized firms, see Levy et al., 2003; Morris et al., 2007; Gnyawali and Park, 2009; Dahl, 2014). Yet despite a steadily growing body of literature on this subject, academic and practitioner understanding of how to apply coopetition successfully is lacking.

The central and overarching objective of coopetition is to develop mutually beneficial exchanges and added values (Chin et al., 2008) and the application of coopetition strategy has become prevalent in companies. Recent examples of coopetition among competing firms abound in different marketplaces worldwide. For example, Toyota and General Motors are competitors in the automotive industry, but they have collaborative agreements in developing fuel cell-powered cars in the American market. The objective of the collaboration is to expand the current market for both companies to compete in. Fujifilm and Kodak are also competitors, but they collaborate on waste disposal problems of single-use cameras by recycling each other's cameras, which helps to reduce the collection costs for both firms. Vodafone and O2 are direct competitors in the UK mobile phone industry but collaborate on maintenance of signal antennas to reduce costs, share 3G networks for expanded UK wide coverage, and are increasing their network collaboration for faster roll out of high-speed mobile services. Both companies are working on creating a national grid of 18,500 sites but will be operating on different competing bands of spectrum. UPS collaborated with DHL to use their logistics channels to Asian countries because UPS's business clients often require this service while UPS lacks established logistics channels in that region. Therefore, they have to cooperate in order to keep clients. On the other hand, some of DHL's clients require them to transport goods to second- or third-tier cities in China, and DHL can only transport to tier-one cities and has to cooperate with a Chinese logistics company (competitor) to utilize their channels. The same strategy has also been widely used in the tourism industry. Tourist attractions compete to attract more visitors, and they also cooperate by selling bundle tickets which allow tourists to visit several attractions with one ticket, because they know they are not only competing with each other, they are also competing with other cities/regions/countries. Selling bundle tickets makes visiting their city more attractive to tourists. In the early phase of this research project, 10 qualitative interviews have been conducted with managers in UK companies to obtain insights. One of the managers states that 'we have never had the mentality

before that we can work together to improve the market place for all of us…in a trade fair your competitor always stands 50 meters away, you would not even look at him, speak to him, you will protect yourself. But we now have come to understand that some of our products are competing with some multi-billion pounds companies…so in order to trying to compete with them, we need to cooperate in certain aspects'. Another Health & Beauty company helps its competitors to distribute their products to other European countries. The company not only get paid the distribution fee and achieve economies of scale when shipping products, but also obtain more product offerings in its portfolio which is more attractive to their customers, because 'customers nowadays are looking for less suppliers, but more choices'.

The term 'coopetition' was coined long ago. However, the origin of the term remains unclear. Stein (2010) suggests that as early as 1911, Kirk S. Pickett from the oyster manufacturer "Sealshipt" coined 'coopetition' by stating 'you are only one of several dealers selling our oysters in your city. But you are not in competition with one another. You are co-operating with one another to develop more business for each of you. You are in coopetition, not in competition." Interestingly, his statement reveals the fact that coopetition helps to expand the industry/market as a whole so that everyone can gain. However, this cooperation among competitors is more passive than proactive since companies are not purposively cooperating. Soon after that, Cherington mentioned 'coopetition' in his book "Advertising as a Business Force" in 1913. However, these early introductions have not attracted public attention or research interest. In the 1980s, Raymond Noorda, CEO of Novell Corporation, introduced the term to the public debate (Luo, 2007). Even though the coopetition concept was introduced, it remained more or less under the radar until 1996, when Brandenburger and Nalebuff's book *Coopetition* was published. Since then, scholars and practitioners began to realise the importance of this new inter-firm relationship.

Before coopetition emerged as a new inter-firm relationship, cooperation and competition were traditionally treated separately to describe relationships among firms (M'Chirgui, 2005). The competitive view is based on the divergent interests of competitors, arguing every firm's objective is to obtain profits higher than the industry average at the expense of its competitors (Padula and Dagnino, 2007). The cooperative view is based on convergent interests, suggesting firms can achieve

common objectives through collective instead of individual actions (Padula and Dagnino, 2007). Cooperation and competition both have their own advantages. Cooperation with other businesses can help a firm to specialise in a core business and have access to resources that the firm does not possess but are necessary for certain business activities, while competition can keep a firm under pressure for being innovative, which can motivate the firm to strengthen its existing competitive advantages and develop new competences (Jorde and Teece, 1989). However, each perspective also has its own limitations and fails to reflect the holistic picture of interdependences among firms (Padula and Dagnino, 2007). Competition theorists regard cooperation only as a result of market imperfection and do not allow for the possibility of cooperation positively impacting on performance (Bouncken et al., 2015), while the cooperation stream underestimates competitive dynamics and views them as negative influences because of risks such as knowledge spillovers and learning races (e.g. Kale et al., 2000).

Scholars and practitioners have realised that striking a right balance between the two is important to a firm's success (Jorde and Teece, 1989). Many scholars (e.g. Gulati, 1998; Khanna et al., 1998; Kogut, 1998; Afuah, 2000) argue that coopetitive activities could be critical sources of innovation, organisational learning, complementary products, capabilities, resources and lead users. By contrast with co-operation (positive-sum) and competition (zero-sum), coopetition has been regarded as a variable-positive-sum game, or a win–win–win game (Walley, 2007), because it has the characteristics of both competition and cooperation simultaneously (Padula and Dagnino, 2007; Okura, 2007). It has a third 'win' because coopetitive activities also create value to the target customers by providing creative (and/or new) products to the market, lowering prices due to more efficiency of resource usage, and better quality products (Kotzab and Teller, 2003). For example, in one of the exploratory interviews, a manager confirms the value of coopetition by saying 'if we are taking on bigger contracts and we needed help, then that's the way to do it, collaborating with competitors…because you both got skills and you can make everything better…we have our own specialities that we are stronger with'.

The rise of coopetition reflects an increasing research interest in the complexity of relationships between economic agents (Dorn et al., 2016). The combination of the

contradictory ‘operating modes’ of competition and cooperation (Bunge, 1979) has inspired the analysis of coopetition at different levels, such as individual level (e.g. Hutter et al., 2011; Baruch and Lin, 2012), intra-firm level (e.g. Luo, 2005), inter-firm level (e.g. Burgers et al., 1998; Bengtsson and Kock, 1999, 2000; Luo, 2007; Daidj and Jung, 2011), and network level (e.g. Gnyawali et al., 2006; Peng and Bourne, 2009). Among these four different levels of coopetition, inter-firm coopetition has drawn most attention as it is where the coopetition concept originated.

Competitors have long been regarded as risky partners but scholars report that companies, particularly those in knowledge-intensive industries, now cooperate with competitors to achieve economies of scale (Miotti and Sachwald, 2003), obtain complementary resources (Ancarani and Costabile, 2010), acquire advancing knowledge (Ritala and Hurmelinna-Laukkanen, 2013), and reduce distribution risks (Meyer, 1998). Moreover, several studies provide evidence that cooperating with competitors contributes more to the development of completely new products and incremental efficiency gains than with non-competitors (Tether, 2002; Belderbos et al., 2004; Quintana-García and Benavides-Velasco, 2004).

However, evidence also exists that it is a risky endeavour (Park and Russo, 1996). Nieto and Santamaria (2007) suggest that coopetition is the least effective way of developing highly novel products due to opportunistic behaviours and lack of trust between partners. Meanwhile, Ritala (2012) adopts a contingency theory perspective and suggests that market uncertainty, network externalities and competitive intensity have moderating effects on the link between coopetition and performance. The early interviews of this study also reveal that sacrifices may need to be made when cooperating with competitors. One manager suggests that ‘you have to share, you have to compromise, give and take, there has to be a trade-off’. Another manager more explicitly points out that when cooperating with competitors, ‘they lose their brand uniqueness and customers may get confused’. In addition, coopetition may lead to ‘loss of identity for the staff that are collaborating together…wearing two hats all the time’. Overall, it can be seen from managerial practice and academic literature that coopetition can be beneficial, but its success is not guaranteed (Bengtsson & Kock, 2000; Gnyawali and Park, 2009, 2011) and various inter-firm and internal tensions exist. Thus, the coopetition strategy can be a viable strategy, but it needs to

be better understood by scholars and practitioners so that potential pitfalls can be identified and avoided. Consequently, research is still needed to further understand the mechanisms by which coopetition can be dangerous for the organisation or when it should be harnessed for better performance.

1.2 Effects of Coopetition on Performance

1.2.1 Coopetition and Innovation

Innovation is probably the most frequently studied performance outcome in the coopetition literature (e.g., Brolos, 2009; Ritala and Hurmelinna-Laukkanen, 2009; Huang and Yu, 2011; Enberg, 2012; Gast et al., 2015). This could be due to the predominant assumption in early coopetition literature that competitors tend to cooperate in input activities (e.g. R&D, production, and logistics) while competing in output activities (e.g. sales and marketing) (Bengtsson and Kock, 2000; Luo, 2007). Scholars argue that competitors tend to have a more common or similar knowledge base than non-competitors, which facilitates knowledge sharing, knowledge integration, knowledge generation and product development (Ritala and Hurmelinna-Laukkanen, 2009; Enberg, 2012). Additionally, competitors operate in the same industry, face similar market conditions, satisfy similar/same customer needs, and confront same uncertainty problems, all of which support a common perception of future changes and help to develop innovations that are beneficial and profitable for all parties involve (Baumard, 2009). Apart from the similarities, competitors' knowledge and capabilities can also complement each other. It is commonly accepted that knowledge needed for innovation is usually not shared equally among competitors (Enberg, 2012), and competitors may possess knowledge or skills that others are missing but needing and vice versa. Firms, especially SMEs, are rarely self-sufficient when performing innovation activities, and coopetition can be an important strategy to overcome knowledge or skill asymmetries. Therefore, compared to alliances with non-competitors, coopetition entails critical benefits for innovation activities.

Empirical studies have indicated a positive relationship between coopetition and innovativeness (Bouncken et al., 2015; Gast et al., 2015). For example, Rodrigues et

al. (2009) argue that coopetition can be a win-win strategy for all involved parties and lead to increased sales, market shares, international brand recognition, and market penetration. Bouncken and Fredrich (2012) have also observed a positive relationship between coopetition and the success of radical innovations. Along this line, Quintana-Garcia and Benavides-Velasco (2004) have suggested that cooperating with competitors leads to more radical product development than with non-competitors.

Nevertheless, contradictory findings related to how coopetition impacts on innovation also exist. Ritala and Sainio (2014) argue that coopetition is negatively related to radical innovation, while Mention (2011) reports no significant relationship between coopetition and novelty of innovation introduced by the firm. Cassiman et al. (2009) suggest that coopetition is fraught with the risk of opportunism and knowledge leakage, which can hamper the development of radical innovations. Nieto and Santamaria (2007) also find that in the manufacturing sector, coopetition is the least fruitful way of producing highly novel innovations because of risks of opportunistic behaviour and a lack of trust between competitors. However, in the manufacturing sector, many firms are low-tech and innovation-related coopetition is not as frequent or beneficial as in high-tech sectors (Tether, 2002; Arranz and Arroyabe, 2008). It is more commonly agreed that knowledge gained from coopetition can be used as a good source of incremental innovation (e.g. Ritala and Hurmelinna-Laukkanen, 2009; Bengtsson and Raza-Ullah, 2016). Interestingly, some managers confirm these views in the interviews. One managers says that ‘product innovation is much much more partner-centric. It’s my own intelligence, it’s my business, I’m doing it or it is partner-centric…and very rarely would you bring in your sworn enemies’. A manager from another company also states that they ‘would try to develop our own innovation’ so that ‘when we bring a product to market we are a little bit ahead of our competitors’.

1.2.2 Coopetition and Knowledge-related Outcomes

Coopetition studies have also examined knowledge-related outcomes such as knowledge sharing, creation and acquisition, which serve as important prerequisites for innovation (Ritala and Hurmelinna-Laukkanen, 2009; Bouncken and Kraus, 2013; Bengtsson and Raza-Ullah, 2016). Knowledge is ‘a set of beliefs held by an

individual about causal relationships among phenomena' (Sanchez and Heene, 1996, p.9). According to knowledge-based view, firms develop capabilities that improve their performance through knowledge work and learning (Grant, 1996). Individuals in firms might store and use codified information about inter-firm work, databases, lessons learned from inter-firm work, and observation of implicit inter-firm routines, to accumulate, use, and extend their own knowledge base (Augusto Felício et al., 2012; Kale and Singh, 2007). When firms are forming alliances with others, the transfer of knowledge across projects can create new knowledge within firms (Newell et al., 2006), such as joint rules and procedures (Holmqvist, 1999), shared practices of project schedules, team coordination and teamwork (Scarbrough et al., 2004), or joint alliance capabilities (Anand and Khanna, 2000; Hoang and Rothaermel, 2005). Additionally, firms can also share knowledge within projects and alliances to extend their resource base, enhance innovation and accelerate the rate of patenting (Shan et al., 1994; George et al., 2002; Kelley and Rice, 2002).

It has been argued that coopetitive relationships, as a form of inter-firm alliance, are also beneficial as they enable knowledge exchange among involved parties (Osarenkhoe, 2010). As aforementioned, since competitors have more common knowledge than non-competitors do, they can more easily exchange, integrate, and create new knowledge (Ritala and Hurmelinna-Laukkanen, 2009; Un et al., 2010). Padula and Dagnino (2007) further argue that the distance between the scientific and technological domains of competitors (know-what), the distance between their organisational systems (know-how) and the distance between their dominant logics of operation (know-why) have an influence on the extent to which competitors' knowledge base can be *accessed and integrated*. When the difference of firms' know-what, know-how, and know-why is small, the possibilities to successfully access and integrate knowledge are increased. Therefore, cooperating with competitors is more lucrative than with non-competitors because the costs arising from overcoming barriers of understanding are reduced.

The knowledge exchange and creation of new knowledge reflect the positive outcome of the cooperative side in a coopetitive relationship. Nevertheless, coopetition also has the competitive elements that affect the dynamics of such alliance (Khanna et al., 1998). Larsson et al. (1998) have identified an inter-firm

learning dilemma within the internal race to learn among the partners. There are several risks of learning within inter-firm relationships: asymmetric learning (Kale et al., 2000), knowledge protection and learning races (Inkpen, 2000), and risks of control and exploitation of trust in knowledge transfer (Inkpen and Currall, 2004). Hence, coopetition might have positive as well as negative impacts on knowledge-related outcomes. Through sharing, competitors can have access to a firm's both implicit and explicit knowledge, which permits an opportunism that arises from competitors' agenda to use knowledge spillovers in a one-way fashion and appropriate partners' key technology (Ritala and Hurmelinna-Laukkanen, 2009; Nielsen and Lassen, 2012; Tracey, 2012). After appropriating the key knowledge, competitors may simply leave the coopetition, deploy the knowledge in competitive fields, and jeopardise the partners' competitive advantages (Lee and Johnson, 2010). Similar views are revealed in the exploratory study. A managers says 'competitors learn and steal your ideas. When you open the door, you are letting somebody into your domain. They could steal your market leadership or technologies'. Another manager also argues that when partners have different learning abilities, 'mistrust is built up…consequently, one would not invest too much into the relationship and it would eventually break down'.

1.2.3 Coopetition and Traditional Performance Outcomes

A number of scholars have investigated the effects of coopetition on traditional firm performance outcomes. Contradicting findings widely exist. Oum et al. (2004) investigate the effect of competitor alliances on firm productivity and profitability, suggesting that competitor alliances are positively related to firm productivity, but have no significant impact on profitability. However, Luo et al. (2007) examine the effects of competitor alliances on firms' financial performance, concluding that alliances with competitors have a curvilinear (inverted U-shaped) impact on profitability. They argue that competitor alliances appear to promote firm profitability, whereas a high intensity of alliance activity has a negative impact on profitability. Peng et al. (2012) also suggest that coopetition leads to better performance in two ways. The first is that the adoption of coopetition permits the attainment of performance levels beyond what would otherwise have been possible, and the second is that the adoption of coopetition changes the timeframe, permitting earlier

achievement of higher performance levels. Additionally, Parzy and Bogucka (2014) argue that coopetition allows for efficient resource utilisation.

Some other studies investigated the relationship specific outcomes, such as successful maintenance of the coopetitive relationship. Park and Russo (1996) use joint venture (JV) termination (including failures and acquisitions) as an outcome measurement, suggesting that coopetition as the form of JV is more likely to fail. Silverman and Baum (2002) use exit rate as the outcome and argue that competitors' alliances are mostly like to have higher exit rate than cooperating with suppliers and customers.

Some non-empirical studies also have conceptualised traditional performance outcomes of coopetition. Park and Ungson (2001) propose that alliances with strong competitors are more likely to fail, because it is difficult to develop a trust-based relationship, to create efficient governance structure, to share knowledge and skills, to resolve organisational dissimilarities, and to develop a coherent strategy. Gnyawali and Park (2009) discuss the benefits and risks of coopetition. The benefits include economies of scale, reduction of uncertainty and risks, and speed in production development, whereas the risks include technological risks, managerial challenges, and loss of control.

1.3 Research Gaps

In this section, research gaps are identified and discussed. A more detailed discussion of research gaps can be found in section 2.4 of the literature review.

Although the concept of coopetition has gained much attention and research interest in the last two decades in strategy and management literature, the research field is still fragmented and entails limitations (Mariani, 2007; Bouncken et al., 2015; Gast et al., 2015). In existing coopetition studies, about 36% are conceptual and 40% are qualitative studies employing case study research. The conceptual and qualitative studies aim at theory development, the goal of which is to explore and describe the field of coopetition (Dorn et al., 2016). The fact that only 20% of the studies have adopted quantitative methods indicates that the coopetition field is still in its infancy.

Quantitative research using large samples is necessary to develop and test proposed theories (Bouncken et al., 2015). In addition, the field of coopetition largely lacks conceptual clarity, coherence, and rigor (Bengtsson and Raza-Ullah, 2016). Scholars often abuse using the term ‘coopetition’ on any relationship that encompasses both competition and cooperation. Such broadly defined coopetition harms our understanding of this phenomenon instead of helping it, as one cannot even distinguish it from other interfirm relationships such as strategic alliances or joint venture. Therefore, a fine-grained and detailed understanding of the conceptualisation and operationalisation of the coopetition concept is needed to increase the validity and generalisability of the research, which is the ***first research gap***.

In the current coopetition literature, scholars have predominantly agreed that coopetition activities can be divided into a) cooperative activities far from the customer (input activities, e.g. logistics, production, and R&D) and b) competing activities close to the customer (output activities, e.g. sales and marketing) (Bengtsson and Kock, 2000; Luo, 2007; Rusko, 2011). This assumption is supported by company examples. Take the smart card industry as an example, firms dominantly cooperate in input activities (e.g. R&D, promotion of standards, and new product development) and compete in output activities (e.g. sales and marketing) where the goal becomes to appropriate the largest share of the collectively created value (M’Chirgui, 2005). However, the assumption that competitors only cooperate in input activities also contradict the practical examples in which competitors also form alliance in output activities such as sales and marketing (Kylänen and Rusko, 2011; Rusko, 2011). Only recently a few studies have acknowledged the importance of coopetition in output activities and started to explore the coopetitive dynamics in them (e.g. Lindström and Polsa, 2016; Chiambaretto et al., 2016). Cooperating with competitors in output activities is a new research area and its success factors and effects on performance remain unknown, which constitutes the ***second research gap***.

When investigating the antecedents and outcomes of coopetition, resource-based view is widely used by scholars. Although scholars have acknowledged the importance of knowledge and learning in coopetition and studied knowledge-related

outcomes, such as knowledge sharing, creation and acquisition (e.g. Ritala and Hurmelinna-Laukkanen, 2009; Bouncken and Kraus, 2013; Osarenkhoe, 2010), studies investigating coopetition outcomes through a knowledge-based (Grant, 1996) lens is rather scarce. It is important to draw a link between knowledge-based outcomes of coopetition and traditional business performance outcomes. Therefore, the ***third research gap*** concerns investigating coopetition and how knowledge-based outcomes (resources and capabilities) can be derived by integrating a knowledge-based view and how this translates into performance outcomes.

Finally, the consequences of inter-firm coopetition should encompass both social and economic outcomes. However, it is quite rare to find empirical studies that adopt a comprehensive view when examining performance outcomes of coopetition. Most empirical studies have used single financial indicator or innovation outcomes (e.g. Luo, 2007; Ritala, 2012; Bouncken and Fredrich, 2012; Wu, 2014). To gain a multidimensional conceptualisation of performance, researchers and managers need to pay equal attention to various aspects of a firm's conduct (Lado et al., 1997). Therefore, the ***fourth research gap*** concerns examine the effect of coopetition on performance by using multidimensional performance indicators.

1.4 Research Objectives

In light of the research gaps identified above, the current study has four main research objectives, including to conceptualise and operationalise the inter-firm coopetition concept, to synthesise cooperating with competitors in input and output activities in one model and contrast their outcomes, to investigate coopetition outcomes from a knowledge-based view, and to investigate the effect of coopetition on performance by using multidimensional performance indicators.

Extant coopetition literature offers valuable accounts and facets of coopetition, whereas they are characterised with a high degree of terminological, conceptual, and explanatory heterogeneity, which hinders research progress (Dorn et al., 2016). Scholars have called for a coherent, synthesising conceptualisation of this construct (Gnyawali et al., 2006; Bengtsson et al., 2010; Gnyawali and Park, 2011). Inter-firm coopetition needs to be narrowly defined so that it can be distinguished from other

inter-firm interactions. However, the majority of extant coopetition studies have adopted Bengtsson and Kock's (1999, p.178) broad definition of coopetition, which is 'a relationship simultaneously containing elements of both cooperation and competition'. However, arguably every inter-firm relationship has both cooperative and competitive elements. Hence, defining coopetition in such a broad approach hampers the development of coopetition concept and a more focused definition is needed. Additionally, scholars have called for development of new measurement scales of the coopetition concept (e.g. Bengtsson and Raza-Ullah, 2016) as existing measurement scales are either incomplete or erroneous (a more detailed explanation can be found in section 2.2.7). Therefore, the first research objective is:

To conceptualise and operationalise the inter-firm coopetition concept.

The majority of coopetition studies are based on the assumption that cooperation between competitors only takes place in business activities far from customers (input activities) (e.g. Bengtsson and Kock, 1999, 2000; Rusko, 2011), whereas recently it has been acknowledged that competitors also cooperate in output activities close to customers such as sales and marketing (e.g. Kylänen and Rusko, 2011; Rusko, 2011; Lindström, and Polsa, 2016). The outcome of cooperating with competitors in output activities remains under-researched and it may have different implications to cooperating in input activities. Therefore, the second research objective is:

To synthesise cooperating with competitors in input and output activities in one model and contrast their outcomes.

As discussed above (section 1.2.2 and 1.2.3), scholars have investigated the effect of coopetition on knowledge-related outcomes and firm performance outcomes. However, these two types of outcomes are examined separately in different studies. According to knowledge-based theory, knowledge is the most strategic and valuable resource in a firm, and can lead to competitiveness and superior firm performance (e.g. Grant, 1996; Lane and Lubatkin, 1998; Chacar and Coff, 2000; Eisenhardt and Galunic, 2000; Gupta and Govindarajan, 2000). Therefore, it is important to investigate whether the new knowledge-based resources and capabilities gained from coopetition can lead to better performance. On the other hand, it has been

identified that sharing knowledge with competitors also entails potential risks such as opportunism and knowledge spillovers (Ritala and Hurmelinna-Laukkanen, 2009; Nielsen and Lassen, 2012; Tracey, 2012). In other words, firms may also lose uniqueness of their existing knowledge base when cooperating with competitors. Thus, it is meaningful to evaluate the positive as well as negative effect of coopetition on performance from a knowledge-based view. Therefore, the third research objective is:

> *To understand coopetition outcomes from a knowledge-based view.*

Firm final outcomes may include perceived success, concurrent financial gain, goal achievement, product or process improvement and adaptability to the environment. It is important to view performance in a wide variety of areas than just the maximisation of short-term profits (Lado et al., 1997). Therefore, the fourth research objective is:

> *To understand the effect of coopetition on performance by using multidimensional performance indicators.*

1.5 Potential Contributions

In addressing the major research gaps identified above, this study aims to make key contributions to the coopetition literature and these are as follows.

First, the most valuable contribution of this study is to conceptualise and operationalise two distinct types of coopetition, and investigate their performance outcomes from a knowledge-based view. As discussed above, competitors not only cooperate in input activities, but also in output activities. Although these two types of coopetition have similarities such as encompassing competitive and cooperative elements, they may lead to different types of generation of different types of knowledge-based resources and capabilities and have different negative effects. This is the first study that conceptualises and operationalises these two coopetition concepts, synthesises them in one conceptual model, and tests their impact on other key coopetition variables with a quantitative approach.

Second, this study makes a theoretical contribution to the establishment and operationalisation of the '*loss of uniqueness of existing knowledge-based resources and capabilities*' construct. In the process of coopetition, firms need to exchange their own knowledge-based resources and capabilities to gain access to their partners'. Extant coopetition studies only implicitly and conceptually argue that firms may lose the uniqueness of their knowledge base when cooperating with competitors (Okhuysen and Eisenhardt, 2002; Luo, 2005), whereas the 'loss of uniqueness' concept has not been operationalised or examined in an empirical way. Scholars have started to investigate how to establish knowledge protection mechanisms and governance structures to minimise the potential risks embedded in coopetition such as knowledge spillovers. Therefore, the operationalisation of the 'loss of uniqueness' construct is important at this stage as it facilitates the future quantitative studies on whether different protection mechanisms can reduce the 'loss of uniqueness' of a firm's existing knowledge-based resources and capabilities.

Third, this study aims to make a contribution to the coopetition performance outcome research. As discussed above, profitability is often used as the single final performance outcome in empirical coopetition studies. However, performance is a multidimensional construct and a more comprehensive view is needed. In this study, a three-dimensional conceptualisation of performance is adopted, consisting of efficiency, effectiveness, and adaptiveness (Ruekert et al., 1985). This multi-dimensional approach is appropriate because it measures the financial performance as well as customer performance and strategic performance. This is the first quantitative coopetition study that investigates the performance outcome in terms of effectiveness and adaptiveness. The results are believed to have theoretical implications for future coopetition performance research.

1.6 Thesis Overview

In order to fulfil the research objectives identified above, the research is implemented in a sequential manner (see Figure 1.1). The thesis in organised into six chapters and each chapter has its individual focus and they are logically connected with each other.

Chapter One has presented the research background and general focus of the study. The significance of the study is also discussed, followed by research gaps and research objectives.

Chapter Two represents a literature review on the topic of coopetition as it is the core concept in this study. Various facets and characteristics of coopetition are reviewed first, including with regard to its definitions, typologies, antecedents, outcomes, tensions, and operationalisation. The theoretical roots of coopetition research are then reviewed in order to develop a theoretical foundation. Four most commonly used theories in the coopetition literature are discussed, which are resource-based view (RBV), knowledge-based view (RBV), game theory, and transaction cost theory. Finally, Third, after reviewing the literature on coopetition and its theoretical foundations, the research gaps are identified and conclusions are drawn for moving forward towards developing the conceptual model.

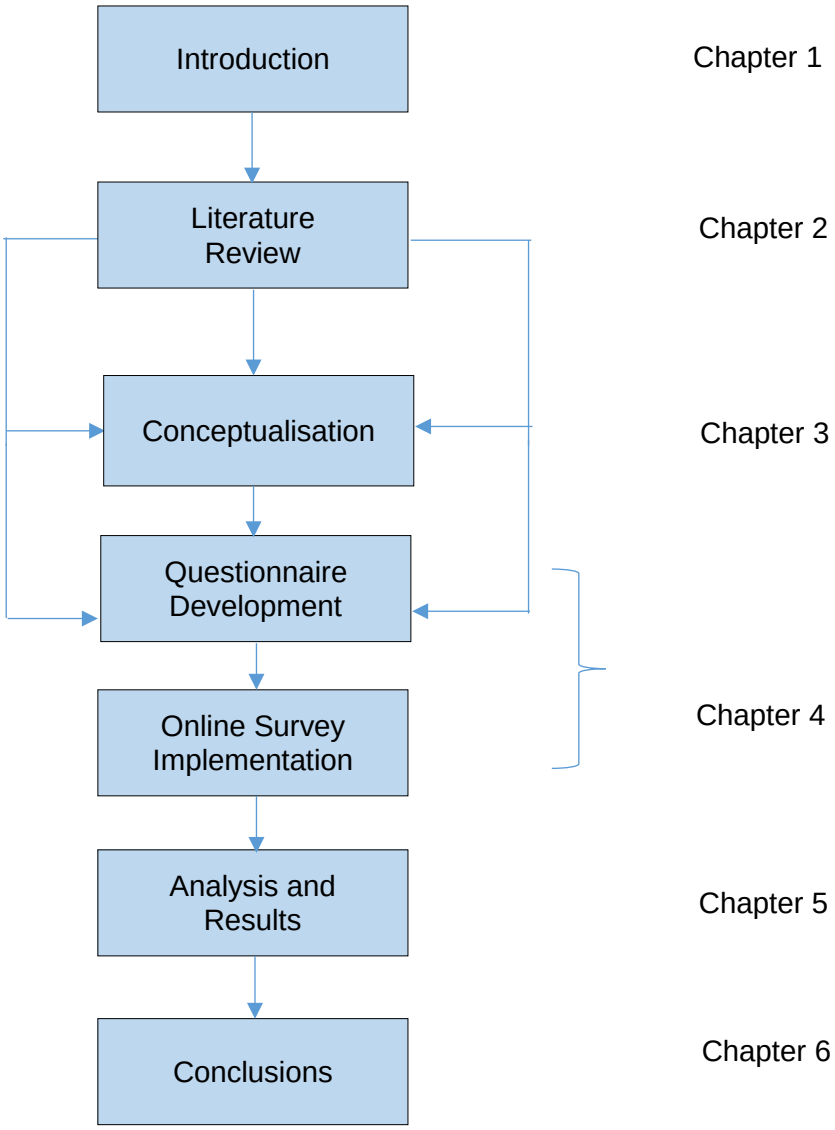
In Chapter Three, the choices of using inter-firm level of analysis and business as unit of analysis are explained first. Then, a number of hypotheses are proposed with regard to the relationships among the key constructs: coopetition, opportunism, new knowledge-based resources and capabilities, loss of uniqueness of existing knowledge-based resources and capabilities, and performance outcomes. The hypotheses are developed during the literature review of Chapter Two and a number of key constructs are firstly proposed. A conceptual framework is also presented at the end of the chapter.

Chapter Four provides a discussion of the research design and empirical method used for hypotheses testing. A quantitative method is chosen as the research method because it allows for further generalisation of the results. Different survey methods are also discussed and their advantages and disadvantages are compared. Online survey is determined to be the survey method. The process of online questionnaire design is also discussed, followed by a detailed description of pilot testing and main survey. In the final section of the chapter, a discussion of the analytical procedure is presented. The analysis of data employs a two-stage approach suggested by Anderson and Gerbing (1988), which includes a measurement model assessment and a structural model assessment.

Chapter Five focuses on presenting and discussing the results of the quantitative study. A preliminary data analysis is conducted first, including missing value analysis, profile analysis, and respondents' knowledgeability assessment. Second, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) are used to develop the measurement model, in which reliability and validity of constructs are also assessed to ensure psychometric soundness. Finally, Structural Equation Modelling (SEM) is chosen as the statistical method for hypotheses testing. Normality of all scales is assessed and then the results of SEM are presented. The Chapter concludes with a summary of the results of hypotheses testing.

Chapter Six presents the conclusions of the study. This Chapter consists of a summary of the research, theoretical and managerial contributions, limitations, and future research directions.

Figure 1.1 Structure of the Thesis



Chapter 2 Literature Review

2.1 Introduction

In this chapter, the literature of the central concepts underpinning this study is reviewed. The purpose of the literature review is to identify the research gaps and to serve as the basis for the development of a conceptual framework. To be more specific, this chapter is composed of three main sections.

In the first part, the literature on coopetition is reviewed as it is the core concept in this study. Because a coopetitive relationship means the co-existence of cooperation and competition (Brandenburger and Balebuff, 1996; Bengtsson and Kock, 1999; Gnyawali et al., 2006; Ghobadi and D'Ambra, 2012), literature of cooperation and competition needs to be firstly reviewed in this section. Various facets and characteristics of coopetition are then reviewed, including its definitions, typologies, antecedents, outcomes, tensions, and operationalisation.

Second, the theoretical roots of coopetition research are reviewed in order to develop a theoretical foundation. The coopetition literature has been criticised to suffer from incompleteness of theoretical foundations (Bengtsson et al., 2016). Theories used by scholars are debated to be fractured and lacked coherence (c.f. Walley, 2007; Bengtsson et al., 2010; Bengtsson and Kock, 2014). Four most commonly used theories in the coopetition literature are discussed, which are resource-based view (RBV), knowledge-based view (RBV), game theory, and transaction cost theory.

Third, after reviewing the literature on coopetition and its theoretical foundations, the research gaps are identified and conclusions are drawn for moving forward towards developing the conceptual model.

2.2 Coopetition

2.2.1 Cooperation and Competition

Competition and cooperation have been studied by scholars in the field of management and marketing research for several decades (e.g., Porter, 1980; Nielsen, 1987; Jorde and Teece, 1990; Fiegenbaum and Thomas, 1993). Padula and Dagnino (2007) reason that the strategic management literature has traditionally focused on the competition domain, which is argued to be a central driving force in pressuring and stimulating firms to innovate and upgrade their competitive advantage (Porter, 1990). While more recently, scholars highlight the importance of cooperation, emphasising a win-win situation for the cooperating firms (Padula and Dagnino, 2007).

Competitive and cooperative theories have been analysed on all levels, including individual, intra-firm, inter-firm, and network. Inter-firm cooperation and competition are predominantly studied in the literature and are also the focus of this study. Competition is traditionally defined as the conflicting and rivalling relationship among competitors (Bengtsson and Kock, 2000). Competition is also seen by Brandenburger and Nalebuff (1996) as a zero-sum game (or win-lose/lose-win game) where a rise in a firm's profit comes only at the expense of rival firms. Competition is also defined as 'a dynamic situation that occurs when several actors in a specific area (market) struggle for scarce resources, and/or produce and market very similar products or services that satisfies the same customer need' (Osarenkhoe, 2010 p 203). Through such competitive activities, competitive advantages are established and accumulated when a firm deploys its core competencies to achieve an advantageous position in the industry or market and offer superior products to customers relative to competitors (Prahalad and Hamel, 1990; Porter, 1980, 1985).

By contrast, cooperation refers to a firm's belief in a cooperative relationship with alliance partners to achieve its strategic goals (Baker et al., 1999). Cooperation has been regarded as a positive-sum-game (or a win-win game) improving common interests such as the demand for products and market size (Rusko, 2011). It highlights collaborative advantage rather than competitive advantage and holds the

idea that players need to rely on interdependent relationships with other businesses through the establishment of strategic cooperation agreements to achieve targets (Miles and Snow, 1986; Thorelli, 1986; Yoshino and Rangan, 1995). Mutual benefits and common goals are the preconditions to build such strategic interdependent business relationships.

However, limitations exist in both streams. Brandenburger and Nalebuff (1996) argue that competitive perspective underestimates the importance of positive interdependences of cooperation, while Padula and Dagnino (2007) suggest that the cooperative perspective overlooks the negative effects of the interdependences among cooperative organisations. Competition theorists regard cooperation only as a result of market imperfection and do not allow for the possibility of cooperation positively impacting on performance (Bouncken et al., 2015), while the cooperation stream underestimates the competitive dynamics and views them as negative influences because of risks such as knowledge spillovers and learning races (e.g., Kale et al., 2000). Nowadays, both perspectives are only partially reflecting the reality. Contemporary businesses require both strategies simultaneously to achieve success (Lado et al., 1997), which leads to the emergence of the relatively new concept: coopetition.

2.2.2 Definitions of Coopetition

The term ‘coopetition’ was first introduced by Raymond Noorda in the 1980s (Luo, 2007). Since the mid-1990s, many articles have been published studying coopetition from different perspectives, such as dyadic coopetition (Bengtsson and Kock, 2000), multifaceted coopetition (e.g., Luo, 2004), intra-firm coopetition (e.g., Amburgey and Rao, 1996; Tsai, 2002; Luo et al., 2006), and industry-level coopetition (Rusko, 2011). The reason why this concept has been put under the spotlight is obvious and straightforward. As discussed above, nowadays organisations need to strategically and simultaneously combine both cooperation and competition to achieve success. Cooperation with other businesses can help a firm to specialise in core business and have access to resources that the firm does not possess but are necessary for certain business activities, while competition can keep a firm under pressure and being innovative, which can motivate the firm to strengthen its existing competitive

advantages and develop new competences. Scholars and practitioners have realised that striking a right balance between the two is vital to a firm's success (Jorde and Teece, 1989). Scholars (e.g., Gulati, 1998; Khanna et al., 1998; Kogut, 1998; Afuah, 2000) argue that coopetitive activities could be critical sources of innovation, organisational learning, complementary products, capabilities, critical resources and lead users.

By contrast with cooperation (positive-sum) and competition (zero-sum), coopetition has been regarded as a variable-positive-sum game [or a win–win–win game (Walley, 2007)] because it has the characteristics of both competition and cooperation (Padula and Dagnino, 2007; Okura, 2007). It has a third 'win' because coopetitive activities also create value to the target customers by providing creative products to the market, lowering prices due to more efficiency of resource usage, and better quality products, etc.

Similar to cooperation and competition, coopetition is also a broad concept that carries meaning across different levels of analysis (individual, intra-firm, inter-firm, and network) within organisational and management research. Coopetition on an *individual level* occurs within teams and can be used to facilitate innovation and creativity (e.g., Hutter et al., 2011; Baruch and Lin, 2012). This happens when team members are expected to cooperate with each other, while simultaneously each individual is incentivised to improve their own performance (e.g., Mooradian et al., 2006). On an *intra-firm level*, coopetition describes the phenomenon when subunits within a firm compete for 'parent resources, corporate support, power delegation, market expansion, and global expansion' (Luo, 2005, p.73) and simultaneously have the need for cooperation (e.g., Ritala et al., 2009). On an *inter-firm level*, there are mainly two streams in the literature. The first stream has dealt with firms that are on the same value chain level and in the same industry (i.e. direct competitors) form cooperative relationships (e.g., Burgers et al., 1998; Bengtsson and Kock, 1999, 2000; Luo, 2007; Daidj and Jung, 2011). The second stream has studied how companies within a supply chain (indirect competitors) cooperate with each other (e.g., Zerbini and Castaldo, 2007; Eriksson, 2008; Bakshi and Kleindorfer, 2009). Studies on a *network level* primarily focus on competitive behaviour within a cooperative network structure (intra-network) (e.g., Gnyawali et al., 2006) and

coopetition between networks (inter-network) (e.g., Peng and Bourne, 2009). Despite that some similarities among the different levels of analysis exist, definitions, theories, characteristics, and findings of them drastically vary, which resulted in the difficulty of building a coherent understanding on coopetition phenomenon (Dorn et al., 2016). Therefore, a more focused approach needs to be taken and the coopetition concept needs to be carefully defined.

The focus of this study is inter-firm coopetition. Currently accepted definitions and descriptions accorded to coopetition are presented in Table 2.1 below. Bengtsson and Kock (2003) simply define inter-firm coopetition as a situation where competitors simultaneously cooperate and compete with each other. While Brandenburger and Nalebuff (1995, 1996) add the purpose of this phenomenon by saying that competing firms cooperate with each other in order to create value and a bigger business pie, and then compete for the created value and divide the pie up. Luo's (2007) study is focusing on the global competition, so coopetition has been defined by him as the simultaneous competition and cooperation between two or more rivals competing in the global market. In general, inter-firm coopetition has been defined either broadly or narrowly. A broad inter-firm coopetition refers to a value-net comprising a firm's supplier, customer, competitors, and complementors (Afuah, 2004; Brandenburger and Nalebuff, 1996), while a narrowly defined coopetition only refers to cooperation between two directly competing firms (Bengtsson and Kock, 1999, 2000; Gnyawali and Madhavan, 2001; Luo, 2005; Padula and Dagnino, 2007). Bengtsson and Kock (2014) suggest that it is important to distinguish coopetition from other inter-organisational interactions, such as strategic alliances and joint venture, in order to clarify and consolidate the definition. When the coopetitive partners are not direct competitors, for example when with complementors, the relationship is usually dominated by cooperation. A typical example is partnership between computer hardware and software companies. The software products complement hardware offerings and make them more appealing, while in such relationship, the competitive elements are minimal. Scholars also use another concept to better describe such relationships: 'strategic alliance'. More importantly, if coopetition is simply defined as the co-existence of cooperation and competition, any cooperative relationship can be regarded as coopetition because there would always be some competitive elements to some extent, such as negotiation of prices and extra services. However, this

broadly defined coopetition may result in a lack of focus, difficulty in obtaining consensus, and heterogeneity in terminologies employed (Dagnino, 2007; Yami et al., 2010; Bengtsson and Kock, 2014; Dorn et al., 2016). Therefore, the coopetition concept needs to be more narrowly defined.

Therefore, a more narrowly focused definition needs to be adopted. Dahl (2014, p. 272) defines coopetition as 'the notion that two organisations simultaneously cooperate in some activities, such as research and development or purchasing, as they compete with each other in, for example, sale activities'. This definition adopts a value-chain perspective, stating that coopetitive firms cooperate on some business activities in the value chain, while at the same time compete on some others. This definition also emphasises the co-existence of both competition and cooperation. If competition and cooperation are independent of each other, with only one of them operating at a given time, coopetition ceases to exist (Luo, 2007; Chen, 2008). Furthermore, inter-firm coopetition can be more narrowly defined as a relationship between direct competitors. Therefore, in this thesis, inter-firm coopetition is defined as: a situation that direct competitors simultaneously cooperate in some activities, such as research and development or purchasing, as they compete in other activities, such as sales and marketing.

Table 2.1: Definitions and descriptions of Coopetition

Year	Author	Definition
2016	Lechner, Soppe, and Dowling	Vertical coopetition describes a situation where a firm has a vertical exchange relationship with a direct competitor (p. 67)
2014	Bengtsson and Kock	Coopetition is a paradoxical relationship between two or more actors simultaneously involved in cooperative and competitive interactions, regardless of whether their relationship is horizontal or vertical (p.182).
2014	Dahl	Coopetition refers to the notion that two organisations simultaneously cooperate in some activities, such as research and development or purchasing, as they compete with each other in, for example, sale activities (p.272).
2012	Song and Lee	Coopetition is an occurrence between different supply chains (p.18).
2011	Gnyawali and Park	Coopetition is a simultaneous pursuit of collaboration and competition between a pair of firms (p.651).
2010	Bengtsson, Eriksson and Wincent	Coopetition is a consequence of changes to structural conditions in the market (p.29).
2010	Ritala	Coopetition is a collaborative relationship between two or more independent economic actors simultaneously engaged in product-market competition (p.21).
2007	Luo	Coopetition is the simultaneous competition and cooperation between two or more rivals (p.130).
2004	Zineldin	Coopetition is a business situation in which independent parties cooperate with one another and coordinate their activities, thereby collaborating to achieve mutual goals, but at the same time compete with each other as well as with other firms (p.780).
2002	Dagnino and Padula	Coopetition is a matter of incomplete interest and goal congruence concerning firms' interdependence (p.2) …It is a multidimensional and multifaceted concept which assumes a number of different forms…it is all but easy to grasp its structure, processes and evolving patterns (p.13).
2000	Bengtsson and Kock	Coopetition is the dyadic and paradoxical relationship that emerges when two firms cooperate in some activities, such as in a strategic alliance, and at the same time compete with each other in other activities (p.412).
Definition used in this thesis		A phenomenon that direct competitors simultaneously cooperate in some activities, such as research and development or purchasing, as they compete in other activities, such as sales and marketing.

2.2.3 Typologies of Inter-Firm Coopetition

Bengtsson and Kock (2003) simply define coopetition as a one-dimensional dyadic relationship and base their typology on the two extreme ends of a firm's value chain. They implicitly assume that coopetitors cooperate in the upstream activities and compete in the downstream activities. Upstream activities involve R&D, buying, and the processing of raw materials, while downstream activities include distribution, services, product development, and marketing (Bengtsson & Kock, 2000; Walley, 2007). In between there are also midstream activities such as production (Mariani, 2007). However, more recently, Lindström and Polsa (2016) start to investigate coopetition activities close to the customer, which are also known as output activities including sales, marketing, and branding. In this sense, inter-firm coopetition can be categorised into *coopetition on upstream activities*, *coopetition on midstream activities*, and *coopetition on downstream activities*.

Bengtsson and Kock (2000) also present another three different types of coopetition based on the level of intensity of competition and cooperation in the relationship. The three types are *cooperation-dominated relationships*, *equal relationships* and *competition-dominated relationships*. They suggest that upstream activities are cooperation-dominated, downstream activities are competition-dominated, and midstream activities are equal relationship.

Rusko's (2010) typology of coopetition can be regarded as a modification of Luo's (2004) approach, which is multidimensional or multifaceted and in the context of multinational companies (MNCs). One dimension of Rusko's (2000) typology is based on the degree of external (or internal) coopetition and involves four 'strategic domains': 1) *coopetition with rivals*, 2) *coopetition with government*, 3) *coopetition with alliance partners*, and 4) *coopetition within a company*. The other dimension is the three stages of the supply chain according to Bengtsson and Kock's *(2000)* study above. Combining these two dimensions produces a 3×4 table describing twelve different types of coopetition (Figure 2.1).

Figure 2.1: Rusko's (2010) Typology of Coopetition

Type of coopetition		Upstream moves Input activities/ cooperation		Downstream moves Output activities/ competition
		Typically cooperation-dominated Relationship	Equal Relationship	Typically competition-dominated Relationship
HIGH *Degree of external coopetition* LOW	1) Coopetition with rivals	Dyadic upstream and factor-based coopetition, with rivals without closeness of customers	Dyadic mid-stream coopetition, e.g. in semi-finished products, with rivals	Dyadic product- and market-based downstream coopetition with rivals, and with closeness of consumer market
	2) Coopetition with a government	Multifaceted factor-based coopetition with rivals and a government	Multifaceted mid-stream coopetition with a government	Multifaceted downstream coopetition
	3) Coopetition with alliance partners	Internal factor-based coopetition with alliance partners	Internal mid-stream coopetition with alliance partners	Internal downstream coopetition with alliance partners
	4) Coopetition within a company	Intra-firm factor-based	Intra-firm mid-stream coopetition	Intra-firm downstream coopetition

Source: Rusko, 2010

Another typology of coopetition is gaining popularity in recent years, which are vertical coopetition and horizontal coopetition (e.g., Choi et al., 2009; Wilhelm, 2011; Lacoste, 2012; Soppe et al., 2014; Lechner et al., 2016). Dowling et al. (1996) identify two types of vertical coopetition: first, a competitor is a supplier of the firm and second, a competitor is a buyer of the firm. Another variation of vertical coopetition is a subcontracting relationship with competitors. In contrast, horizontal coopetition refers situations where direct competitors form partnership such as joint ventures or strategic alliances (Soppe et al., 2014). However, as discussed above, it is important to distinguish coopetition from other forms of inter-organisational interactions. Therefore, in this study, joint venture is not regarded as a form of coopetition because it is usually a new business entity created by two or more firms, which is against the notion of coopetition discussed in last section that competitors cooperate on some business activities while compete on some others.

2.2.4 Antecedents of Coopetition

Antecedents of coopetition refer to the specific conditions that make coopetition more likely to emerge (Dorn et al., 2016). In the alliance literature, firms are engaged in partnership with other firms in order to learn from partners (Dussauge et al., 2000), share and create knowledge (Khanna et al., 1998; Inkpen, 2000), share the risks and costs of R&D (Ouchi and Bolton, 1988; Hagedoorn, 2002), internalise partners' skills and resources (Dussauge et al., 2000), share expertise and create radical innovation (Afuah, 2000; Rothaermel, 2001), create economies of scale (Koh and Venkatraman, 1991), and raise entry barriers (Eisenhardt and Schoonhoven, 1996).

Some of the reasons why firms cooperate with direct competitors are similar to the reasons above. Firms cooperate with competitors to obtain more resources and capabilities than the firm owns to exploit market opportunities, such as developing new products in response to market demands (Garette et al., 2009) and entering international markets (Luo, 2007). However, cooperating with direct competitors is a more difficult decision than with non-competitors. Therefore, specific conditions are required to make coopetition more likely to occur. These conditions can be categorised into three facets: market conditions, dyadic factors between potential partner firms, and individual factors of firms.

2.2.4.1 Market conditions

Industry properties and dynamics determine how likely coopetition is to occur (e.g., Luo et al., 2006; Lai et al., 2007; Chetty and Michailova, 2011). Dowling et al. (1996) suggest that coopetition is more likely to take place in consolidated industries, global industries, regulated industries, and munificent environments. Scholars (e.g., Gnyawali and Park, 2009, 2011; Bouncken and Fredrich, 2012) also argue that companies in high-tech industries are more likely to form coopetition because of high R&D expenses, short product lifecycles, and the combination of different technologies. These characteristics of high-tech industries mean that companies have the pressure to react and adapt quickly and flexibly with high investments, which sometimes force them to cooperate even with the fiercest competitors. Padula and Dagnino (2007) investigate coopetition in a more general context and report that

coopetition is more likely to occur in highly dynamic and competitive markets. Gnyawali and Park (2011) also state that existing coopetitive relationships in an industry may make coopetition more likely to be formed by other rivals in order to remain competitive in the industry.

Another market condition that makes coopetition more likely to occur is related to the lifecycle stage of the industry. Vernon (1966) proposes the product life-cycle theory which includes four stages: introduction, growth, maturity, and decline. Scholars (e.g., Gnyawali and Park, 2011; Oshri and Weeber, 2006) note that coopetition is likely to occur in an early lifecycle stage when there is a need for rapid standard-setting. More researchers (e.g., Lechner and Dowling, 2003; Gnyawali et al., 2006; Bonel and Rocco, 2007; Bengtsson et al., 2010) report that firms in mature industries are motivated to form coopetition for the purpose of achieving economies of scale, reducing costs, and penetrating existing distribution channels. Another reason is that when an industry develops into a mature stage, it is difficult to eliminate competitors and cooperating with them is a more beneficial strategy (Harfield, 1999).

Political or regulatory environment may also become an antecedent of coopetition. They could either hinder or promote coopetition (e.g., Dowling et al., 1996; Mariani, 2007; Kylänen and Rusko, 2011). Governments sometimes force competitors to work together to ensure efficient resource usage (Mariani, 2007). By contrast, governments sometimes hinder coopetition in order to prevent monopoly or formation of cartel (Burgers et al., 1998).

2.2.4.2 Dyadic factors between potential firms

Other scholars (e.g., Ngowi and Pienaar, 2005; Barretta, 2008; Cheng et al., 2008; Gnyawali and Park, 2009; Osarenkhoe, 2010) have focused on the dyadic factors in the relationship between potential firms that may lead to coopetition. One important factor is compatible resource endowment (e.g., Gnyawali and Park, 2009). Due to high market commonality and resource similarity, competitors are likely to face similar challenges and possess resources and capabilities that are directly relevant to each other (Chen, 1996), which may make cooperating with a competitor more preferable than non-competitors. Second, presence of trust between potential

partners (Ngowi and Pienaar, 2005; White, 2005) also facilitates formation of coopetitive relationships. Mutual trust could counterbalance the potential for opportunistic behaviour in coopetition (Das and Teng, 2000).

2.2.4.3 Individual factors of firms

It has been reported that certain firm-specific factors can also make coopetition more likely to occur (e.g., Lydeka and Adomavicius, 2007; Eriksson, 2008; Gnyawali and Park, 2009; Schiavone and Simoni, 2011). Gnyawali and Park (2009) suggest that firm-level drivers of coopetition can be broadly divided into two key aspects. The first one is prospecting strategy, which is due to proactive reasons. The second one is perceived vulnerability, which is due to reactive reasons. They argue that firms with prospecting strategy are motivated to engage in coopetition because 1) they have a strong desire to learn from competitors who possess valuable knowledge, 2) they want to increase and solidify bargaining power, and 3) they want to increase overall competitive advantage. Gnyawali and Park (2009) also point out that perceived vulnerability is a reactive driver for the formation of coopetition when new competitors are entering the market; the firm itself is trying pioneering technologies; the firm is experiencing poor performance relative to targets; and the firm lacks resources.

Similarly, Dahl et al. (2015) suggest that the reasons for coopetition strategies can be deliberate or emergent. Deliberate coopetition is a planned practice which is characterised with goal-orientation and intension (Dagnino and Rocco, 2009; Kylänen and Rusko, 2011). In this scenario, the rationality stems from profit maximisation or acting in line with the social system in which the firm operates (Whittington, 2001). In contrast, when a firm engages in coopetition because of emergent reasons, its strategic activities are based on spontaneous acts (Kylänen and Rusko, 2011) and without pre-articulated intentions (Tidström, 2008).

In addition, Schiavone and Simoni (2011) note that a firm's prior experience with coopetition is an important driver that determines whether it will enter a relationship with competitors and how the relationship will be set up.

2.2.5 Benefits of Coopetition

It has been discussed in Chapter 1 (section 1.2) that coopetition may lead to innovativeness, competitiveness, creation and acquisition of new knowledge, and higher profitability. Dorn et al. (2016) suggest that output of coopetition for a firm include enhanced financial outcomes and enhanced structures and processes through learning from coopetitive partners. It is reported in the literature that coopetition strategies can help firms to share costs, mitigate risks, and achieve economies of scales (Luo, 2007; Gnyawali and Park, 2011). Therefore, coopetition can enhance the efficiency and effectiveness of firms and create a win-win situation with lower overall costs (Chin et al., 2008). Even though engaging in coopetition also helps competitors to lower cost and increase their competitiveness, Soubeyran and Weber (2002) argue that the benefits of lowering own costs outweigh the negative effects. In addition, coopetitive firms are in a more advantageous position than those who are not part of the cooperation.

With regard to non-financial benefits, scholars suggest that firms also cooperate with competitors on R&D (Walley, 2007) in order to have access to competitors' knowledge and expertise which they can then internalise into their own company (Bengtsson and Kock, 2000). Many studies have shown that through coopetition, partners can develop a common knowledge base using all involved firms' experience and expertise that enhances their innovation capacity (e.g., Quintana-Garcia and Benavides-Velasco, 2004; Ritala and Hurmelinna-Laukkanen, 2009; Ritala, 2012). Walley (2007) notes that coopetition on innovation can help firms to develop new products or services which they would not be able to develop without a coopetitive partner or at a much slower speed if only developing by themselves. Bouncken and Kraus (2013) argue that customers can also benefit from the joint innovation efforts which result in multi-feature products at reasonable prices stemming from economies of scale, complementary resources, integrative technologies, reduced duplication, and intensified competition at the group level. However, Oliver (2004) states that coopetition is more likely to occur in the early exploratory stages of the innovation process when firms need novel solutions. Nieto and Santamaria (2007) claim that coopetition strategy is only viable when firms are performing basic research and establishing standard settings. When firms are at the stage of developing novel

products, coopetition is the least advantageous strategy because a more novel product is highly important to a firm's competitive advantages. Therefore, Nieto and Santamaria (2007) conclude that coopetition is an inappropriate strategy when firms are developing highly novel innovation.

2.2.6 Risks of Coopetition

Because of the competitive elements in the coopetitive relationship, the benefits of coopetition are not warranted and managing coopetition is a challenging task (Gnyawali and Park, 2009). Pellegrin-Boucher et al. (2013, p. 74) even describe coopetition as a 'dangerous situation' because of the complex and conflicting nature of the relationship. Bouncken and Bogers (2015) suggest that the risks associated with coopetition can be divided into conflicts with partners and internal tensions.

2.2.6.1 Conflicts with partners

Bengtsson and Kock (2000) suggest that inter-firm coopetition may affect the entire network positively as well as negatively. Coopetitive partners face the dilemma between creation of common value and appropriation of private value (Gnyawali et al., 2012; Ritala and Tidström, 2014). After knowledge creation, opportunistic behaviour of coopetitive firms can be a critical issue when firms appropriate and integrate knowledge (Levy et al., 2003; Baumard, 2009). Sometimes opportunistic coopetitors use their power to force other parties to act in a way which is only to their own best interest at the expense of others (Bouncken and Kraus, 2013; Pellegrin-Boucher et al., 2013). It is also possible that coopetitive partners become less committed to the cooperation over time once they have achieved their own objectives (Bouncken and Bogers, 2015). Therefore, Cassiman et al. (2009) argue that opportunistic behaviour and knowledge leakage can hinder the development of radical innovation which then negatively impact on the competitive advantages of the partners. Moreover, Coopetitive partners can also have different strategic priorities when forming cooperation, which may also lead to disagreement and conflicts (Bonel and Rocco, 2007). When joint objectives or mutual goals are not defined clearly because of a lack of planning before the coopetition starts, misunderstanding and mistrust can occur, which then results in inter-firm conflicts (Lado et al., 1997;

Anslinger and Jenk, 2004). In addition, Baumard (2009) suggests that depending on coopetitive partners' resources and expertise may lead to a loss of flexibility and freedom.

2.2.6.2 Internal tensions

Bengtsson and Kock (2000) argue that conflicts with coopetitive partners may not necessarily be seen as a threat, instead it needs to be accepted and better managed. However, they argue that it is difficult for individuals to cooperate and compete with each other simultaneously, and therefore management of cooperation and management of competition need to be separated to manage internal tensions (c.f. Dowling et al., 1996; Herzog, 2010).

However, other scholars have criticised the 'separation' principle because the separation principle may create new internal tensions (Das and Teng, 2000; Oshri and Weber, 2006; Chen, 2008). The individuals in the functions that cooperate with competitors can be perceived as 'traitors' because they cooperate with 'the enemy' (Le Roy and Fernandez, 2015), which may stimulate more inter-individual tensions and threaten stability within the firm. Therefore, scholars (e.g., Das and Teng, 2000; Oshri and Weber, 2006; Chen, 2008; Lüscher and Lewis, 2008; Smith and Lewis, 2011) have proposed an integration principle, which allows individuals to understand each other's roles in the coopetitive relationships and to cooperate accordingly.

More recent studies suggest the combination of both principles to better manage internal tensions (Pellegrin-Boucher et al., 2013; Fernandez et al., 2014; Le Roy and Fernandez, 2015). They suggest that the separation principle needs to be adopted to avoid individuals' role ambiguity and to achieve better efficiency, while the integration principle can help to reduce internal tensions between individuals who are in charge of cooperation and those in charge of competition. Combining these two principles helps firms to maintain a balance between competition and cooperation and allows individuals to behave not too cooperatively or too competitively.

2.2.7 Operationalisation of Coopetition

In the coopetition literature, measures of coopetition are not well-established because of the limited number of quantitative studies. In fact, Dorn et al. (2016) report that 36% of the coopetition articles are conceptual, and about 40% are qualitative studies that mostly employ case study research, while only 20% use quantitative methods. Except that Mention (2011) uses a single dichotomous item to measure coopetition (1= firm is involved in at least one cooperation with competitor; 0= firm has no cooperation with competitor), coopetition is mostly operationalised as *coopetition propensity* (e.g., Luo, 2007; Peng et al., 2012; Ritala, 2012; Wu, 2014) or as a *multiplicative measure of cooperation and competition* (e.g., Bouncken and Fredrich, 2012; Kim et al., 2013; Bengtsson et al., 2016).

2.2.7.1 Coopetition Propensity

Ritala (2012) uses a continuous and single variable to measure coopetition orientation. Two questions about coopetition are asked in the survey: ‘How many alliances have you formed over the last five years?’, and ‘How many of these alliances have you formed with your competitors (firms operating in the same business area)?’ Coopetition propensity is measured by dividing the number of alliances with competitors by total number of alliances. The rationality is that the more competitors there are in a firm’s portfolio of alliances, the more oriented towards coopetition the firm is. However, measuring coopetition only on the basis of this ratio is problematic because it fails to reflect how closely the firm is cooperating with each coopetitive partner. For example, firm A and B both are cooperating with 10 out of 100 competitors in their own industry. Firm A cooperate these 10 competitors on R&D, NPD, and manufacturing, while firm B only cooperate on manufacturing. Their scores on the ‘coopetition orientation’ are the same, even though firm A is obviously more coopetitive than B.

Luo et al. (2007) and Peng et al.’s (2012) measures of coopetition propensity are similar in nature. Luo et al. (2007) use seven-point Likert scales to measure coopetition with five items: We have established cooperative agreements on 1) R&D with competing firms; 2) New product development with competing firms; 3)

Technology improvement with competing firms; 4) Market segmentation with competing firms; 5) Cross-selling with competing firms. Peng et al.'s (2012) study is based on the Taiwanese supermarket industry and uses five indicators for measuring coopetition: co-procurement, co-distribution, co-marketing, Chain-store co-management, and integrated information system (IT). Their measures use different business activities on which coopetition may occur to determine the firms' coopetition propensity. In this manner, comparisons can be made between companies not only based on the number of business activities on which they are cooperating with competitors, but also based on the intensity of each coopetitive activity. However, the items need to be exhaustive to cover all business activities on which coopetition may takes place. For example, if a company cooperates with a competitor on distribution or promotion, the respondent from the company cannot find these items in Luo et al.'s (2007) scale.

2.2.7.2 Multiplicative measure of cooperation and competition

Some scholars use another approach to measure coopetition, in which intensity of cooperation and competition are measured separately first and then a multiplicative score is calculated to determine the coopetition intensity (Bouncken and Fredrich, 2012; Kim et al., 2013; Bengtsson et al., 2016).

Kim et al.'s (2013) items of the cooperative dimension of a coopetition strategy are adapted from Jap (1999) and de Ruyter et al. (2001), and items of the competitive dimension are adapted from Jap (1999) and Jap and Ganesan (2000). The items are:

Cooperative dimension of coopetition strategy:

. Our firm helps out this partner in whatever ways they ask.
. The business relationship with this partner could better be described as a "cooperative effort".
. Our firm worked with this partner firm to exploit unique opportunities.
. Our firm is always looking for synergistic ways to do business together with this partner firm.

Competitive dimension of coopetition strategy:

. Our firm competes against this partner firm for a better market share for the product.

. The relationship between our firm and this partner can best be described as "fighting for a fixed pie".

. Our firm usually has conflict of interest with this partner firm in our working context.

Bengtsson et al. (2016) use the same multiplicative approach but in a much simpler form by only having one item for measuring cooperation intensity and competition intensity respectively: (1) cooperation intensity: to what extent do you cooperate with your competitors? (2) competition intensity: to what extent are you taking competitive actions against your competitors? However, their single-item measure of competition intensity is problematic because it is not coopetition-specific. In other words, it measures the competition intensity with all competitors but not the ones that they are cooperating with. It can be argued that the multiplicative scale can sometimes produce misleading results. For example, if the intensities of cooperation and competition are reported as 1 and 7 respectively on a 7-point Likert scale, the value of coopetition intensity would be 7. However, when intensities of cooperation and competition are reported as 7 and 1 respectively, the value of coopetition intensity would be the same. Therefore, this multiplicative approach cannot distinguish the difference between these two completely different cases, even when these two cases represent two extremes of cooperation-dominated coopetition and competition-dominated coopetition.

2.3 Core Theories in Coopetition Literature

The coopetition literature has been argued to suffer from incompleteness with regard to theory (Bengtsson et al., 2016). Theories used for explaining coopetition strategies are fractured and lack coherence (c.f. Walley, 2007; Bengtsson et al., 2010; Bengtsson and Kock, 2014). The reason could be that coopetition encompasses both cooperation and competition, consequently the theory (theories) need to not only combine but also explore the differences between the paradoxical natures of this phenomenon. In the following sections, the commonly used theories

in the coopetition literature are reviewed, which include resource-based view, knowledge-based view, and game theory.

2.3.1 Resource-based View (RBV)

The resource-based view of the firm developed from the economics and strategy literature of the 1950s (Hooley et al., 2005). The key focus of RBV is to investigate the characteristics and types of firm resources that can lead to competitive advantages. Barney (1991, p. 101) broadly defines firm resources as 'all assets, capabilities, organisational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness'. Barney (1991) also makes a distinction between competitive advantage and sustained competitive advantage. He argues that a competitive advantage is obtained when a firm is implementing a value creating strategy not simultaneously being implemented by any current or potential competitors, while a sustained competitive advantage also requires that other firms are unable to duplicate the benefits of this strategy. It is important to note that a sustained competitive advantage does not mean it will last forever. It only implies that it cannot be competed away through the duplication efforts of competitors. Unexpected environmental changes in an industry can make what was a competitive advantage no longer valuable to a firm (Rumelt and Wensley, 1981; Barney, 1986).

RBV provides an internally focused view on building sustained competitive advantages through acquiring heterogeneous, valuable, rare and inimitable firm resources and capabilities (Rumelt, 1984; Wernerfelt, 1984; Barney, 1991). However, subsequent studies have criticised the view that competitive advantages can only be developed through the resources and capabilities that a firm owns and scholars acknowledge the importance of the role of the context and the wider industry (e.g., Levinthal and Myatt, 1994; Barney et al., 2001; Wills-Johnson, 2008). Traditionally firms emphasise the ownership of resources and capabilities, while Dyer and Singh (1998) argue that it is control over resources and capabilities that permits exploitation and not necessarily ownership. Competitive advantages can be developed not only through a firm's internal resources and capabilities, but also driven by market position and external relationships (Levinthal and Myatt, 1994). In

other words, a firm's competitive advantages depend not only on the resources it owns but also on the resources it can gain access from relationships with other organisations (Lenz, 1980).

RBV is the most commonly used theory in coopetition literature (e.g., Bengtsson and Kock, 2000; Dussauge et al., 2000; Park and Ungson, 2001; Silverman and Baum, 2002; Peng and Bourne, 2009). According to RBV, a firm is more likely to launch competitive actions when it has adequate unique resources and capabilities, in order to maintain a competitive position in the market, avoid competition, constitute entry barrier, and enhance core competencies. However, when firms do not have enough internal resources, they must exchange with other firms which have relevant resources they need (Lambe and Spekman, 1997). Forming inter-firm cooperation can supplement the shortage of internal resources and enhance competitive advantages. Even though cooperating with competitors is risky because competitors may appropriate most of the value created (Park and Russo, 1996; Alvarez and Barney, 2004), forming cooperative relationships with competitors sometimes is more beneficial than with non-competitors. First, competitors are more likely to possess similar resources and capabilities which can lead to economies of scale, capacity expansion, reduced costs and development of technological standards (Gomes-Casseres, 1997; Morris et al., 2007). In addition, competitors may also have their own strengths (i.e. unique resources and core capabilities) that are heterogeneous and complementary. Coopetition enables firms to gain access to them, which makes participating firms more competitive than non-collaborating competitors (Barnir and Smith, 2002). Second, competitors are in the same industry, facing similar market opportunities and threats, serving the same types of customers, and, therefore, they have similar needs for basic resources and capabilities to be able to secure competitive positions in the market (Amit and Schoemaker, 1993). Because of the similarities among competitors, they tend to have similar mind-set and it is relatively easier to establish mutual interests and goals.

From the lens of RBV, when firms can prevent their unique resources and capabilities from competitors' acquisition during the coopetition process, and know that their competitive position will not be affected by resource sharing, it will enhance the cooperative relationship between competitors (Morris et al., 2007). The essence

of coopetition is to identify the complementarity of resources from both sides, and enhance and consolidate coopetitive firms' competitive advantages in the market. Therefore, the coopetition strategy is a complementary business mind-set, and its ideology is to expand market opportunities rather than compete for a market of a fixed size (Huang and Chu, 2015).

2.3.2 Knowledge-based View (KBV)

Some KBV theorists see KBV as an extension of RBV (e.g., Reed and Defillippi, 1990; Grant, 1996a; Decarolis and Deeds, 1999; Winter and Szulanski, 2001). In RBV, knowledge is considered as a resource which is required to obtain and transform other resources (Wernerfelt, 1984). Barney (1991) suggests that firms need the capability to transform resources in order to gain a competitive advantage. He also argues that to make resources and capabilities difficult to imitate, they need to have three distinct characteristics: historically determined, socially embedded in the firm, and tacit. Foss and Eriksen (1995) suggest that resources are always tradeable and tied to individuals, while capabilities are not tradeable and do not necessarily belong to sole individuals. Grant (1996b) further proposes a knowledge-based view of strategy. He argues that competitive advantages in a dynamic environment cannot be obtained through knowledge that is proprietary to the firm, because the value of such knowledge erodes quickly because of obsolescence and imitation. Rather, it is the non-proprietary knowledge in the form of tacit individual knowledge that determines sustained competitive advantages. Tacit individual knowledge is the source of competitive advantage because it is unique and relatively immobile.

Even though RBV theorists recognise the value and role of knowledge in obtaining competitive advantages, KBV theorists criticise that the resource-based thinking is not enough. More specifically, KBV theorists argue that knowledge is not a generic type of resources and it has special properties that distinguish itself from other types of resources (Kaplan et al., 2001). For example, Spender (1996) suggests that knowledge is not an observable or transferable commodity. He argues that a firm can be viewed as a system of knowing activity, rather than a system of applied knowledge bundles. In other words, a firm can also be viewed as 'a dynamic,

evolving, quasi-autonomous system of knowledge production and application' (Spender, 1996, p. 59). Similar to Spender (1996), some other scholars (e.g., Blackler, 1995; Kogut and Zander, 1996; Cook and Brown, 1999; Patriotta and Pettigrew, 1999) criticise that the 'knowledge as resource' view is incomplete and argue for a more contextual, processual, and situated view of knowledge, linking more closely with learning theory and social identity. Scholars (e.g., Lane and Lubatkin, 1998; Chacar and Coff, 2000; Eisenhardt and Galunic, 2000; Gupta and Govindarajan, 2000) also argue for the importance of recognising the strategic value of knowledge and whether the value can be appropriated by the firm rather than retained by individual knowledge-holders.

In the strategy literature, knowledge is traditionally viewed as 'justified true belief' and the focus is on the explicit nature of knowledge (Nonaka and Takeuchi, 1995). In other words, the knowledge construct has characteristics such as unambiguous, reducible, and easily transferable. This view on knowledge has resulted in some theories that are based on assumptions such as knowing is all about processing information and an organisation is a machine-like function (Santos, 1999).

In contrast to the traditional conception of knowledge, more recent strategy literature has made an epistemological distinction between tacit and explicit knowledge (Grant, 1996a). This typology is commonly agreed by KBV scholars and it also has other names such as knowing how vs knowing about, subjective vs objective, implicit vs explicit, and personal vs propositional (e.g., Kogut and Zander, 1992; Tsoukas, 1996; Spender and Grant, 1996; Simonin, 1999). The distinction between the two types of knowledge lies in transferability and the mechanisms for transfer across individuals, space, and time (Grant, 1996a). Tacit knowledge is linked to individuals in a firm, very difficult to articulate, and can only be revealed through application or observation. In contrast, the ease of communication is the fundamental characteristic of explicit knowledge. The distinction between tacit and explicit knowledge is the most important reason that distinguish knowledge from other types of firm resources (Kogut and Zander, 1992, 1996). This approach also suggests that tacit knowledge is the most important strategic resource in a firm, as it is difficult to imitate and relatively immobile (Grant, 1996a; Decarolis and Deeds, 1999; Gupta and Govindarajan, 2000).

In the coopetition literature, it is surprising to find out that none of the papers has used KBV as the theoretical root, even though the importance of knowledge and learning has been acknowledged as an important element in the coopetitive relationship (e.g., Levy et al., 2003; Mention, 2011; Bouncken and Kraus, 2013; Ritala and Hurmelinna-Laukkanen, 2013). As discussed above (see section 2.2.4.3), the desire to learn from competitors who possess valuable knowledge is one of the drivers of coopetition (Gnyawali and Park, 2009; Bengtsson and Kock, 2000). Scholars also suggest that coopetition enables partnering firms to develop a common knowledge base using all firms' experience and expertise, which enhances their innovation capacity (e.g., Quintana-Garcia and Benavides-Velasco, 2004; Ritala and Hurmelinna-Laukkanen, 2009; Ritala, 2012). The possibility of knowledge leakage/spillover is also acknowledged by scholars as one of the downsides of coopetition strategy that negatively impacts on competitive advantages (e.g., Cassiman et al., 2009). However, the extant coopetition literature is only viewing knowledge as a type of business resources and has not gone any further. Critical questions on knowledge still remain to be answered through a KBV lens. For example, what knowledge can be learned during coopetition and whether the new knowledge-based resources and capabilities can be used to improve performance? Under circumstances where competitors are opportunistic, can firms gain more or less knowledge-based resources and capabilities? Does exchanging own knowledge-based resources and capabilities with competitors mean that they are no longer unique, and whether the loss of uniqueness affect business performance? To the author's best knowledge, these questions are vitally important when studying coopetition and still remained to be answered from a KBV perspective.

2.3.3 Game Theory

Game theory is commonly adopted in the coopetition literature because it provides another useful lens when investigating the dynamic interaction between cooperation and competition (e.g., Lado et al., 1997; Park and Ungson, 2001; Clarke-Hill et al., 2003; Gnyawali and Park, 2009; Ritala and Hurmelinna-Laukkanen, 2009; Ritala, 2012). In addition, game theory helps to explain organisational behaviours in inter-firm relationships. Specifically, game theory explains how firms devise and

implement their independent decision-making that allow them to maximise payoffs (or avoid costs) in inter-firm relationships (Lado et al., 1997).

According to Brandenburger and Nalebuff (1996), competitors cooperate for the purpose of increasing the size of the business pie, and then they compete to divide it up. This metaphor shows the essence of coopetition, which is to mutually increase the total value so that there is more to allocate among the partnering firms individually than there would be otherwise. However, Park and Ungson (2001) suggest that collective benefits from the inter-firm cooperation are usually uncertain and future-oriented, while individual benefits gained from opportunistic behaviour are more immediate and often tangible. This is particularly prevailing when partnering firms lack a long-term view and when competitive intensity is high. The classic game of the prisoner's dilemma also provides an insight about how opportunistic behaviour emerges within an inter-firm relationship.

In the game of prisoner's dilemma, two criminals are arrested and imprisoned. Each prisoner is in solitary confinement with no means of speaking to or exchanging messages with the other. The prosecutors do not have enough evidence to convict them. Therefore, the prosecutors offer each prisoner a bargain. Each prisoner can choose either to testify that the other committed the crime, or to remain silent. The offer is:

• If A and B each betray the other, each of them serves 2 years in prison

• If A betrays B but B remains silent, A will be set free and B will serve 3 years in prison (and vice versa)

• If A and B both remain silent, both of them will only serve 1 year in prison

The strategies and results of the game can be shown in the matrix below:

B / A	Stays silent	Betrays
Stays silent	Each serves 1 year	Prisoner A: 3 years Prisoner B: goes free
Betrays	Prisoner A: goes free Prisoner B: 3 years	Each serves 2 years

Here, no matter what the other decides, each prisoner gets a better payoff by betraying the other. If B stays silent, A should betray, because going free is better than serving 1 year. If B betrays, A should also betray, because serving 2 years is better than 3 years. For B, it is the same strategy. In game theory, this is called the Strictly Dominant Strategy. Unfortunately, simultaneous betrayal by both parties has negative consequences for both but remaining silent can only by optimal if both parties are in a situation of trust.

In coopetitive relationships, the reason why partners may behave opportunistically is similar to the prisoner's dilemma. Assuming companies A and B are cooperating, if both are cooperative, the benefits both can gain are labelled as 2. If A is opportunistic while B is cooperative, A gains 3 and B 0, vice versa. If both are opportunistic, each will gain 1. It is can be shown in the matrix below:

B / A	Cooperative	Opportunistic
Cooperative	A: 2 B: 2	A: 0 B: 3
Opportunistic	A: 3 B: 0	A: 1 B: 1

Therefore, being opportunistic is the Strictly Dominant Strategy here for the participants. If company B is cooperative, A gains more if behaving opportunistic (gaining 3) than cooperative (gaining 2). If company B is opportunistic, A also gains more if being opportunistic (gaining 1) than cooperative (gaining 0). Even though that each firm has better payoffs when all behave cooperatively than when all behave non-cooperatively, a firm can gain more by behaving non-cooperatively when others

behave cooperatively. When all partners have such mind-set and temptations to renege on the cooperative agreement, they start sacrificing collective goals and only pursuing private self-interests, which eventually lead to poorer performance for all parties and failure of the alliance (Park and Ungson, 2001).

Child and Faulkner (1998) suggest that the example above is a one-shot prisoner's dilemma game, and the logic of decision-making does not apply to a multiple-shot game. Nor does it apply to situations where the penalty for defection is very high or partners prioritise more on their own reputation in their business community. In these situations, the outcome of the prisoner's dilemma game could change. If both parties expect to have a long-term alliance, they may behave more cooperatively (Clarke-Hill et al., 2003). However, when they see the relationship is coming to an end, each party may want to benefit from holding things back instead of maximising the collective gains. According to Axelrod (1981, 1984), a repeated-game (i.e. multi-shot game) strategy is more preferable than other strategies because it emphasises the norms of cooperation, clarity in communicating the 'rules of the game', the consequences of partners' different decisions, and retaliation against defections.

In summary, the application of game theory can help researchers to understand the paradoxical relationship between competition and cooperation. In game theory, competition and cooperation are treated as separate strategic options, which is an atomistic view focusing on a single player or play (Clarke-Hill et al., 2003). Moreover, game theory also demonstrates the complex interaction between competition and cooperation, neither of which can be removed from the analysis of the game. Child and Faulkner (1998) suggest that game theory has substantial value for advancing our understanding of inter-firm relationships. In this respect, game theory will be used as one of the underlying theories in this study.

2.3.4 Transaction-Cost Economics

Another theoretical lens that commonly used by coopetition scholars is transaction-cost economics (e.g., Park and Russo, 1996; Silverman and Baum, 2002; Oum et al., 2004; Ritala and Hurmelinna-Laukkanen, 2009). The transaction-cost economics paradigm helps to explain the rationale for forming inter-organisational relationships

(Coase, 1937; Williamson, 1985) and explains the conflicts when the partners are direct competitors (Bresser, 1988; Park and Russo, 1996; Kogut, 1998).

According to transaction-cost economics, firms form cooperation in order to acquire others' tacit knowledge because it is difficult to formalise the transmission of tacit knowledge among firms (Quintana-Garcia and Benavides-Velasco, 2004). For example, if a potential buyer is uncertain about the true value of a product, revealing the knowledge to convince the buyer could paradoxically reduce the value of the product because the buyer then would have the knowledge without paying for it (Buckley and Casson, 1976; Madhok, 1997). Therefore, strategic alliances are formed by firms to meet their individual objectives, and are more likely to be successful when collective value outweighs opportunity costs and when the allocation of collective value is fair (Jarillo, 1988).

However, transaction-cost theorists argue that alliances are more likely to fail when the partners are direct competitors (Bresser, 1988; Park and Russo, 1996; Kogut, 1998). It is argued that the failure of cooperation between competitors can stem from disclosing uncontrolled information (Bresser, 1988) and goal conflicts (Kogut, 1998). Transaction-cost economics see coopetition as a risky strategy because protecting key know-how from competitors can be difficult, while simultaneously competitors have more incentives to behave opportunistically. The incentives can be intensified when the competitor has strong abilities to recognise and appropriate key technologies and know-how from partners (Quintana-Garcia and Benavides-Velasco, 2004).

2.3.5 Conclusion

In this study, the main theories to use will be KBV and game theory. It is argued that knowledge is the most strategic resource of a firm. Knowledge-based resources and capabilities are the most hard-to-imitate, socially complex, immobile and heterogeneous and therefore constitute the sustained competitive advantages (Helfat and Peteraf, 2003). Game theory is also used because it not only treats competition and cooperation as separate strategic options, but also demonstrates the complex interaction between them (Clarke-Hill et al., 2003), which has

substantial value for advancing the understanding of inter-firm relationships (Child and Faulkner, 1998).

2.4 Critique of the Literature and Research Gaps

During the last decade, coopetition research has become an important domain for industrial practice which has resulted in an increasing rate of publications in academic journals. Despite the growing interest, the coopetition research is still in its infancy (Bouncken et al., 2015). Coopetition research is still rather fragmented, reflected by different terminologies, a lack of generalisability, and a high degree of conceptual and explanatory heterogeneity (Bouncken et al., 2015; Dorn et al., 2016).

First, one of the most popular definitions of coopetition is proposed by Bengtsson and Kock (1999, p. 178), which is 'a relationship simultaneously containing elements of both cooperation and competition'. As discussed above (see section 2.2.2), this definition lacks focus and clarity because almost every cooperative relationship would have elements of both cooperation and competition. It is also difficult to use this definition to distinguish coopetition from other inter-organisational interactions such as strategic alliance and joint venture. Moreover, the broad definition of coopetition by Bengtsson and Kock (1999) has also created problems for the development of typologies of coopetition. For example, Luo's (2004) definition is based on different entities a firm is cooperating with: 1) coopetition with rivals, 2) coopetition with government, 3) coopetition with alliance partners, and 4) coopetition within a company. Rusko (2010) not only uses Luo's typology but also adds another dimension, which results in 12 different types of coopetition. Therefore, the coopetition phenomenon needs to be more narrowly defined to capture its heterogeneity from other inter-organisational relationships and to obtain conceptual consolidation and focus. In this study, Dahl's (2014, p. 272) definition of coopetition is adopted because arguably it not only emphasises the co-existence of both competition and cooperation, but also distinguishes coopetition from other inter-organisational relationships.

Second, existing operationalisations of coopetition are either theoretically problematic or incomplete. As discussed in section 2.2.6, coopetition is mostly

operationalised as coopetition propensity or as a multiplicative measure of cooperation and competition. Luo et al. (2007) and Peng et al.'s (2012) measures use different business activities on which coopetition may occur to obtain a collective score on overall coopetition propensity. However, they only respectively have five items as business activities which is rather incomplete to cover most business activities. It has also been proven in section 2.2.6 that using a multiplicative score of cooperation and competition is theoretically incorrect, as the multiplicative score cannot reflect a firm's coopetition intensity. Therefore, the ***first research gap*** lies in the lack of consensus on what coopetition is and how to measure it. It is of paramount importance to establish new measures of coopetition now because many coopetition studies are conceptual and exploratory which has provided an initial conceptual basis (e.g., Bengtsson and Kock, 2000; Mariani, 2007; Cassiman et al., 2009), and researchers have begun to use quantitative studies to empirically test the correlations between distinct coopetitive relationship variables (e.g., Bello et al., 2010; Kumar, 2010; Li et al., 2011). However, existing measures of coopetition are either incomplete or theoretically erroneous.

Third, scholars have predominantly focused on coopetitive interactions on business activities that are far from the customer, known as input activities (e.g., logistics, production and R&D) (e.g., Bengtsson and Kock, 1999, 2000; Rusko, 2011). Little research is conducted on business activities that are close to the customer (Lindström and Polsa, 2016). However, it is acknowledged that competitors also cooperate in output activities close to the customer, e.g., in marketing activities (Kylänen and Rusko, 2011; Rusko, 2011). Moreover, cooperation between competitors in output activities (e.g., sales and marketing) can also be found in practical examples outside of coopetition literature (Moilanen, 2008; Felzenstein and Gimmon, 2009). Therefore, both theory and practice demonstrate that cooperation between competitors can exist in business activities that are far from customer and close to customer. Importantly, cooperating with competitors in input and output business activities may have different performance consequences, while no studies have examined the outcomes of these two different types of coopetition in one conceptual model, which constitutes the ***second research gap***.

Fourth, Coopetition scholars have intensively used RBV to explain the antecedents and outcomes of coopetition. Even though the importance of knowledge and learning has been acknowledged as an important element in the coopetitive relationship, to the author's best knowledge, none of the academic research to date have investigated coopetition through a KBV lens, which leaves many knowledge-related questions unanswered. For example, 1) what types of knowledge can be generated through different types of coopetition, 2) whether competitors' opportunism hampers the development of new knowledge-based resources and capabilities, 3) whether different coopetition harms the uniqueness of a firm's existing knowledge-base, and 4) whether the new knowledge developed from coopetition can help to improve business performance. In light of the above, the ***third research gap*** identified concerns investigating coopetition through a knowledge-based view.

Last but not least, how coopetition is related to firm performance is still under-researched and conflicting findings exist. In early conceptual studies of coopetition, scholars argue that coopetition strategies can enhance the financial performance of firms through sharing overall costs, mitigating risks, and achieving economies of scales (e.g., Soubeyran and Weber, 2002; Chin et al., 2008; Gnyawali and Park, 2011). Bouncken and Kraus (2013) argue that coopetition on innovation can also improve customer performance due to the joint creation of multi-feature products at reasonable prices. Many coopetition studies have suggested that knowledge is also one of the coopetition outcomes when firms are engaged in innovation-related cooperation (e.g., Quintana-Garcia and Benavides-Velasco, 2004; Ritala and Hurmelinna-Laukkanen, 2009; Ritala, 2012). However, as discussed above, coopetition scholars have rarely investigated whether the knowledge developed through coopetition can lead to better business performance. In addition, quantitative studies on coopetition have predominantly focused on the financial performance of coopetition and innovation performance (e.g., Luo, 2007; Ritala, 2012; Bouncken and Fredrich, 2012; Wu, 2014), while neglected other dimensions of performance such as customer performance and strategic performance. Only a recent study by Sanou et al. (2016) has included a customer performance dimension by investigating whether coopetition leads to higher number of the operator's subscribers and higher average increase in the mobile telephone industry. A firm's performance is a multidimensional in nature and it is necessary to use multiple measures

(Venkatraman and Ramanujan, 1986). Therefore, the ***fourth research gap*** concerns investigating the performance outcomes of coopetition.

2.5 Conclusion

The literature surrounding competition and the main theories associated with it were examined in this Chapter. In doing so, specific research gaps were identified regarding 1) existing measures of the coopetition construct are either incomplete or erroneous; 2) cooperating with competitors in input and output business activities may have different properties and outcomes, while no studies have examined these two distinct types of coopetition in one model; 3) scholars have acknowledged the importance of knowledge in coopetition but no work has investigated coopetition through a knowledge-based view; 4) the coopetition literature has predominantly focused on the financial outcomes and innovation outcomes of coopetition, while other important dimensions of business performance such as customer performance and strategic performance are largely neglected. Knowledge-based theory and game theory will now be applied to proceed to examine coopetition further in this study. In doing so, how coopetition can create performance results through the creation/acquisition (loss) of knowledge-based resources and capabilities is conceptualised.

Chapter 3: Conceptual Framework and Hypotheses

3.1 Introduction

This chapter focuses on the development of a conceptual model to describe how coopetition creates performance results through the creation of knowledge-based resources and capabilities or through loss of uniqueness of existing knowledge-base. The proposed conceptual framework and hypotheses are based on the existing literature. Knowledge-based theory and game theory are used to underpin the conceptualisation. This chapter consists of seven sections. The first section presents the level and unit of analysis and provides justification for using the business as the unit of analysis. In the second place, how different types of coopetition can affect development of new knowledge-based resources and capabilities is explained. The third part discusses whether coopetition leads to a loss of uniqueness of a firm's existing knowledge-based resources and capabilities. In the fourth section, the impact of competitor's opportunism on new knowledge-based resources and capabilities is discussed. The fifth part further explains whether competitor's opportunism leads to a loss of uniqueness of existing knowledge-based resources and capabilities. The last two sections respectively present how acquisition of new knowledge-based resources and capabilities and loss of uniqueness of existing knowledge-based resources and capabilities affect business performance. Finally, control variables are discussed and a summary of the chapter is presented at the end.

3.2 Level and Unit of Analysis

As discussed in the literature review chapter, coopetition is a multi-dimensional construct that carries meaning across different levels of analysis within organisational and management research. Bengtsson et al. (2010, p.200) define coopetition as 'a process based upon simultaneous and mutual cooperative and competitive interactions between two or more actors at any level of analysis (whether individual, organizational, or other entities).' The four most commonly adopted levels

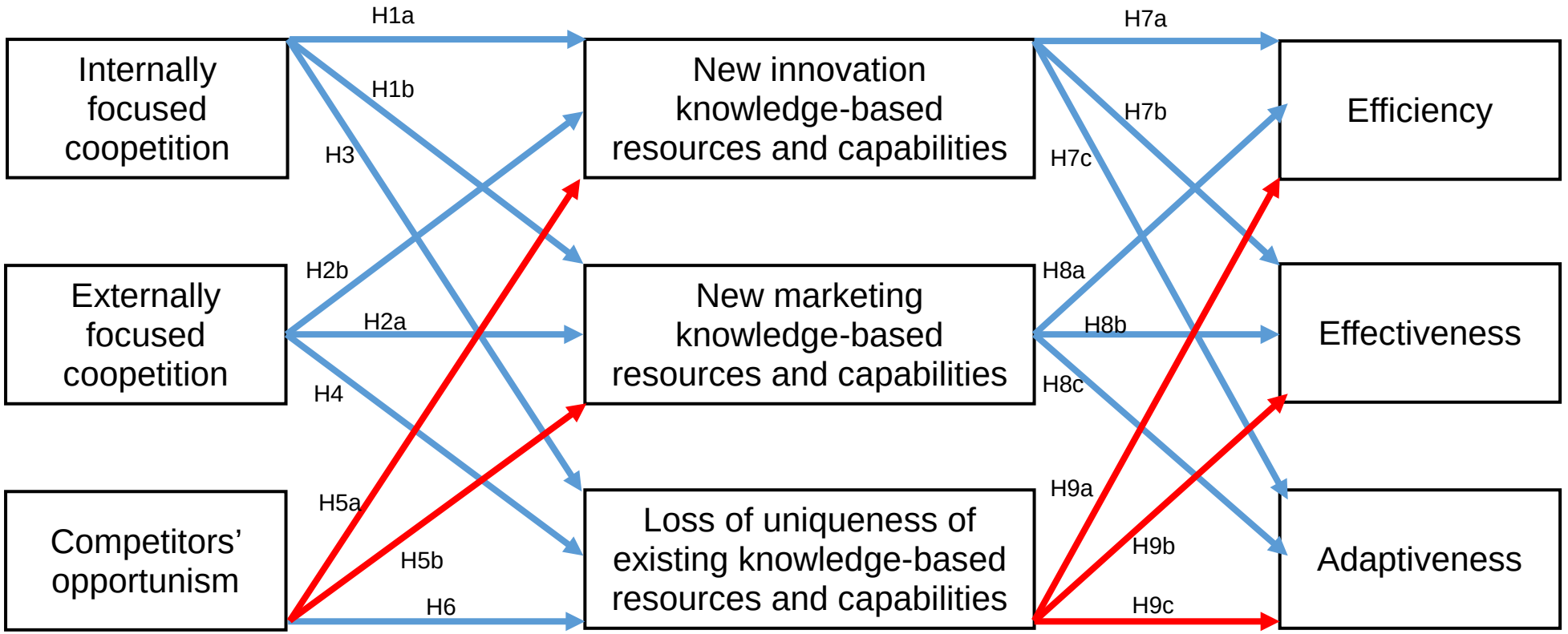
of analysis are individual, intra-firm, inter-firm, and network (Dorn et al., 2016). Although these four distinct levels of analysis share some similarities such as the co-existence of both cooperation and competition, the terminology, definitions and findings from studies on these four levels of analysis are largely different from each other.

As discussed in Chapter 2 (see section 2.2.2), the focus of this study is inter-firm coopetition. Most quantitative coopetition studies that focus on the inter-firm level use the firm as the unit of analysis when investigating the coopetition outcomes (e.g., Mention, 2011; Luo, 2007; Ritala, 2012; Wu, 2014; Bouncken and Fredich, 2012), arguing coopetition is positively related to firm novelty (Mention, 2011), number of radical innovation of a firm (Bouncken and Fredich, 2012), a firm's innovation performance, and a firm's market performance (Ritala, 2012). Some other quantitative studies provide contradictory findings arguing that coopetition has an inverted U-shaped relationship with a firm's innovation performance (Wu, 2014) and firm profitability (Luo, 2007).

Using the firm as the unit of analysis have certain advantages. First, it may encourage respondents to provide information as such information is at a broader level which can be easily accessible through the firm's financial statements. Second, secondary data may be available about firm-level performance which can be used to complement and corroborate primary data and provide additional information on firm performance. However, it is possible that a firm is composed of multiple businesses. In a situation where coopetition takes place in only one business of the firm, using the overall firm performance to measure the performance of the coopetition project is not appropriate. Therefore, arguably using the business where coopetition takes place as the unit of analysis can more accurately reflect the performance outcomes of coopetition.

In the following sections, the conceptual framework is presented first, after which relationships between the examined constructs are presented.

Figure 3.1: Conceptual Framework



3.3 Coopetition and New Knowledge-based Resources and Capabilities

As discussed in chapter 2 (see section 2.2.3), the early coopetition literature has predominantly suggested that coopetition activities are divided into a) cooperative activities far from the customer (input activities, e.g., R&D, production, and logistics) and competing activities close to the customer (output activities, e.g., sales and marketing) (Bengtsson and Kock, 2000; Luo, 2007). However, this view has been challenged recently by scholars arguing competitors also cooperate in output activities close to the customer (Kylänen and Rusko, 2010; Rusko, 2011; Lindström, and Polsa, 2016). It was identified in the second research gap in section 2.4 that cooperating with competitors in input and output business activities may have different performance consequences. Therefore, it is meaningful to divide coopetition into these two types so that their individual effects on development/loss of knowledge-based resources and capabilities can be examined individually. In this study, the phenomenon where a business cooperates with competitors in business activities far from customers (input activities) and competes in business activities close to customers (output activities) is termed as '***internally focused coopetition***'. In contrast, the phenomenon where a business cooperates with competitors in business activities close to customers (output activities) and competes in business activities far from customers (input activities) is termed as '***externally focused coopetition***'.

Dutta (2015) suggests that in hypercompetitive environments, firms need to have the ability to integrate knowledge and constantly combine and recombine its capabilities. However, firms usually face a burgeoning knowledge gap, known as a 'knowledge trap'. Cooperating with strong competitors can be an effective way to integrate new knowledge and avoid the knowledge trap. When cooperating with competitors, firms can not only absorb explicit knowledge (e.g., technologies) such as through combining (technological) components, but also acquire individually-held tacit knowledge through direct person-to-person interactions (Hansen, 1999). Dutta et al. (1999) argue that in high-tech industries, the most important determinant of a firm's performance is its innovation and marketing capabilities. Innovation capabilities reflect a firm's ability to constantly develop new innovations, while marketing capabilities determine whether a firm can successfully commercialise the innovations

into products that meet market needs. Coopetition scholars suggest that firms can acquire competitors' innovation knowledge and expertise when cooperating with them on innovation-related business activities such as R&D and NPD (e.g., Walley, 2007; Bengtsson and Kock, 2000). Many studies have suggested that individual firms can use coopetition to develop a common knowledge base and enhance their own innovation capacity (e.g., Quintana-Garcia and Benavides-Velasco, 2004; Ritala and Hurmelinna-Laukkanen, 2009; Ritala, 2012). Therefore, it is proposed that:

H1a: Internally focused coopetition is positively related to new innovation knowledge-based resources and capabilities.

Even though cooperation among competitors in input activities (internally focused coopetition) is more common, scholars have found that competitors also cooperate in output activities close to the customer (externally focused coopetition) such as in marketing activities (Kylänen and Rusko, 2010; Rusko, 2011). In addition, cooperating with competitors in output activities can be found in some practical examples outside of coopetition literature (e.g., Moilanen, 2008; Felzensztein and Gimmon, 2009; Felzensztein et al., 2012). Felzensztein and Gimmon (2009) suggest that in collaborative marketing activities, both formal and informal meetings with competitors can facilitate the exchange of marketing knowledge which would otherwise be unavailable or costly to locate. In another work by Felzensztein et al. (2012), they also suggest that competitors can form many types of inter-firm cooperative arrangements such as market research activities, joint distribution, and co-branding. The development of networks among competitors serve as conduits for knowledge exchange about important technological developments and emerging market opportunities (Stuart and Sorenson, 2003; Owen-Smith and Powell, 2004). This implies that when competitors cooperate in business activities that are close to customers such as sales, branding and customer service, they can also have access to competitors' know-how and develop new marketing knowledge, therefore, it is hypothesised that:

H2a: Externally focused coopetition is positively related to new marketing knowledge-based resources and capabilities.

Partners in a coopetitive relationship should be capable of understanding each other's knowledge and because of this, a 'learning race' may take place in which the firm with better absorptive capacity is more likely to become the winner (Hamel, 1991). Extant coopetition literature commonly agrees that besides the shared (explicit) knowledge, firms can also have access to additional resources and knowledge of their partners and benefit from partners' knowledge spillovers (non-shared parts) (Bouncken and Kraus, 2013; Quintana-García and Benavides-Velasco, 2004). In each firm, individuals might accumulate, use and extend their knowledge gained through observing implicit routines of their partners (Kale and Singh, 2007; Augusto Felício et al., 2012). Therefore, it is suggested that each partner wants to minimise outgoing knowledge spillover and to maximise incoming knowledge flows (Cassiman and Veugelers, 1998).

However, the coopetition literature has not explicitly discussed what knowledge can be acquired from partners' knowledge spillovers. It is possible that the leaked knowledge is related to the cooperative activities, but could also be related to non-cooperative activities. For example, when company A is using a competitor B's distribution channels to export its goods, company A gains access to B's international distribution resources and can accumulate knowledge on it (knowledge about cooperative activity), whereas company B could view A's product formation when reporting to customs and internalise the product knowledge (knowledge about non-cooperative activity). In addition, informal discussions between employees from the coopetitive companies may also lead to knowledge spillover. Therefore, the following two hypotheses are proposed:

H1b: Internally focused coopetition is positively related to new marketing knowledge-based resources and capabilities

H2b: Externally focused coopetition is positively related to new innovation knowledge-based resources and capabilities

3.4 Coopetition and Loss of Uniqueness of Existing Knowledge-based Resources and Capabilities

According to knowledge-based theory proposed by Grant (1996a), sustained competitive advantages of a firm in a dynamic environment cannot be obtained through explicit knowledge because the value of such knowledge erodes quickly because of obsolescence and imitation. Rather, it is tacit individual knowledge that determines a firm's sustained competitive advantages because it is unique and relatively immobile. Tacit knowledge is difficult to articulate and can only be revealed through application and observation.

However, coopetition grants the partnering competitors access to a firm's tacit knowledge. Partners operating in the same industry usually have their own unique skills or knowledge (Nelson and Winter, 1982). Coopetitive firms face the dilemma that they must share knowledge and capabilities to achieve common goals (Gnyawali and Park, 2011; Mention, 2011), while they also want to protect the strategic core of its own knowledge and skills from its competitors (Baumard, 2010; Ritala et al., 2015). The unique knowledge shared within a cooperative project potentially could be used by the competitor for other products or markets, which is known as 'appropriability hazard' (Oxley, 1997).

Therefore, inter-firm coopetition may have positive as well as negative effects. In coopetition, firms can obtain access to their competitors' unique knowledge, assemble discrete pieces of knowledge, and subjectively process the knowledge (Okhuysen and Eisenhardt, 2002). Knowledge sharing enables competitors to overcome the barriers to the partners' tacit and unique knowledge (Luo, 2005), which jeopardise the partner's competitive advantage (Lee and Johnson, 2010). Gnyawali and Park (2009) suggest that it is quite challenging to balance knowledge sharing and knowledge protection. In coopetition, firms have the opportunity to learn from their competitors, but they also simultaneously face the risk of competitors' imitation of their best practices and losing the uniqueness of their core knowledge-based resources and capabilities.

Based on the discussion above, the following two hypotheses are proposed:

H3: Internally focused coopetition is positively related to loss of uniqueness of existing knowledge-based resources and capabilities.

H4: Externally focused coopetition is positively related to loss of uniqueness of existing knowledge-based resources and capabilities.

3.5 Competitors' Opportunism and New Knowledge-based Resources and Capabilities

In the early opportunism literature, Williamson (1975, p.6) defines opportunism as 'self-interest seeking with guile'. In Williamson's (1985, p.47) subsequent work, guile is defined as 'lying, stealing, cheating, and calculating efforts to mislead, distort, disguise, obfuscate, or otherwise confuse'. Two general forms of opportunism are identified, namely, active and passive (Wathne and Heide, 2000). Passive opportunism involves one party to the exchange purposely withholding critical information (Kreps, 1990) or effort (Masten, 1988; Rousseau, 1995), or somehow refraining from performing agreed-on actions (Goetz and Scott, 1981). Active opportunism, on the other hand, involves a party deliberately lying or misrepresenting facts (Shell, 1991), or violating formal contracts (Wathne and Heide, 2000).

Kaufmann (1987) and Ghosh and John (1999) note that an inter-firm relationship should be analysed from two perspectives: creating joint value (i.e. total gains) and claiming a share of it (i.e. value distribution). Wathne and Heide (2000) suggest that both active and passive forms of opportunism have the potential to restrict value creation and lead to value redistribution. The coopetition literature reports similar findings to the early general inter-firm cooperation studies. Bouncken and Kraus (2013) suggest that through sharing, firms can have easier access to both explicit and tacit knowledge of their partnering competitors. This however permits opportunistic behaviours to use knowledge spillovers in a one-way fashion and appropriate partners' key technologies (Ritala and Hurmelinna-Laukkanen, 2009; Nielsen and Lassen, 2012; Tracey, 2012). Once the firms have accumulated the

knowledge they need, they may simply leave the coopetition and utilise the knowledge in competitive areas and harm the partners' competitive advantage (Lee and Johnson, 2010).

In addition, because of the competitive elements in coopetition, partners have strong incentives for opportunism when sharing resources and capabilities (Levy et al., 2003; Bouncken and Kraus, 2013). Lechner et al. (2016) argue that competitors' opportunism reduces the potential benefits of the relationship and enable only partial access to resources and knowledge. The partial access means partners need to spend additional time and effort searching for alternatives which reduces the speed of firm development. In a coopetitive relationship where the powers of partners are unbalanced, the weaker partner faces a strong competitive threat because the powerful partner will tend to compete rather than cooperate in its core-competence areas (Dowling et al., 1996). Stronger partners also have a tendency to behave opportunistically so that they can extract a higher share of the total value created (Casciaro and Piskorski, 2005).

Therefore, when the coopetitive partner is opportunistic, both the total value created and proportion that can be allocated to the firm become less. Thus, the following two hypotheses are proposed:

H5a: Competitor's opportunism is negatively related to new innovation knowledge-based resources and capabilities.

H5b: Competitor's opportunism is negatively related to new marketing knowledge-based resources and capabilities

3.6 Competitors' Opportunism and Loss of Uniqueness of Existing Knowledge-based Resources and Capabilities

Competitors' opportunism may not only reduce the amount of knowledge-based resources and capabilities that firms could gain from the relationship, but may also render a loss of uniqueness of firms' existing knowledge-based resources and

capabilities. As discussed above, cooperating with competitors opens up the access to a firm's both explicit and tacit knowledge. According to knowledge-based theory, a firm's tacit knowledge is the source of competitive advantage because it is unique and relatively immobile (Grant, 1996a; Decarolis and Deeds, 1999; Gupta and Govindarajan, 2000). Tacit knowledge is held by individuals in a firm, very difficult to articulate, and can only be revealed through application or observation (Grant, 1996a). In a coopetitive relationship, employees from competing firms typically work together or meet on a regular basis. During this process, the tacit knowledge of a firm can be revealed when its employees are applying it on the joint project, which can then be observed by the employees from the competing firms.

Ritala and Hurmelinna-Laukkanen (2013) alert firms that the presence of a competitor close to the core business increases the risk of exposing confidential knowledge. Knowledge leakage may occur both intentionally or unintentionally. Unintentional knowledge leakage occurs when the focal firm is unaware of the knowledge transfer (Mohr and Sengupta, 2002), often due to frequent interactions among individuals from the partnering firms (Kale et al., 2000). It may also occur due to unrestricted collaborative agreements or because the focal firm unthinkingly grants the competitor access to confidential information (Jiang et al., 2013). On the other hand, intentional knowledge leakage occurs when the appropriator performs opportunistic activities such as private learning and unauthorised imitation. As discussed in the last section, competitors with strong learning ability may quickly accumulate the knowledge they need and use it in competitive areas (Lee and Johnson, 2010). The strong incentives for opportunism may result in illegal transfer of core knowledge for individual benefits (Gnyawali and Park, 2009; Kang and Kang, 2010). Therefore, a firm's tacit knowledge is vulnerable when cooperating with a competitor, especially when the competitor is more powerful and behaving opportunistically. The powerful partner may use their power to force other firms to act in a way to the best interest of itself and acquire knowledge for their own competitive advantages at the expense of others (Bouncken and Kraus 2013; Pellegrin-Boucher et al. 2013). In this sense, the tacit knowledge is no longer unique to the vulnerable firm and its own competitive advantage is jeopardised. Therefore, the following hypothesis is proposed:

H6: Competitor's opportunism is positively related to loss of uniqueness of existing knowledge-based resources and capabilities.

3.7 New Knowledge-based Resources and Capabilities and Business Performance

3.7.1 New Innovation Knowledge-based Resources and Capabilities and Business Performance

The ultimate reason why firms form collaboration with competitors is to improve their own performance (e.g., Mooradian et al., 2006). It has been discussed and hypothesised above that a coopetition strategy enables firms to gain access to new innovation and marketing knowledge-based resources and capabilities, but a critical question is: whether the new knowledge-based resources and capabilities can lead to better performance? The relationship between coopetition and firm performance has been conceptualised or empirically studied by many coopetition scholars (e.g., Rodrigues et al., 2011; Bouncken and Fredrich, 2012; Wu, 2014; Lundgren-Henriksson and Kock, 2016; Volschenk et al., 2016). Most studies stress the positive relationship between coopetition and a firm's innovativeness (e.g., Gnyawali and Park, 2009; Gast et al., 2015), and coopetition creates a win-win situation for all involved firms with regard to increased sales, market shares, brand recognition, and market penetration (Le Roy et al., 2007; Gnyawali and Park, 2009; Rodrigues et al., 2011). Quintana-Garcia and Benavides-Velasco (2004) also suggest that cooperating with competitors can lead to more radical product development than cooperating with non-competitors. However, contradictory findings also exist. For example, scholars also argue that coopetition is fraught with opportunism and knowledge leakage which harm the development of radical innovations (e.g., Nieto and Santamaria, 2007; Cassiman et al., 2009). Some other quantitative studies argue that coopetition has an inverted U-shaped relationship with a firm's innovation performance (Wu, 2014) and firm profitability (Luo, 2007). However, these studies predominantly use firm as the unit of analysis. As discussed above (see section 4.2), a firm may have multiple businesses and it is possible that coopetition does not take place in all business units. Therefore, investigating the performance outcomes on a

business-level is more meaningful. In addition, it is hypothesised above that through coopetition, two different types of knowledge-based resources and capabilities can be developed, namely, innovation and marketing. These two different types may have same or distinct effects on business performance measures, which is worth being hypothesised and tested in the subsequent sections.

With regard to the business performance dimensions of this study, a three-dimensional conceptualisation of business performance is adopted, consisting of efficiency, effectiveness, and adaptiveness (Ruekert et al., 1985). This conceptualisation seems to be commonly accepted in the management research literature and is defined as follows: efficiency considers the relationship between business outputs and the inputs required to reach those outputs, effectiveness involves the degree to which business goals are reached, and adaptiveness reflects the ability of the business to adapt to changes in the environment (Ruekert et al., 1985). This multi-dimensional approach is appropriate to cover the gamut of performance perceptions managers have.

Efficiency can be simply expressed as the ratio between output and input. Walley (2007) suggests that coopetition enables firms to develop new products or services which they would not be able to develop without a coopetitive partner or at a much slower speed if they develop only by themselves. Because one of the key motivations for firms to engage in coopetition is to share costs and achieve economies of scales (Luo, 2007; Chin et al., 2008; Gnyawali and Park, 2011), the new innovation knowledge-based resources and capabilities obtained through coopetition is obtained at a lower cost (lower input), which is advantageous to business efficiency. From a knowledge-based perspective, it is very difficult to acquire competitors' tacit knowledge because of its inimitability and immobility (Grant, 1996a; Decarolis and Deeds, 1999). Firms can either develop such knowledge by themselves through exploratory research which is likely to be very slow, or through purchasing from other companies which can be costly. However, forming alliances with competitors enables firms to have quick access to the knowledge needed at much lower costs.

In terms of the output in the efficiency ratio, it is believed that competitors possess complementary experience and expertise which can be used to develop a common knowledge base and enhance the overall innovation capacity (e.g., Quintana-Garcia and Benavides-Velasco, 2004; Ritala and Hurmelinna-Laukkanen, 2009; Ritala, 2012). As suggested by Brandenburger and Nalebuff (1995, 1996) in their early coopetition work, the purpose of coopetition is to create a bigger pie so that everyone can also have a bigger slice. Bouncken and Kraus (2013) also state that operating within the realm of coopetition is critical to SMEs' survival and success because they can obtain access to additional knowledge and benefit from knowledge spillovers. They also argue that if SMEs integrate their partners' knowledge, it can have a positive effect on revolutionary innovation.

Effectiveness is concerned with whether business goals can be achieved. With the new knowledge gained from coopetition, firms can develop new products or services which they would not be able to develop solely by themselves or at a much slower speed (Walley, 2007). Large-scale innovation products require substantial resources and knowledge, which entails high risks when firms, especially SMEs, only rely on themselves (BarNir and Smith, 2002; Bougrain and Haudeville, 2002). Therefore, accessing and utilizing competitors' resources and capabilities can vastly accelerate the speed of innovation process and reduce costs. Bouncken and Kraus (2013) also suggest that customers can also benefit from the joint effort because firms can use the new innovation knowledge learned from competitors to integrate more features into its existing offerings. In this sense, the new innovation knowledge enables firms to develop not only radical but also incremental innovation on its products or services which is advantageous to attract new customers and satisfying existing customer groups.

Adaptiveness reflects the ability of the business to adapt to changes in the external environment (Ruekert et al., 1985). Companies in high-tech industries need to cope with pressures from high R&D expenses, new market entrants, short product lifecycles, and the combination of different technologies (Gnyawali and Park, 2009, 2011; Bouncken and Fredrich, 2012). Under these pressures, firms need to react and adapt quickly and flexibly to external opportunities and threats. Competitors' knowledge can help to not only identify environmental changes, but also potentially

develop solutions to cope with the changes. In addition, a key component of the environmental changes that affects business strategies is competitors' strategic moves. In this sense, businesses in coopetition are more likely to better understand the competitive environment and competitors, as well as their motives and behaviours (Sanou et al., 2016). This enhanced understanding is likely to help businesses to make better strategic decisions that are more appropriate for the industry context.

Thus, the following three hypotheses can be surmised:

H7a: New innovation knowledge-based resources and capabilities are positively related to efficiency.

H7b: New innovation knowledge-based resources and capabilities are positively related to effectiveness.

H7c: New innovation knowledge-based resources and capabilities are positively related to adaptiveness.

3.7.2 New Marketing Knowledge-based Resources and Capabilities and Business Performance

Competitors share knowledge when engaging in coopetitive relationships, hence the more a firm engages in coopetition, the more it creates new knowledge about technologies, products, customers and competitors. The marketing knowledge learned from competitors enhances a business's understanding of its customers and the market (Sanou et al., 2016). Because competitors operate in the same industry and serve the same group of customers, the marketing knowledge learned in coopetition is likely to be highly relevant and readily applicable. Therefore, the business's marketing activities are more likely to avoid the 'trial and error' process and achieve favourable market outcomes at a much faster speed. Based on this reasoning, both efficiency and effectiveness can be achieved, no matter whether the

new marketing knowledge is used to refine the business's existing marketing strategies or to develop new ones.

Similar to new innovation knowledge, the new marketing knowledge developed from coopetition also enhances a business's understanding towards their partnering competitors' marketing behaviours. The focal business can then refine their strategies accordingly to react and adapt to competitors' marketing strategies. In addition, an improved understanding of customers can shed light on new trends of customer demands which entails new market opportunities. It also enables the business to evaluate its existing marketing strategies and to identify potential problems. As discussed above, high-tech industries are usually characterised with short product life cycle and rapidly changing customer needs. Therefore, in theory the new marketing knowledge developed through coopetition can improve a business's ability of quickly adapting to environmental changes.

Based on the discussion above, it is proposed that:

H8a: New marketing knowledge-based resources and capabilities are positively related to efficiency.

H8b: New marketing knowledge-based resources and capabilities are positively related to effectiveness.

H8c: New marketing knowledge-based resources and capabilities are positively related to adaptiveness.

3.8 Loss of Uniqueness of Existing Knowledge-based Resources and Capabilities and Performance

The knowledge-based view suggests that knowledge in the form of tacit individual knowledge is the most strategically important source of sustained competitive advantage because it is unique and relatively immobile (Grant, 1996a; Grant and Baden-Fuller, 2004). However, if firms exchange the rent-generating knowledge

beyond the firm boundary in coopetition, such knowledge is susceptible to expropriation hazards (Li et al., 2008; Oxley and Sampson, 2004). It is commonly agreed that when competitors appropriate a firm's tacit knowledge, the firm's ability to sustain superior performance is jeopardised (Kogut and Zander, 1992; Oxley and Sampson, 2004). Knowledge leakage leads to adverse outcomes because the appropriator may use the acquired knowledge to compete in the same business domain (Branstetter and Sakakibara, 2002) or increase the bargaining power in the alliance (Baughn et al., 1997; Inkpen, 2000).

The performance differentials of firms stem from the unique and firm-specific knowledge from a KBV perspective (Grant, 1996a). Losing uniqueness of a business's existing knowledge-based resources and capabilities is disadvantageous to its performance outcomes. Once the unique knowledge is 'stolen' by competitors and applied on their products or marketing practices, the value of such knowledge largely decreases because the offerings of the focal business is no longer unique to its customers, which means the business's existing product or marketing strategies become less effective. Therefore, to develop more unique knowledge and skills and regain competitive advantages, the business needs to invest in acquisition of new knowledge and skills from other organisations, or to develop internally. Both approaches will result in an increase in financial and managerial input, which is disadvantageous to business efficiency. Before the knowledge transfer in coopetition, the business's unique knowledge-based resources and capabilities act as a 'protective shield' against competition because it can be used to develop differentiated products/services or to promote the offerings in a differentiated fashion, both of which may attract more customers. However, after competitors' appropriation of its unique knowledge-based resources and capabilities and applying on their own strategies, the business may face threat from losing its existing customers, in addition to the various environmental changes identified above, making it even more difficult to adapt to the situation. Moreover, the increase of financial and managerial input for new knowledge and skills may also worsen the situation because fewer business resources can then be used for monitoring and adapting to environmental changes.

According to the analysis above, the following three hypotheses are proposed:

H9a: Loss of uniqueness of existing knowledge-based resources and capabilities is negatively related to efficiency.

H9b: Loss of uniqueness of existing knowledge-based resources and capabilities is negatively related to effectiveness.

H9c: Loss of uniqueness of existing knowledge-based resources and capabilities is negatively related to adaptiveness.

3.9 Control Variables

The dependent variables in this study may be affected by other factors outside the conceptual model, hence several control variables are also incorporated. First, firm size refers to the scale of a firm's operation. Generally speaking, large firms have greater resources and stronger capabilities than smaller firms for assimilating knowledge (Dröge et al., 2003), devoting to product innovation (Eisenhardt and Tabrizi, 1995) and achieving better performance. Firm size is treated as a key factor of alliance participation (Hagedoorn and Schakenraad, 1994; Simonin, 1997), and firm size also influences competitive activities (Ferrier et al., 1999). Firm size may also influence the decision making of the coopetition strategy model in this study, as larger firms may value their own reputation more and are reluctant to behave opportunistically. Firm size is measured by number of employees (e.g., Quintana-Garcia and Benavides-Velasco, 2004; Wu, 2014; Huang and Chu, 2015; Lechner et al., 2016) and total sales revenue (e.g., Ritala and Sainio, 2014).

Second, firm age (i.e., number of years in operation) is also included as a control variable because it may influence a firm's financial performance and growth stability (Lechner et al., 2016). Older firms may achieve better performance levels because their experience and expertise, while younger firms may grow rapidly and perform better because of new innovative ideas and dynamic management (Wijewardena and Tibbits, 1999).

Third, environmental turbulence may also affect a firm's overall performance. Environmental turbulence refers to the state of the environment in the industry, the rate of change in the environment, and the firm's ability and inability to forecast changes in the environment (Song et al., 2005). When a firm is operating in a highly turbulent environment, acquisition of new resources and capabilities is critical to allow the firm to make strategic changes quickly and understand how to leverage its capabilities to create maximum value for customers (Sirmon et al., 2007). Environmental turbulence is normally measures as three dimensions: technological turbulence, competitive intensity, and market dynamism (Kohli and Jaworski, 1990). Technological turbulence refers to the rate of speed of the technological changes in the industry (Akgün et al., 2007). Competitive intensity denotes the competitors' aggressiveness (Cadogan et al., 2002). Market dynamism is concerned with the rate at which the needs and preferences of customers change (Olson et al., 2005).

3.10 Conclusion

In this chapter, a conceptual framework for this study was presented. The hypotheses were proposed based on the relevant literature. It was hypothesised that both internally and externally focused coopetition are positively related to new innovation and marketing knowledge-based resources and capabilities, whereas these two types of coopetition also positively related to loss of uniqueness of existing knowledge-based resources and capabilities. Moreover, competitors' opportunism negatively impacts on development of new knowledge-based resources and capabilities, and positively on loss of uniqueness of existing knowledge-based resource and capabilities. Finally, both innovation and marketing knowledge-based resources and capabilities have positive influence on business performance, while loss of uniqueness of existing knowledge-based resources and capabilities has negative impact on business performance.

In the next chapter, the methodology used to implement the study is discussed.

Chapter 4 - Methodology

4.1 Introduction

The purpose of this chapter is to present the methodology used to collect and analyse the data. Overall, data collection and analysis are undertaken to test the conceptual model (Chapter 3), which is developed based on the literature review (Chapter 2).

This chapter starts with outlining the research design. In this section, the epistemology and differences between exploratory research and conclusive research are discussed, after which the main data collection approaches available are compared, namely primary versus secondary data and qualitative versus quantitative data. In the second part, sampling issues are discussed, including target population, sample frame, sampling procedure, sample size determination, and sample elements selection. The third part presents the questionnaire design in terms of development of measurements of key constructs, which is followed by the pre-testing procedures. Fourthly, the main survey is discussed with regard to response rate and analysis of non-response bias. Finally, analytical procedures chosen for the data analysis are presented. A two-stage analytical procedure is followed, including a measurement model assessment and a structural model assessment (Anderson and Gerbing, 1988).

4.2 Research Design

A research design is the first step of conducting a study. It determines the type of data to be collected, sources of the data, and data collection methods (Malhotra and Birks, 2003). A research design can significantly improve the success of a study and reliability of results when properly conducted.

4.2.1 Epistemology

Epistemology is the theory of knowledge and in turn what this study considers to be valid knowledge on the phenomenon under investigation. The root definition of

epistemology is the 'theory of science of the methods or ground of knowledge… it refers to the claims or assumptions made about the ways in which it is possible to gain knowledge of this reality, whatever it is understood to be; claims about what exists may be known' (Blaikie, 1993, p. 6-7). 'The central issue is the question of whether the social world can and should be studied according to the same principles, procedures, and ethos as the natural sciences' (Bryman, 2004, p.11). Based on this central issue, three major epistemological stances have emerged, which are *Positivism, Realism*, and *Interpretivism*. Positivism is a scientific approach to research, and affirms the importance of imitating natural sciences. In positivism studies, the role of the researcher is to collect data and interpret results through objective approach and the research findings are usually observable and quantifiable. Realism share similar beliefs with positivist but with one major difference, that, the scientific reality exists independently and innately to our perceptions of it. Interpretivism carries subjective meaning of social action, arguing that social science cannot be imitated as different people view the world differently.

In fact, the three epistemological stances identified are not independent and mutually exclusive (Deshpandé, 1983). Researchers from one epistemological school of thought may share views with those of rival schools of thought, in other words, different epistemological stances fall along a philosophical continuum (Aram and Salipante, 2003). Therefore, the epistemological stance of a researcher is often a mixture of several epistemologies rather than having one single, absolute epistemological stance. Epistemology hence differs from person to person as everyone has a different view on what can be considered to be valid knowledge on a subject.

The majority of literature concerning strategy and marketing is positivistic in that empirical evidence is needed to allow for analysis and findings from research to be justified. In this study, a quantitative approach will be employed. This is an empirical form of research and as such adopts a positivist epistemological stance. The decision to adopt a quantitative approach to model and hypotheses testing is justifiable as this study seeks to not only generate theory, but also seek to confirm the theory proposed. This suggests the need to follow a logical empiricist

epistemology as its primary interest is in verification rather than theory generation (Deshpandé, 1983).

4.2.2 Exploratory and Conclusive Research Designs

Research design can be broadly divided into two categories: exploratory and conclusive. Exploratory research is a preliminary investigation of topic and does not provide conclusive answers to research questions. Exploratory research is widely used in early research stages with a minimum expenditure of money and time (Kinnear and Taylor, 1991). However, it can be helpful in understanding the phenomenon and defining the research problem (Stebbins, 2001).

Conclusive research, on the other hand, aims to describe a specific phenomenon, test hypotheses, and examine relationships among constructs (Parasuraman et al., 2007). Objectives are strictly defined and data collection procedures are highly structured (Kinnear and Taylor, 1991). The major differences between exploratory and conclusive research designs are presented in Table 4.1.

Table 4.1: Major differences between exploratory and conclusive research design

Research project components	**Exploratory research**	**Conclusive research**
Research purpose	General: to generate insights about a phenomenon	Specific: to verify insights and aid in selecting a course of action
Data needs	Vague	Clear
Data sources	Ill defined	Well defined
Data collection form	Open-ended, rough	Usually structured
Sample	Relatively small; subjectively selected to maximize generalization of insights	Relatively large; objectively selected to permit generalization of findings
Data collection	Flexible; no set procedure	Rigid; well-laid-out procedure
Data analysis	Informal; typically non-quantitative	Formal; typically quantitative
Inferences/recommendations	More tentative than final	More final than tentative

Source: Pride and Ferrell (2007)

In this research, a quantitative study is designed to verify the conceptual model and hypotheses developed based on the relevant literature, as exploratory research is not sufficient for verifying hypotheses or making generalisable conclusions.

Therefore, a conclusive research design is necessary and is the focus of the next section.

4.2.3 Main Conclusive Research Designs

Conclusive research can be divided into two categories: descriptive and causal. Descriptive research, as the name suggests, describes specific elements, causes, or phenomena in the research area. Descriptive research can be further divided into cross-sectional and longitudinal, which are the principal forms of research design often used in business research (Churchill, 2001). Causal research, also known as experimental research, is used to study cause-and-effect relationships. It is defined as a 'scientific investigation in which an investigator manipulates and controls one or more independent variables and observes the dependent variable or variables for variation concomitant to the manipulation of independent variables' (Churchill 2001, p. 138). The advantages of causal research lie in the ability to control extraneous variables which might bias the research results, and allows a higher level of validity (Campbell and Stanley, 1963). However, in reality, controlling all extraneous factors is very difficult to achieve (Churchill, 2001). Moreover, experimentation is more expensive and time-consuming than the descriptive approach, and can only be appropriate when a limited number of variables are being studied. Therefore, given the conceptual model and number of hypotheses developed in last chapter, causal research is not a viable approach for this study.

4.2.3.1 Longitudinal Approach

A longitudinal study (also known as panel research) refers to data collection from the same sample (or samples) over a period of time. It can be regarded as a series of cross-sectional studies within the same sample (Malhotra and Birks, 2003). Some researchers (e.g., Podsakoff and Organ, 1986, Filipescu et al., 2013) advocate using longitudinal research over cross-sectional for the following reasons. First, a longitudinal study provides evidence of time order of occurrence, which is essential for testing for causation. Second, a longitudinal study can help better deal with common method variance. According to Rindfleisch et al. (2008), to reduce common method variance, three strategies are encouraged: 1) employing multiple

respondents, 2) obtaining multiple types of data, and 3) gathering data over multiple time periods. A longitudinal research design can help with these issues. Third, in this study, the relationships between coopetition strategy, knowledge-based resources and capabilities, and business performance are examined. Using a longitudinal study would be desirable because 1) a coopetition project may last for a few years, and 2) the knowledge-based resources and capabilities may have lagged effects on performance measures.

Despite these advantages of longitudinal studies, certain limitations also exist. First, because a longitudinal study requires the same sample (panel) to take part in the research at least twice over an extended period of time, respondent attrition may occur, which may reduce sample size (Rindfleisch et al., 2008). Second, respondents' first response may alter or bias the following ones (Menard, 2002), which is known as testing effects and reduce the validity of results. As a result, 'longitudinal survey research is easier to advocate than to implement…' (Rindfleisch et al. 2008, p.262). Last but not least, a longitudinal study requires substantial resources which makes it rarely viable (Lee and Lings, 2008).

4.2.3.2 Cross-sectional Approach

Cross-sectional research refers to collection of data on more than one case at a single point in time so as to assemble a body of data about two or more variables in order to observe the pattern of relationships (Bryman, 2004). It is similar to a 'snapshot' of the situation of a group of companies (Malhotra and Birks, 2003). To infer causation between two variables, one of the pre-requisites is evidence of time order of occurrence, which means it is difficult to make a conclusive argument for causal relationships between the variables examined. However, a cross-sectional research enables researchers to test for association found in the data. That said, causation can be supported if strong theories can be developed, where one variable causes the other and not vice versa (Lee and Lings, 2008).

A cross-sectional study in general requires much less financial and time expenditures than a longitudinal study. Given the fact that a doctoral study completion is required within four years with a limited budget, using a cross-sectional

approach is more realistic. In conclusion, a cross-sectional approach is more appropriate and is used in this study.

4.3 Data Collection

4.3.1 Choice of Primary or Secondary Data

Data collected can be categorised into primary and secondary data. Primary data are new data gathered to help solve the particular problem under investigation (Hair et al., 2011), while secondary data consist of information that has already been gathered for other purposes and might be relevant to the problem at hand (Patzer, 1995). Primary data are usually collected through using survey, observation, and experiment. Its major advantage is its high relevance to the specific problem, but the process of collecting primary data is usually more time-consuming and costly than secondary data collection.

Secondary data may be able to solve a particular research problem and help to reduce costs and time, but its limitations need to be fully understood by researchers. First, for some research problems, there are simply no secondary data. Second, secondary data may not be highly relevant to the research problem. This is due to the nature of secondary data, which is collected for other purposes. Third, secondary data may not be accurate or reliable. Various errors can occur when a researcher gathers, codes, analyses, and reports data. However, it is often difficult to discover and solve these errors using secondary data. Last but not least, secondary data may simply not be sufficient to bring closure to a research problem. Secondary data may provide part of the answers but primary data is still needed (McDaniel and Gates, 2014).

In this study, in spite of the advantages, secondary data needed for testing the proposed hypotheses are simply unavailable. Therefore, primary data need to be collected to test the hypotheses.

4.3.2 Choice of Qualitative or Quantitative Data

Data collected can also be categorised into qualitative and quantitative. Qualitative data are not subject to quantification or quantitative analysis, while quantitative data are analysed mathematically (McDaniel and Gates, 2014).

The choice of qualitative or quantitative data is largely determined by the purpose of the study. Qualitative research is usually exploratory in nature (Malhotra and Birks, 2007) and generally used for inductive purposes (Silverman, 2005), which is concerned with the generation of new theories based on the data. Examples of qualitative research methods include in-depth interview, storytelling, focus group, participant observation, and projective test (Taylor et al., 2015). Qualitative data is useful in developing theories and hypotheses, but it does not allow researchers to statistically test them and generate conclusive answers to research problems (Silverman, 2005) because data are analysed in a subjective and interpretive manner. Moreover, qualitative research methods usually use text and image analysis and do not allow researchers to measure quantity, extent, intensity or frequency of a particular phenomenon (Denzin and Lincoln, 2000).

Quantitative research, on the other hand, entails a deductive approach (Newman and Benz, 1998). Theories and hypotheses are usually developed before collection of quantitative data (Kinnear and Taylor, 1991). In quantitative research, questions are often highly structured and closed-ended. Quantitative data is analysed statistically and objectively to test theories and hypotheses (Teddlie and Tashakkori, 2008). The main differences of qualitative and quantitative researches are presented in Table 4.2 below.

Table 4.2: Qualitative versus quantitative research

	Qualitative research	Quantitative research
Types of questions	Probing	Limited probing
Sample size	Small	Large
Amount of information from each respondent	Substantial	Varies
Requirements for administration	Interviewer with special skills	Interviewer with fewer special skills or no interview
Type of analysis	Subjective, interpretive	Statistical, summation
Hardware	Sound recorders, projection devices, video recorders, pictures, discussion guides	Questionnaires, computers, printouts, mobile devices
Degree of replicability	Low	High
Researcher training	Psychology, sociology, social psychology, consumer behaviour, marketing, marketing research	Statistical, decision models, decision support systems, computer programming, marketing, marketing research
Type of research	Exploratory	Descriptive or causal

Source: McDaniel and Gates, 2014

4.3.3 Quantitative Data Collection Methods

After opting for a cross-sectional and quantitative approach for the main research design, the next step is deciding which data collection method is used. A survey is the main method for collecting quantitative data and is a commonly used data collection method in business and management research (Griffins et al., 2003). When a survey method is used, all respondents are asked the same questions which gives researchers a structured and systematic set of data (de Vaus, 1996). There are several types of survey methods that can be chosen, including face-to-face interviews with a specific set of questions, telephone interviews, mail questionnaires, and online questionnaires (Churchill, 2001). Each method has its own advantages and disadvantage, and needs to be evaluated based on the research objectives and constraints.

Face-to-face interviews, as the name suggests, involve interviewing respondents in person. This method generally can produce high quality data (Bryman, 2004) because it is a personal interaction with all the attendant advantages, such as immediate feedback from respondents, the ability to explain complicated terms and tasks, and the ability to show respondents other stimuli. Moreover, respondents are more at ease in a familiar and comfortable environment. However, this method is open to significant problems surrounding interviewer bias. This method of survey is rarely used by researchers, in part due to high costs in terms of travel time, mileage, and survey time (McDaniel and Gates, 2014). In addition, the refusal rate is likely to be high because qualified respondents in this study are senior managers who are busy with their schedules. Thus, face-to-face interview is not an appropriate survey method in this study.

Telephone interviews are popular in survey research. It has certain advantages when compared with face-to-face interviews. First, telephone interviews are relatively cheaper because interviewers can stay in a central location and do not need to go to respondents to conduct interviews. It is likely to be especially useful when interviewing hard-to-reach respondents and when interviewer safety is a consideration (Bryman and Bell, 2015). Second, asking sensitive questions by telephone is likely to be more effective when the interviewer is not physically present (McDaniel and Gates, 2014). However, certain disadvantages of telephone interviewing need to be borne in mind. First, telephone interviewing is unlikely to be effective when the questionnaire is long (Bryman and Bell, 2015). Respondents may hang up before the survey is complete. Second, the format of questions can be asked in telephone interviews is limited. The questions and answers need to be generally brief, and complex scales such as semantic differential and Stapel are likely to be less effective (McDaniel and Gates, 2014).

Mail survey and online survey both have the advantage that respondents can choose their convenient time and place to complete the questionnaire, but using online survey is more advantageous because of a number of reasons. First, respondents' personal email addresses are more easily collected than their personal addresses. Second, an online survey is easier for respondents to complete and return. Using mail survey requires them to send the completely physical copy back, which may

reduce response rate. Third, more complicated techniques such as skip patterns are more readily used in online questionnaires. Fourth, business professionals are often out of the office, working from home, meeting clients or traveling to other places. These circumstances make it difficult for them to receive a mailed questionnaire or significantly delay their completion, whereas online surveys are more accessible regardless of respondents' location (Fricker and Schonlau, 2002; Hooley et al., 2012). Fifth, when an online survey is used, data from completed questionnaires can be received much quicker and readily imported into a data analysis software package (e.g., SPSS) without manual processing, which eliminates processing error. Finally, using online survey reduces many types of costs that are inevitable in mail survey, such as printing, mailing, and data entry (Griffins et al., 2003). Because of the advantages above and rapid development of digital devices, conducting email and web surveys is becoming increasingly frequent in business research (Hooley et al., 2012; Dillman, 2007). Therefore, the online survey method is chosen for data collection.

4.4 Sampling

There are mainly five steps for drawing a sample before data collection, which are 1) defining target population; 2) identifying the sample frame; 3) select a sample procedure; 4) determining the sample size; 5) select sample elements (Churchill and Lacobucci, 2002). The proceeding sections will cover these five steps in sequence.

4.4.1 Target Population

The population refers to the entire group of people about whom information is needed (McDaniel and Gates, 2014). Defining the target population is usually the first step in the sampling process because the source of information is important for the accuracy of the results. Determining the target population involves two steps: a) determining the types of companies about which information is needed, and b) identifying the characteristics of key informants.

Broadly speaking, the target companies for the current study consist of UK companies that currently collaborate with competitors. However, it is very difficult, if

not impossible, to identify which UK companies are currently collaborating with competitors. Not least as there are no readily available databases or records that track such behaviour. Some may argue that such information can be traced through checking company reports and press. Nevertheless, it is virtually unpractical to use such a method to compile a large enough number of UK companies that can be used for quantitative research. Moreover, companies found through this approach are more likely to be large- or medium-size enterprises, which cannot represent the entire population.

A review of the coopetition literature reveals that coopetition strategy has been more frequently adopted by companies in knowledge-intensive, dynamic and complex industries (e.g., Carayannis and Alexander, 1999) such as biotechnology (e.g., Quintana-Garcia and Benavides-Velasco, 2014; Lai et al., 2007), the IT domain (e.g., Bouncken and Kraus, 2013), and high tech industries in general (e.g., Gnyawali and Park, 2009). Certain characteristics of these industries have pushed companies into coopetitive behaviour, including shorter product life cycles, convergence of multiple technologies, high R&D costs, and necessity of industry standards (Gnyawali and Park, 2009). To ensure higher response rate in a quantitative study, selecting industries where coopetition commonly takes place is crucial. Thus in this research *UK companies in high-tech industries* (including aerospace, automotive, biotechnology, IT, telecommunications, computer science, nanotechnology, nuclear physics, robotics, and semiconductors) are targeted.

After determining the target industries, the next step is to determine the key informants. The ideal key informant is the one responsible for the coopetition project. However, this person is difficult to locate because it largely depends on what business activities the company is cooperating with competitors. For instance, if a company were cooperating with competitors on marketing, the Marketing Director would be the ideal informant of the survey. However, if a company were cooperating on production, then the Production Manager would be ideal. Therefore, choosing a specific management job title is problematic and could lead to bias in data. However, COOs (Chief Operating Officers) and MDs (Managing Directors) of companies are usually familiar with their companies' coopetition strategy and have easier access to

the financial data. Thus, they are chosen as the key informants of the survey research.

4.4.2 Sample Frame

The second step in the sampling process is to identify the sample frame. Sample frame refers to a list of the members or elements of the population from which units to be sampled are to be selected (Malhotra and Birks, 2007). Ideally, the sample frame should be complete and accurate, but unfortunately, such lists of population elements usually do not exist (Churchill and Lacobucci, 2002). In such situations, researchers can specify a procedure that will develop a sample frame with needed characteristics.

To develop the sample frame, the Kompass database (www.kompass.com) is used. It is a leading provider of business information that can be used for purposes such as sales, marketing, procurement, and research. The database allows users to select firms based on various criteria including industry, location, number of employees, and annual turnover. It also provides the contact details of top management and department managers. Among the Kompass classification of industries, the following industries are selected:

- Chemicals, Pharmaceuticals & Plastics
- Electrical, Electronics & Optical
- Energy, Environment
- IT, Internet, R&D
- Metals, Machinery & Engineering

The location of the businesses is United Kingdom, and executive function is MD/COO. After applying these selection criteria, there are 13,143 companies in the list, with MD/COO’s contact details.

4.4.3 Sampling method

After identifying the sample frame, the next step is to select a sampling method, which depends on the objectives of the research, financial resources, and time restraints. Sampling methods can be categorised under two headings: probability and nonprobability sampling methods (Kinnear and Taylor, 1991).

In probability samples, the probability of every element of the population being selected is known and nonzero (Churchill and Iacobucci, 2002). In other words, because the sample size is predetermined by researchers, the population size is known. In probability samples, researchers need to select sample elements from the population carefully to avoid arbitrariness or bias (Aaker and Day, 1990). There are four types of probability samples: simple random sampling, systematic sampling, stratified sampling, and cluster sampling (Cohran, 1977).

Simple random sampling is the purest form of probability sampling. It starts with a complete list of all the elements in the population, and then each sample element is drawn from the population list in a random fashion. However, to ensure randomness, software programs are needed because it is difficult to select manually.

Systematic sampling is often used as an alternative for simple random sampling. It gives researchers expediency and does not have a high risk of producing a non-representative sample. Researchers need to first identify a skip interval, which can be computed through using the following formula:

$$\text{Skip interval} = \frac{\text{Population size}}{\text{Sample size}}$$

For example, if the population size is 1000 and the sample size is 100, the skip interval is 10. Then researchers draw a random number between 1 and 10 as the starting point, from which the skip interval is employed and each 10^{th} unit is selected after the starting point until the sample size is reached (Malhotra and Birks, 2007).

Stratified sampling applies a two-step procedure. First, the population is divided into two or more mutually exclusive and exhaustive subsets. Second, in each subset, simple random samples are used to select the sample elements.

The three types of probability sampling methods discussed above are all single unit samples, in which all sampling units are selected separately. However, in cluster sampling, sampling units are selected in groups. The first step of cluster sampling is the same as stratified: the population is divided into mutually exclusive and collectively exhaustive subsets, but the second step is to randomly select a sample of the subsets and draw all the elements from these subsets as the final sample (McDaniel and Gates, 2014).

There are also four types of nonprobability sampling methods: convenience sampling, judgement sampling, quota sampling, and snowball sampling (McDaniel and Gates, 2014).

Convenience sampling, as the name suggests, is used for reasons of convenience. It uses people who are easily accessible, such as family, friends, colleagues, and random strangers.

In judgement sampling, the selection criteria are based on the researcher's own judgement about where to find a representative sample.

Quota sampling's two-step procedure is very similar to stratified sampling. First, the population is divided into proportions based on different characteristics. Then sample elements are drawn from each subgroup using convenience or judgement.

In snowball sampling, researchers obtain additional respondents based on referrals from initial respondents.

In this study, and because the sample frame (population list) can be developed using the Kompass database, the probability of each element being selected is known. Thus, probability sampling is used. The next step is to choose one probability sampling method among the four types. Stratified sampling is used when the

population of interest can be divided on the basis of factors related to the characteristics of interest in the population. This study is not investigating similarities or differences among different stratums, thus there is no need to expend the time and effort on stratification. A key benefit of cluster sampling is that the sampling units are selected in groups, which makes the sampling process quicker. However, in this study, the population list is presented in a spreadsheet instead of existing clusters. Thus, cluster sampling does not warrant the benefits it is designed for. When choosing a probability sampling method from the remaining two: simple random and systematic sampling, the latter is more advantageous because of its simplicity and accuracy. Simple random sampling requires computer programmes to ensure the complete randomness, while systematic sampling is often used as a substitute and has a small risk of producing a non-representative sample (McDaniel and Gates, 2014). To calculate the skip interval and starting point in systematic sampling, the sample size is the next step to be decided on.

4.4.4 Sample Size Determination

Spector (1992) suggests that it is necessary to have between 100 to 200 respondents in order to test for reliability and validity of the measures used to capture constructs in survey data. By reviewing recent literature on strategic management in which top management is surveyed (e.g., Dennis, 2003; Newbert, 2008; Gruber et al., 2010; Kumar et al., 2011), it is anticipated that about a 10% response rate can be achieved. However, it is worthwhile to note that not all the respondents are qualified to complete the survey because this study is focused on coopetition strategy, while not every company being surveyed is necessarily cooperating with competitors. The literature reports that about half of the cooperative relationships take place between competitors (Harbison et al., 1998). Thus, it can be assumed that about half of the companies in our chosen industries are currently cooperating with competitors. Taking into account the 10% response rate and 50% coopetition rate, obtaining about 150 qualified responses requires the sample size to be 3000.

4.4.5 Sample Elements Selection

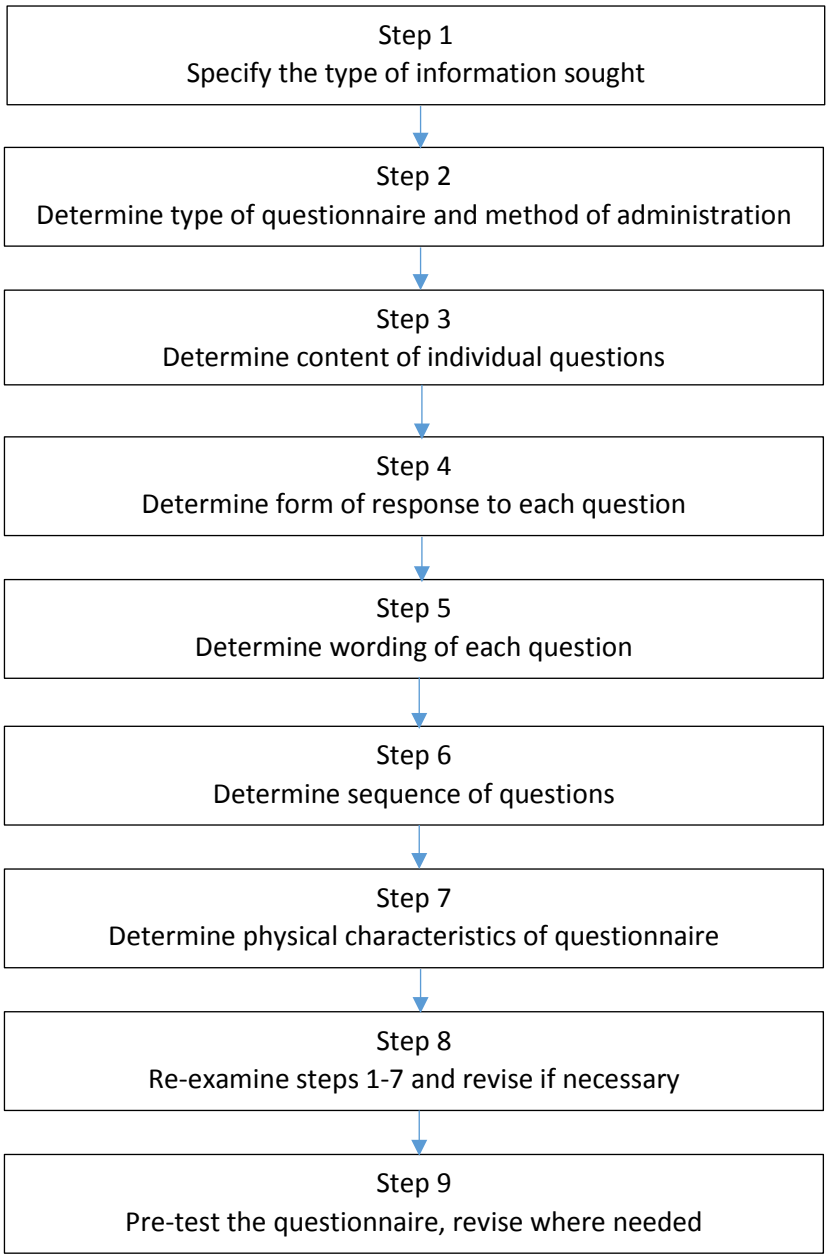
After determining the sample frame, sample size, and sampling method, the next step is to select sample elements from the sample frame. The first step is to calculate the skip interval, which equals to 13143/3000 = 4.381. After rounding down, the skip interval is 4. The second step is to pick a random number between 1 to 4. Four small pieces of paper with these four numbers are put into a box, and the number 3 was randomly picked as the starting point. Then all the companies in the sample frame are alphabetically listed to ensure randomness, and every 4th company after the starting point is added into the sample. A total number of 3285 companies were obtained. The first 3000 companies are selected resulting the final sample size of 3000.

4.5 Survey Design

4.5.1 Questionnaire Design

After having proposed the data collection method and sampling procedures, this section gives a detailed description of the questionnaire design process. A poorly designed questionnaire can result in incomplete information, inaccurate data, lower response rate, and higher costs (McDaniel and Gates, 2014). Moreover, poorly designed content and wording of the questionnaire can become sources of common method biases, which can have potentially serious effects on research findings (Podsakoff et al., 2003). Designing a questionnaire is an iterative process, which takes a lot of time and effort, revisions, and reconsiderations (Sudman and Bradburn, 1982). The specific procedures of developing a questionnaire are presented in the figure below:

Figure 4.1: Procedures of Questionnaire Design



Source: Iacobucci and Churchill (2010)

Step 1: Specify the type of information sought

The information sought is related to the objectives of the study. Using a knowledge-based view, this study is concerned with whether coopetition can help firms to develop new knowledge-based resources and capabilities, while in the meantime, result in the loss of uniqueness of their existing knowledge-based resources and capabilities. This study is also investigating the impact of competitors' opportunistic behaviour from a game theoretical perspective. A detailed list of types of information is presented in Table 4.3.

Table 4.3: Information Sought from Respondents

Coopetition strategy • Is the firm cooperating with competitors? • Which business activity (activities) is the firm cooperating with competitors on? • How intensively is the firm employing this strategy?
Level of opportunism • Are the competitors behaving opportunistically when collaborating? • If yes, how opportunistic are they?
Knowledge-based new resources and capabilities • Is the firm developing new knowledge-based resources and capabilities in the coopetition process? • To be more specific, what resources and capabilities have been developed?
Uniqueness of existing knowledge-based resources and capabilities • Is coopetition strategy helping to build the firm's uniqueness of existing resources and capabilities or causing to lose uniqueness? • Does cooperating with competitors on different types of business activities have different impacts on uniqueness of resources and capabilities?
Performance • Do the new knowledge-based resources and capabilities help to improve performance? • If so, to what extent? • Does uniqueness of existing knowledge-based resources and capabilities help to improve performance?
Business environment • Is the market the business is operating in turbulent?
Firm profile information • Company size • Company age • Industry

Step 2: Determine type of questionnaire and method of administration

As discussed earlier (Section 4.3.3), there are four basic approaches to administer a questionnaire-based survey: face-to-face interviews, telephone interviews, mail survey, and online survey. Online survey is chosen as the approach and completion of the questionnaires is self-administered.

Step 3: Determine content of individual questions

To propose measures of the key constructs in the conceptual model, a literature search was conducted (see Chapter 2). The original measures capturing the key constructs were purified, refined, and validated in order to meet specific research objectives (Churchill, 1979; Spector, 1992). A detailed explanation of how the measurement of each constructs was developed is presented in the next section (4.5.2 Constructs Measurements).

Step 4: Determine form of response to each question

Two main types of questions can be used in business research: open-ended and closed-ended. Open-ended questions require respondents to reply in their own words, while closed-ended questions allow respondents to choose from a list of answers. Close-ended questions are used much more intensively in quantitative business research than the counterpart because of the low response rate of open-ended questions (Hox and De Leeuw, 1994). Moreover, data from closed-ended questions is easier to be analysed using statistics software such as SPSS, and comparisons of different respondents' answers can be made more easily (Churchill, 1999). To ensure higher response rate, closed-ended questions are mostly used in the questionnaire. Only a few questions in the end of the survey require manual input and are open-ended questions (e.g., annual turnover, number of employees, age of the company, industry). After choosing a closed-ended format of questions, the next step is to select different types of answer scales.

In closed-ended questions, there are four basic levels of measurement scales, which are nominal, ordinal, interval, and ratio (Kinnear and Taylor, 1991). Nominal scales partition data into mutually exclusive and collectively exhaustive categories. The numbers assigned to the answers are only names or categories but have no true

numeric value, which means the numbers cannot be ordered, added, or divided (McDaniel and Gates, 2014).

Ordinal scales have the labelling characteristics of nominal scales plus an ability to order data. Ordinal scales can only be used to indicate rank order. The gaps between the numbers do not indicate absolute quantities, in other words, intervals between the numbers are not necessarily equal (Lee and Lings, 2008).

Interval scales have all the characteristics of ordinal scales plus intervals between the points on the scale are equal. Interval scales are more preferable than ordinal by researchers because data generated from interval scales are amenable to computation of a mean, standard deviation, and correlation coefficients (Kerlinger and Lee, 2000). However, it is worth noting that the zero point of interval scales is arbitrary. Therefore, interval data can only be added or subtracted, but cannot be divided or multiplied (McDaniel and Gates, 2014).

Ratio scales have all the characteristics of interval scales as well as a meaningful absolute zero point. Ratio scales are often used to measure physical characteristics such as age, weight, height, distance, turnover, net profit, market share, and population counts (May, 2004).

In social science research, measuring respondents' attitudes is more difficult than measuring physical attributes in physical sciences because attitudes are not directly observable. The abstract variables that cannot be directly measured are termed as latent variables, such as perceptions, beliefs and attitudes. Latent variables are measured indirectly by using scale(s) that contain observed indicators which indirectly measure the latent variables (Hair et al., 2011; Byrne, 2010). Some commonly used scales such as Likert, rating, constant sum, semantic differential, and Stapel scales allow researchers to measure at an interval level (de Vaus, 1996). In Likert scales, respondents are asked to indicate the level of agreement or disagreement with each statement by assigning it a numerical score ranging from 1 to 5 or 1 to 7 (McDaniel and Gates, 2014). Likert scales are often used as an interval scale (Kinnear and Taylor, 1991). Itemised rating scales are similar to the Likert scales. Respondents are asked to select an answer from a limited number of

ordered categories. Itemised rating scales are more flexible and answer options can be from ‘much worse’ to ‘much better’, ‘very bad’ to ‘very good’, and ‘not at all’ to ‘extremely’ etc. Constant sum scales ask respondents to divide a given number, typically 100, among two or more attributes (McDaniel and Gates, 2014). Semantic differential scales require respondents to select an answer between dichotomous pairs of options, such as from ‘boring’ to ‘stimulating’. The Stapel scale is a modification of the semantic differential. It only gives a single adjective and asks the respondent to rate it on a scale, typically ranging from +5 to -5.

Likert scales and itemised rating scales are used to measure most of the items in the questionnaire. A key advantage of using them is that in each item, only one statement of phrase needs to be developed, with the scale running from one extreme to the other. Another important decision that needs to be made is the number of categories to be included in a scale. If the number of points is too small, for example 3 points, the scale is crude and lacks richness. But if there are too many categories, such as 9, it may be beyond a respondent’s ability to accurately discriminate different categories which may lead to frustration and inaccuracy (Kim, 1998). 5- and 7-point scales are the most commonly used ones in business research and produce most reliable results (e.g., Krosnick and Fabrigar, 1997; Viswanathan et al., 2004). However, a recent study by Finstad (2010) suggests that 7-point scales provide a more accurate measure of a participant’s true evaluation and are more appropriate for electronically-distributed questionnaires. In this study, all items are measured on 7-point scales.

Step 5: Determine wording of each question

Once the content of the items, response format, and scales have been decided on, the next step is to check the actual wording of each questions. There are certain guidelines about the wording of the question. For example, de Vaus (1996) suggests researchers to follow these recommendations:

- Jargon or technical terms should not be used
- Short questions are preferable
- Each single question should not contain more than one question (not be double-barrelled)

- Leading questions have to be avoided

McDaniel and Gates (2014) provide four general guidelines about wording of questions:

- Make sure the wording is clear
- Avoid biasing the respondent
- Consider the respondent's ability to answer the questions
- Consider the respondent's willingness to answer the questions

Step 6: Determine sequence of questions

After formulating the questions, the next step is to determine the sequence of questions and develop a layout for the questionnaire. The questionnaire flow is crucial and a well-organised structure can help to elicit answers (Sudman and Bradburn, 1982) and reduce common method variance (Podsakoff et al., 2003). First, screening questions need to be used at the beginning of the questionnaire to identify qualified respondents. This step is especially important in this study because not every company cooperates with competitors, in other words, not every respondent is eligible to participate in the survey. The screening question is:

To what extent do you cooperate with your competitors? Please choose one of the following options below.

1 = we do not cooperate with any of our competitors

2 = we rarely cooperate with competitors

3 = we cooperate with competitors on a small range of aspects of our business

4 = we cooperate with competitors on some aspects of our business

5 = we cooperate with competitors on many aspects of our business

6 = we cooperate with competitors on most aspects of our business

7 = we cooperate with competitors on all aspects of our business

If option 1 or 2 are selected by the respondent, the survey ends and thanks them for their participation.

Second, general questions need to be asked right after the screening questions. Questions that need more effort and commitment are placed in the middle. Sensitive,

threatening, and demographic questions (for example financial data), need to be positioned at the end of the questionnaire (Bradburn et al., 2004).

Step 7: Determine physical characteristics of questionnaire

After determining the content and sequence of the online questionnaire, the next step is to decide on the physical characteristics. Qualtrics, an online survey tool, is used for survey data collection. One important decision that needs to be made is the usage of sophisticated questionnaire design. On the one hand, online questionnaires that have advanced features such as html table, multiple colours, animation, java-applets, and sound tracks may increase the attractiveness of online survey and enhance response rate. On the other hand, adding these complex features may make questionnaires more difficult for some people to access and complete because the additional features may overload some respondents' browsers (Dillman, 2007). Thus, complex online questionnaire design may also lower the response rate. Dillman's (2007) experiment suggests that a plain online questionnaire without advanced features provides better results than a fancy version of the same questionnaire. In the experiment, the plain questionnaire has a higher response rate and is more likely to be fully completed.

Therefore, the online questionnaire in this study is designed in a more conventional way. Black letters and a white screen are used. University logos are placed on top of each page. The survey link is checked to make sure it can be properly opened on different operating systems (different versions of windows and iOS), different web browser tools (e.g., IE, Chrome, Firefox), tablets, and smart phones.

Step 8: Re-examine steps 1-7 and revise if necessary

Developing a good questionnaire is an iterative process. After designing the first draft of the questionnaire, it still potentially might require revisions. Researchers need to avoid misinterpretations or confusion, ensure continuity of the questions, address all typos, and make sure there are no better alternatives for the questions (Sudman and Bradburn, 1982).

Step 9: Pre-test the questionnaire, revise where needed

Before the questionnaire is sent out to the sample, a pre-test of the survey is necessary. Questionnaire pre-testing usually has two stages: protocols/debriefings and pilot study(s) (Aaker and Day, 1990). The first stage involves personal interviews with potential respondents or academics. The second stage needs to be conducted in the exactly same mode as the main survey, so as to examine response rate, respondents' actions, and errors in questions. The pre-test process is discussed in more detail in Section 4.6, including a discussion of debriefing methods.

4.5.2 Constructs Measurements

To develop new measures and adapt existing measures to this research context, relevant literature needs to be first reviewed and existing measures can be used as the starting point. However, it is unlikely that existing measures can be used directly without any adaptation. Sometimes existing measures are inadequate and problematic when they are used in a different research context, which implies new measures may need to be developed.

4.5.2.1 Coopetition

Most of the coopetition studies in the literature have adopted a qualitative approach (e.g., Gnyawali and Park, 2009; Peng et al., 2012; Fernandez et al., 2014). Only a very small percentage of coopetition studies have employed quantitative methods (Bouncken et al., 2015). Given the infancy of coopetition research and novelty of this study, appropriate and well-developed measures do not exist to perform large-sample studies of coopetition (Peng et al., 2012). Therefore, coopetition measures need to be developed.

This study focuses on investigating whether cooperating with competitors can help companies to build new knowledge-based resources and capabilities, and whether the new resources and capabilities can improve overall company performance. Therefore, coopetition needs to be measured on a continuous scale and Mention's (2011) single dichotomous item (1= firm is involved in at least one cooperation with competitor; 0= firm has no cooperation with competitor) is not appropriate. As

discussed in the literature review (see section 2.2.7), using multiplicative measure of coopetition and competition intensities is problematic because the multiplicative score is sometimes misleading and fails to reflect how coopetitive the firm is. Luo et al. (2007) and Peng et al. (2012) measure coopetition as the propensity that a firm may cooperate with competitors on different business activities. Each item represents a business activity and seven-point Likert scales are used to indicate the propensity that coopetition may occur. However, as mentioned in section 2.2.7, the items representing business activities need to be as exhaustive as possible. Therefore, following Luo et al. (2007) and Peng et al.'s (2012) approach, 11 items of coopetition propensity are designed based on the coopetition literature and exploratory research conducted. The first six items are designed to measure *internally focused coopetition*, while the last five are to measure *externally focused coopetition*. 7-point Likert scales are used for all the items.

- Over the last year, we closely collaborated with some of our competitors on R&D.
- Over the last year, we closely collaborated with some of our competitors on new product development.
- Over the last year, we closely collaborated with some of our competitors on technology improvement.
- Over the last year, we closely collaborated with some of our competitors on information systems.
- Over the last year, we closely collaborated with some of our competitors on procurement.
- Over the last year, we closely collaborated with some of our competitors on manufacturing.
- Over the last year, we closely collaborated with some of our competitors on distribution.
- Over the last year, we closely collaborated with some of our competitors on sales.
- Over the last year, we closely collaborated with some of our competitors on marketing.

- Over the last year, we closely collaborated with some of our competitors on branding.
- Over the last year, we closely collaborated with some of our competitors on customer service.

To simplify the wording of the items and make it easier for respondents to read, the final wording of the measures is presented in Table 4.4 below.

Table 4.4: Operationalisation of Internally and Externally Focused Coopetition

To what extent do you agree or disagree with the following statements?							
Over the last year, we closely collaborated with some of our competitors on:							
	Strongly disagree (1)	Disagree (2)	Slightly disagree (3)	Neutral (4)	Slightly agree (5)	Agree (6)	Strongly agree (7)
R&D							
New product development							
Technology improvement							
Information systems							
Procurement							
Manufacturing							
Distribution							
Sales							
Marketing							
Branding							
Customer service							

4.5.2.2 Competitors' Opportunism

Questions on competitors' opportunism include 10 items. They are drawn from the existing literature and adapted to the coopetition context. The first 7 items are drawn from Morgan and Hunt (1994), Skarmeas, et al. (2002), and Caniels and Gelderman (2010), and adapted for the coopetition context. Last 3 items are from Heide et al. (2007) and Rokkan et al. (2003). As opportunism has not been operationalised in the coopetition context in extant literature, it is important to draw on literature from other business research domains (e.g., supply chain management, marketing) to create the measurement instrument. However, a balance needs to be achieved because including too many items may reduce response rate by increasing the size of the survey and introducing problems surrounding respondent fatigue. As with all

measurement batteries, a balance needs to be made between number of items and respondent effort.

Table 4.5: Operationalisation of Threat of Opportunism

Thinking about your cooperative arrangements with your competitors, to what extent do you agree or disagree with the following statements? Strongly disagree (1), Disagree (2), Slightly disagree (3), Neutral (4), Slightly agree (5), Agree (6), Strongly agree (7)	
Variables and Items	Source
On the whole, our competitor exaggerates needs to get what they desire.	John, 1984 Morgan and Hunt, 1994 Simonin, 1999 Skarmeas, et al., 2002 Caniels and Gelderman, 2010 Cheng and Sheu, 2012
Our competitor breaches cooperative agreements to their benefit.	
Overall, our competitor alters facts to get what they want.	
Good faith bargaining is not a hallmark of our competitor's negotiation style.	
Our competitor has benefited from our relationship to our detriment.	
To accomplish their own goals, sometimes our competitor promises to do things without actually doing them later.	
Our competitor is not always honest with us.	
On occasion, our competitor lies about certain things in order to protect their interests.	Rokkan et al., 2003 Heide et al., 2007
Our competitor tries to take advantage of "holes" in our contracts to further their own interests.	
Our competitor sometimes uses unexpected events to extract concessions from our firm	

4.5.2.3 Knowledge-based Resources and Capabilities

In the first iteration of questionnaire development, 11 categories of knowledge-based resources and capabilities were identified and there were 58 items in total. The 11 categories echo typical knowledge-based resources and capabilities considered in the literature (c.f., Hughes and Morgan, 2007). They include production and R&D resources, product capabilities, intellectual resources, knowledge, technological resources, innovation capabilities, relationship-building capabilities, brand management capabilities, selling capabilities, marketing planning capabilities,

marketing communication capabilities, and marketing implementation capabilities. The measurement items and their sources are shown in Table 4.6. The items of the knowledge-based resources and capabilities are presented in the table below.

Table 4.6: Operationalisation of Knowledge-based Resources and Capabilities

Please indicate the extent to which you have gained access to the following as a result of your cooperative arrangements with competitors. Not at all (1) to Extremely (7).	
Variables and Items	Source
Production and research-and-development (R&D) resources	Leonidou, Palihawadana, and Theodosiou, 2011
Modern production technology and equipment	
Availability of production capacity	
Possession of unique/patented products	
Possession of proprietary technical knowledge	
Amount of money spent on R&D	
Product capabilities	Morgan, Vorhies, and Mason, 2009
Ability to develop new products/services	
Developing new products/services to exploit R&D investment	
Successfully launching new products/services	
Ensuring that product/service development efforts are responsive to customer needs	
Intellectual resources	Leonidou, Palihawadana, and Theodosiou, 2011
Knowledge about market demand	
Knowledge about business practices	
Knowledge about regulations and paperwork	
Knowledge about logistical requirements	
Knowledge	Gruber et al., 2010
Knowledge of the design and specification of company products/services.	
Knowledge of the application and functions of company products/services.	
Knowledge of our customers' markets and products.	
Knowledge of our target markets.	

Knowledge of competitors in this market.	
Knowledge of the channel in this market.	
Knowledge of the broad market environment.	
Technological Resources	Morgan, Vorhies, and Schlegelmilch, 2006
Knowledge and experience of our technical (R&D, scientific, laboratory, engineering, etc.) personnel.	
Technical and scientific knowledge and information relevant to the industry.	
Patented knowledge relevant to the industry.	
New technical and scientific discoveries relevant to the industry.	
Relevant discoveries by our technical and scientific personnel.	
Innovation capabilities	Kaleka, 2011
Adopting new methods and ideas in the production process	
Developing new/innovative products	
Adopting innovative marketing techniques and methods	
Sensing trends and competitors' movements	
Relationship-building capabilities	Morgan, Slotegraaf, and Vorhies, 2009
Obtaining reliable representation in our markets	
Establishing business ties with other organisations	
Establishing and maintaining close supplier relationships	
Identifying and targeting attractive customers	
Establishing a "dialogue" with target customers	
Getting target customers to try our products/services	
Focusing on meeting customers' long term needs to ensure repeat business	
Maintaining loyalty among attractive customers	
Enhancing the quality of our relationships with attractive customers	
Maintaining positive relationships when migrating unattractive customers	
Brand Management capabilities	Morgan, Slotegraaf, and
Using consumer insight to identify valuable brand positioning.	

Establishing desired brand associations in consumers' minds.	Vorhies, 2009
Maintaining a positive brand image relative to competitors.	
Achieving high levels of brand awareness in the market.	
Leveraging customer-based brand equity into preferential channel positions.	
Tracking brand image and awareness among target customers.	
Selling capabilities	Morgan, Vorhies, and Mason, 2009
Giving salespeople the training they need to be effective	
Sales management planning and control systems	
Selling skills of salespeople	
Sales management skills	
Providing effective sales support to the salesforce	
Marketing planning capabilities	Morgan, Vorhies, and Mason, 2009
Marketing planning skills	
Ability to effectively segment and target market	
Developing creative marketing strategies	
Thoroughness of marketing planning processes	
Marketing communication capabilities	Morgan, Vorhies, and Mason, 2009
Developing and executing advertising programs	
Advertising management and creative skills	
Public relations skills	
Brand management skills and processes	
Marketing implementation capabilities	Morgan, Vorhies, and Mason, 2009
Allocating marketing resources effectively	
Organizing to deliver marketing programs effectively	
Translating marketing strategies into action	
Executing marketing strategies quickly	

4.5.2.4 Loss of Uniqueness of Existing Knowledge-based Resources and Capabilities

After reviewing the literature, it is to the author's best knowledge that the measures of loss of existing knowledge-based uniqueness of resources and capabilities do not exist and need to be created. The knowledge-based view of the firm (KBV) assumes that a firm has a competitive advantage or enhanced performance if it possesses tacit individual knowledge that is unique and relatively immobile (Grant, 1996a). A firm's tacit knowledge is also hard to be imitated by competitors. However, due to knowledge sharing in coopetition, competitors may gain access to the focal firm's tacit knowledge and accordingly develop critical capabilities. Therefore, the measurement items of loss of uniqueness are developed based on the relevant literature.

Table 4.7: Operationalisation of Loss of Uniqueness of Existing Knowledge-based Resources and Capabilities

Please rate the extent to which you agree or disagree with the following statements: From engaging in cooperative arrangements with our competitors... Strongly disagree (1), Disagree (2), Slightly disagree (3), Neutral (4), Slightly agree (5), Agree (6), Strongly agree (7)
1. ...we have sacrificed unique information and knowledge to our competitors.
2. ...our resource-base is no longer unique in comparison to our competitors.
3. ...we no longer possess unique knowledge over and above our competitors.
4. ...we have provided competitors with knowledge that they found difficult to develop by themselves.
5. ...we have given up uniqueness in our resource-base.
6. ...we have provided competitors with knowledge that may help them imitate us.

4.5.2.5 Performance

Sieger (1992) defines performance measures as a quantitative indicator used by managers to judge how well one part or all of a company is doing. However, some other scholars argue that performance measures should not be confined to only quantitative and financial measures. Including subjective judgements is necessary in accurately determining the overall performance (Dess et al., 1997). In this study, only

perceptual/subjective measures of performance are used mainly for three reasons. First, financial performance measures such as ROI and ROA are typically not available or require further calculation at the business unit level. Second, financial data on its own does not reflect performance because the figures need to be compared with past years and competitors' performance data. Third, evidence exists that perceptual performance measures have a high correlation with objective financial performance measures, which supports their validity (Venkatraman and Ramanujam, 1986, 1987; Naman and Slevin, 1993; Hart and Banbury, 1994). Fourth, performance is frequently associated with achieving set objectives and it is difficult to address this using objective data alone as managers are in the best position to provide information on this. Taken together, it is appropriate to use perceptual measures of performance.

Performance is assessable in different ways. Respondents can be asked to reflect on various performance criteria in comparison with their direct competitors (Morgan and Strong, 2003); reflect on dimensions of efficiency, effectiveness and adaptiveness (Ruekert et al., 1985; Krohmer et al., 2002) and so forth. While all have merit as approaches to assessing performance, a multi-dimensional approach is appropriate to cover the gamut of performance perceptions managers have. Therefore, perceptual measures of effectiveness, efficiency, and adaptiveness are used to measure performance (Ruekert et al., 1985).

Table 4.8: Operationalisation of performance

Efficiency Please rate your business' performance over the last year in terms of: Very bad (1) to very good (7)
1. Earning profits?
2. Achieving better results at lower cost?
3. Achieving efficiency in business activities?
4. Performing business activities right the first time?
Effectiveness Please indicate the extent to which you have met the following objectives over the last year. Very ineffective (1) to very effective (7)
1. Achieving customer satisfaction?
2. Providing value for customers?
3. Attaining desired growth?
4. Securing desired market share?
5. Keeping current customers?
6. Attracting new customers?
Adaptiveness: Please rate your business' performance over the last year in terms of: Very bad (1) to very good (7).
1. Adapting your business strategy adequately to changes in the business environment of your organisation?
2. Adapting your business strategy adequately to changes in competitors' business strategies?
3. Adapting your business strategy quickly to the changing needs of customers?
4. Reacting quickly to new market threats?

Source: Ruekert, Walker, and Roering, 1985

4.5.2.6 Environmental Turbulence

Environmental turbulence is measured three-dimensionally, which are technological turbulence, market dynamism and competitive intensity (Kohli and Jaworski, 1990). While we can measure environmental turbulence in a unidimensional or formative manner by collapsing the three dimensions into one, such an approach risks creating

confounding effects or confused findings as we lack insight into what aspect of environmental turbulence is having an effect.

Table 4.9: Operationalisation of Environmental Turbulence

To what extent do you agree or disagree with the following statements? Strongly disagree (1), Disagree (2), Slightly disagree (3), Neutral (4), Slightly agree (5), Agree (6), Strongly agree (7)
Market dynamism:
In our kind of business, customers' product preferences change quite a bit over time.
Our customers tend to look for new products all the time.
We are witnessing demand for our products and services from customers who never bought them before.
New customers tend to have product-related needs that are different from those of our existing customers.
We cater to many of the same customers that we used to in the past.
Competitive intensity
Competition in our industry is cutthroat.
There are many 'promotion wars' in our industry.
Anything that one competitor can offer, others can match readily.
Price competition is a hallmark of our industry.
One hears of a new competitive move almost every day.
Our competitors are relatively weak.
Technological turbulence
The technology in our industry is changing rapidly.
Technological changes provide big opportunities in our industry.
It is very difficult to forecast where the technology in our industry will be in the next 2 to 3 years.
A large number of new product ideas have been made possible through technological breakthroughs in our industry.
Technological developments in our industry are rather minor.

4.5.2.7 Company Profile information

In addition to environmental turbulence, company profile information is also included in the conceptual model as control variables. To be more specific, company profile questions are open-ended including last year's annual turnover, number of employees, age of company, and industry type. These questions provide a general profile of the companies responding to the survey and provide sufficient depth of insights into these companies. In addition, firm size, age, relative sales and industry type are frequently used control variables in management research and as such the profile characteristics here will allow for these to be used in future analysis in such a manner. The 4 profile questions are presented in Table 4.10.

Table 4.10: Profiling Variables

What was your company's annual turnover over the last financial year? (in British Pounds)
How many full-time employees does your business currently have (approximate number)?
How many years has your business been operating (approximate number)?
Which industry (industries) is your company operating in?

4.6 Pre-testing

Before the survey is implemented within the sample group, the questionnaire must be pre-tested. Pre-test is an essential step of survey design because it can help to identify potential problems with the survey instrument such as poor skip patterns, inappropriate wording, misinterpretation of questions, and improper measurement items (Churchill and Iacobucci, 2002). In addition, pre-testing also provides information regarding respondents' reactions such as response rate, sensitivity of certain questions, and preferred format of questions. Questionnaire pre-testing usually has two stages: protocols/debriefings and pilot study(s). The first stage involves personal interviews with potential respondents or academics. The second stage uses the same data collection method as for the main study but on a smaller sample (Aaker and Day, 1990).

4.6.1 Protocols/Debriefings

Protocol analysis and debriefing have similar purposes but differ in procedures. Protocol analysis is conducted when a respondent is asked to think out loud in the process of completing of a questionnaire (Diamantopoulos et al., 1994). Debriefing allows respondents to provide feedback after completing the questionnaire (Hair et al., 2011). Both approaches give researchers feedback on wording, sequence, physical appearance, clarity, and difficulties of the questionnaire.

Protocols/debriefings are very valuable in evaluating the face validity and content validity of the questionnaire. Allen and Yen (1979), Anastasi (1968), and Nevo (1985) define face validity as the degree to which respondents or users judge that the items of an assessment instrument are appropriate to the target constructs and assessment objectives. Content validity is defined by Nunnally and Bernstein (1994) as the degree to which a measure's items represent a proper sample of the theoretical content domain of a construct. In order to determining face and content validity, having experts, such as academics and manager in relevant fields, assess the questionnaire becomes crucial.

Both protocols and debriefings were used to pre-test the questionnaire. In total four protocols were conducted with academics and two debriefings with company managers. Each protocol with academics lasted for about one hour. The debriefings took place on the internet and managers are asked to send their feedback on the questionnaire back via emails after completing the questionnaire.

4.6.1.1 Structure and content

All respondents in the protocol analysis and debriefings expressed their concerns over the length of the questionnaire. In particular, the two managers warned that a nine-page questionnaire takes about 30 minutes to complete, which is much longer than the questionnaires they normally receive and may affect response rate. One manager suggested the removal of the following sentence from the front page: 'there are 9 pages, which should take between 20 and 30 minutes to complete'. However, respondents should be informed of the length of the questionnaire before they start

the survey (Hornik, 1981). Therefore, the sentence indicating the length of the questionnaire was retained. To reduce the length of the questionnaire, researchers can either reduce the number of constructs, or reduce the number of items in certain constructs. The number of constructs cannot be reduced because they are all part of the conceptual model. After a careful evaluation of the number of items in each construct, I noticed that the 'knowledge-based resources and capabilities' construct had many more items than others and two pages were allocated to it. Therefore, to reduce questionnaire length significantly it was decided that the measures for knowledge-based resources and capabilities should be simply based on the resources and capabilities themselves as a list and not have reflective items for each and every resource and capability. This approach is consistent with existing work in the marketing literature, for example, the work of Vorhies and Morgan (2003). When Vorhies and Morgan (2003) measure marketing capabilities, respondents are asked to rate how well their firms perform on a set of specific capabilities: environmental scanning, market planning, marketing skill development, and marketing implementation relative to competitors. The same approach is used in this study. The new measurement items of 'knowledge-based resources and capabilities' are presented in Table 4.11. The first five items are designed to measure '*new innovation knowledge-based resources and capabilities*', while the last ten items are to measure '*new marketing knowledge-based resources and capabilities'*.

Table 4.11: Final Measurement Items of Knowledge-based Resources and Capabilities

On a scale of (1) Not at all, to (7) Extremely, please indicate the extent to which you have developed the following capabilities as a result of your cooperative arrangements with competitors.
Research and Development
New product development
Innovation
Information technology
New product launches
Environmental scanning
Marketing planning
Marketing implementation
Marketing communication
Brand management
Public relations
Relationship-building with customers
Understanding of customers
Distribution
Supply chain management

One manager suggested that when potential respondents open the questionnaire, the first several lines will determine whether they will be interested and continue reading the questionnaire. In other words, the questionnaire can start with reasons why they should participate in the survey. Following his guidance, four reasons are given at the start of the welcome page:

Why fill this questionnaire in?

- Receive a full research report when we finish the study
- Understand how to improve your firm's performance via collaboration
- Better understand how to manage relationships with your competitors
- Identify areas where your organisation may be underperforming

One academic noticed that the concept of coopetition was not defined in the questionnaire. She warned that it was dangerous to assume all respondents would

know the meaning of it, and even if they do, they may have different understanding or interpretation on it. Defining this key concept is necessary and needs to be placed at the beginning of the survey. Therefore, a definition of coopetition was designed as a separate paragraph in the welcome page as follows:

The questionnaire is about your "COOPETITION" practices. By "coopetition", we mean whether, and how, you cooperate with your competitors in the same industry who serve the same groups of customers.

It was also advised that the definition of ‘cooperative arrangements’ was too academic and difficult to read. The old definition was ‘a relationship between parties to cooperate on an agreed upon project or meet an agreed objective’, which was replaced by a new definition: ‘relationships with other companies to cooperate on a specific area’.

At the debriefing stage one manager raised his concern that many items were similar and advised to remove those similar items in order to reduce the length of the questionnaire. His suggestion was not adopted because most of the constructs use reflective measures, which means their items are interchangeable (Cadogan and Lee, 2013). However, to overcome such concerns, an explanation was placed on the welcome page: ‘You may notice that some questions are very similar; this is deliberate, and helps with statistical analysis’.

One academic pointed out that in measures of competitors’ opportunism, all questions were about level of opportunism when cooperating with one competitor. However, a respondent’s company can be engaged in several cooperative relationships with multiple competitors. Thus, the plural form is applied and ‘competitor’ is changed to ‘competitors’. The same academic also suggested changing the wording of one item in competitors’ opportunism from ‘our competitors are not always sincere’ to ‘our competitors are not always honest with us’. This suggestion was adopted because ‘honest’ is a more appropriate word choice.

Another academic suggested that respondents’ knowledgeability needed to be assessed. Coopetition strategies are usually implemented by certain departments of

a business and it is unlikely that many people have access to the relevant data. In addition, the data for the current study were collected from a single respondent. Therefore, verifying respondents' knowledgeability becomes necessary before analysing the data. Following the academic's suggestion, a three-item measure of knowledgeability of respondents was added at the end of the questionnaire (Morgan et al., 2003). A 7-point Likert-type scale (from 'strongly disagree' to 'strongly agree') was used for the scale. The three items of knowledgeability of respondents are as follows.

Item 1: '*My job role qualifies me to answer questions about the cooperative arrangements with competitors in my company'.*
Item 2: '*I am competent to answer the above questions'.*
Item 3: *'I am confident that my answers reflect the company's situation'.*

4.6.1.2 Visual design and response format

One of the academics suggested putting Loughborough University and Durham University logos on each page of the questionnaire. This can help to increase the credibility of the research and give respondents confidence in the security of the data they are providing when completing the questionnaire. One of them also recommended varying the look of questions. The similar-looking questions could quickly bore the respondents and may cause them to drop out in the middle of the questionnaire (Dillman, 2007). This advice was followed and a variety of response formats was used such as matrices of choices, dropdown menus, and sliders before sending them to managers for debriefings. However, one manager disliked the dropdown menus as he said the dropdown menus required two mouse clicks to select an answer, while other forms only require one. Therefore, eventually only two constructs with relatively fewer items were chosen to use dropdown menus and others were using matrices of choices and sliders.

One manager mentioned that they would like to know the progress of completion when filling in the questionnaire. To help respondents gauge the progress, a progress bar was added.

4.6.2 Pilot Study

As discussed above, the sample frame has been identified in which 3000 UK high-tech companies with MD/COO email addresses were available for sampling. After sorting the companies alphabetically, the first 200 companies were selected for pre-testing.

The process of the pilot study needed to be the same as the main survey. Potential respondents were firstly contacted over the phone for two reasons. First, common ineligibility problems could occur because of wrong or outdated contact details, non-existence of the company, and non-high-tech companies being selected. Phoning the companies first can help to identify such potential problems and provide solutions. For example, new contact details can be found. Second, this pre-notification exercise has been found to positively influence the response rate (Jobber and O'Reilly, 1998). It increases the chances that potential respondents will pay some attention to the questionnaire when they receive it later, especially if they have agreed to participate in the survey over the phone (Dillman, 2007).

After contacting the 200 companies for the pilot study, 59 companies were found not to be eligible to take part in the survey. There are several reasons for ineligibility:

- The contact number of the company was invalid or no one answered the call during five attempts: 40 companies
- The company was not a high-tech company: 11 companies
- The company no longer existed or have moved to a new address: 8 companies

Consequently, the sample of pilot study has 141 companies. The implementation of the pilot study followed Dillman's (2007) five-stage procedure:

1) The first stage involves pre-notifying potential respondents, the purpose of which is to explain the survey and confirm email addresses. At this stage, 39 companies refused to participate in the survey because of lack of interest (13 companies), busy work schedule (21), and restriction of company policies (5).

Thus, 102 email addresses of the MD/COOs were collected and confirmed for the next stage.

2) After one or two days, an email (see Appendix 4.1) was sent to 102 companies within which purpose of the study was explained and survey link enclosed.

3) A week after sending the first email, a reminder email (see Appendix 4.2) was sent to the non-respondents. The survey link was again enclosed in case the respondents have deleted the previous survey email.

4) Two weeks after sending the first email, a second reminder was sent to those who still had not responded (see Appendix 4.3).

5) Three weeks after sending the first email, the respondents were contacted by phone in order to remind them one last time.

After implementing these five stages, 18 respondents completed the questionnaire. Two respondents started the survey but dropped out in the middle of completion. This may be because they realized the questionnaire was too long and they lost patience. Therefore, the response rate was 18/141=12.8%. However, it is important to note that only 8 among the 18 companies were engaged in coopetition, and other 10 respondents were screened out after answering the first question. The results showed that as expected, not all high-tech companies were engaged in coopetition, and the ratio was 8/18=44.4%. This gave us confidence that with a response rate of 12.8% and coopetition rate of 44.4%, a sample size of 3000 would generate about 3000*12.8%*44.4%=170 qualified responses, which would be ideal for statistical analysis (Spector, 1992). After finalising the debriefings, protocols and pilot study, the main survey was started.

4.7 Main Survey

The implementation of the main survey was aligned with the efforts made at the pre-test stage of the study. The modifications of the questionnaire at the pre-test greatly helped to improve the questionnaire quality. The pilot study provided confidence in the chosen sample size of 3000. Only one minor change of the questionnaire was made after the pilot study. Some questions in the first four pages were moved to the last four pages, which resulted in fewer questions in the first half of the questionnaire. This helped respondents build confidence and momentum while answering the survey, with the aim of reducing dropout rate. The questionnaire used for the main survey is in Appendix 4.4.

4.7.1 Response Rate Enhancement

Having a reasonably good response rate is crucial for representativeness of the sample (Churchill, 2001). Low response rate may lead to non-response bias and reliability of results. Most response rate enhancement techniques have been discussed above and will be summarized here.

First, the target population needs to be carefully chosen (Baruch, 1999). Particularly in this research, target companies are those who cooperate with competitors. Bearing in mind not all companies are engaged in coopetition, it is important to target industries in which coopetition strategy is more likely to be adopted. Hence, companies in UK high-tech industries are selected using Kompass database.

Second, monetary and non-monetary incentives can help to increase response rate (Church, 1993). One of the most commonly used non-monetary incentives is a report based on the research results (Jobber and O'Reilly, 1998). Typical monetary incentives include lottery draws (Harkness et al., 1998) and charitable donations (Robertson and Bellenger, 1978). Because of the budget constraints of the current study, only a non-monetary incentive was used. Respondents were promised to receive a report of the research findings once the data was analysed.

Third, telephone pre-notification and follow-up reminders were also used to improve response rate (Singer, 1978). The procedure of the main survey was the same as the pilot study.

Fourth, it is important to guarantee respondents confidentiality of the information they provide (Singer et al., 1995). Their identity and companies' names will be kept confidential and the information provided by them will be purely for research purposes. This is particularly critical in this research because the questionnaire involves questions with regard to the relationship with competitors.

Fifth, a well-organised structure of the questionnaire and a scrutinised sequence of questions can also enhance response rate. In addition, University logos are enclosed in the questionnaire to increase credibility of the research. The questionnaire also starts with some information that can attract respondents' interest (Dillman, 2007). When respondents open the survey link, the first several lines are:

'Why fill this questionnaire in?

- Receive a full research report when we finish this study
- Understand how to improve your firm's performance via collaboration
- Better understand to manage relationship with your competitors
- Identify areas where your organisation may be underperforming'.

Finally, it is vital to determine the optimal day and time for contacting potential respondents. Weekends were avoided because most UK companies are closed and professionals are less likely to check emails. Mondays were also avoided because companies were usually busy. Contacting top management in the morning was also inefficient since they tend to have more meetings and prioritize errands that are more important in the morning. Therefore, companies were primarily contacted between 2~4pm on Tuesday to Friday, no matter via emails or telephone calls.

4.7.2 Response Rate Analysis

After using 200 companies as the sample for the pilot study, the final sample for the main survey had 3000-200=2800 companies. The procedures of the main survey

were the same as the pilot test. All 2800 companies were initially pre-notified by phone to check eligibility, after which the survey link was emailed to the eligible companies. Two reminder emails were sent to those who did not respond within one and two weeks' time respectively. Three weeks after sending the first email, potential respondents were contacted by phone as a final reminder. Among the 2800 companies, 580 companies were found ineligible in the pre-notification stage. The reasons of their ineligibility were the same as in the pilot study.

- The contact number of the company was invalid or no one answered the call during five attempts: 286 companies
- The company was not a high-tech company: 95 companies
- The company no longer existed or have moved to a new address: 199 companies

Therefore, the final sample for the main survey consisted of 2800-580=2220 companies. After the survey procedures were implemented, a total of 348 responses were received. However, in the first question 71 respondents chose 'We do not cooperate with any of our competitors', and 68 respondents chose 'We rarely cooperate with competitors'. Therefore, these 139 respondents were screened out after answering the first question. In addition, 61 respondents dropped out in the middle of completing the questionnaire, yielding excessive missing answers and so were removed from the final data set. A total of 148 qualified responses were received eventually.

The response rate for the main survey was (348-61)/2220=12.9%. This response rate was considered as acceptable, taking into account the length of the questionnaire and seniority of respondents in the company (Dillman, 2007). The research topic itself may also reduce response rate because for those companies who were not engaged in coopetition, their respondents may feel the questionnaire was irrelevant and then close it right after reading the welcome page.

4.7.3 Non-response Bias Analysis

Non-response bias refers to the errors that result from systematic differences between those who do and those who do not participate in the research (Armstrong and Overton, 1977). Non-response bias is a critical threat to validity because it implies that research results obtained are not generalisable (Morgan and Hunt, 1994). Non-response bias can be examined by either sampling the non-respondents, or assess non-response bias using time trend method. Because the non-respondents have been contacted for five times, it is quite unlikely that they are willing to participate. Thus, time trend method is used to assess non-response bias. This method is based on the presumption that late respondents (those who only respond after receiving at least one reminder) are similar to non-respondents (Armstrong and Overton, 1977; Churchill, 1979). Therefore, early and late respondents need to be located. Early respondents are those who responded after the first emails and before the reminder emails. Late respondents are those who responded after the first, second email reminder, and last call reminder. The table below provides the numbers of responses of each stage:

Table 4.12: Number of Respondents of Different Stages

Survey stages	Initial email	First email reminder	Second email reminder	Last call reminder
Number of responses	87	37	13	11

Early and late responses need to be compared to find out whether significant differences exist. To achieve this, t-tests were performed for the first 50 respondents (i.e. early respondents) and the last 50 respondents (i.e. late respondents). ‘The t-test assesses the statistical significance of the differences between two independent sample means for a single dependent variable’ (Hair et al. 2011, p. 388). Key variables of the two groups are compared, including coopetition focus, threat of opportunism, knowledge-based resources and capabilities, loss of uniqueness, efficiency, effectiveness, and adaptiveness. The results of the independent t-tests carried out are presented in table below. A more comprehensive table of results can be found in Appendix 4.5.

Table 4.13: Comparison between early and late respondents

Variables	Early respondents (N=50)	Late respondents (N=50)	Sig. of t-values (2-tailed)
Coopetition focus	3.2952	2.9740	0.232
Competitors' opportunism	3.7820	3.8620	0.720
Knowledge-based resources and capabilities	2.8652	3.1240	0.370
Loss of uniqueness	3.6467	3.4733	0.445
Efficiency	4.9050	5.1950	0.108
Effectiveness	5.5150	5.4450	0.679
Adaptiveness	5.0550	5.0650	0.955

As can be seen from the table, differences between the means of early and late respondents are not significant at five percent significant level, which indicates that the mean differences between the two sample groups are due to chance (Churchill, 2001). Thus, it can be concluded that there were no major differences between the respondents and non-respondents. Accordingly, it is considered that non-response bias did not have significant impact on the main constructs used in this study.

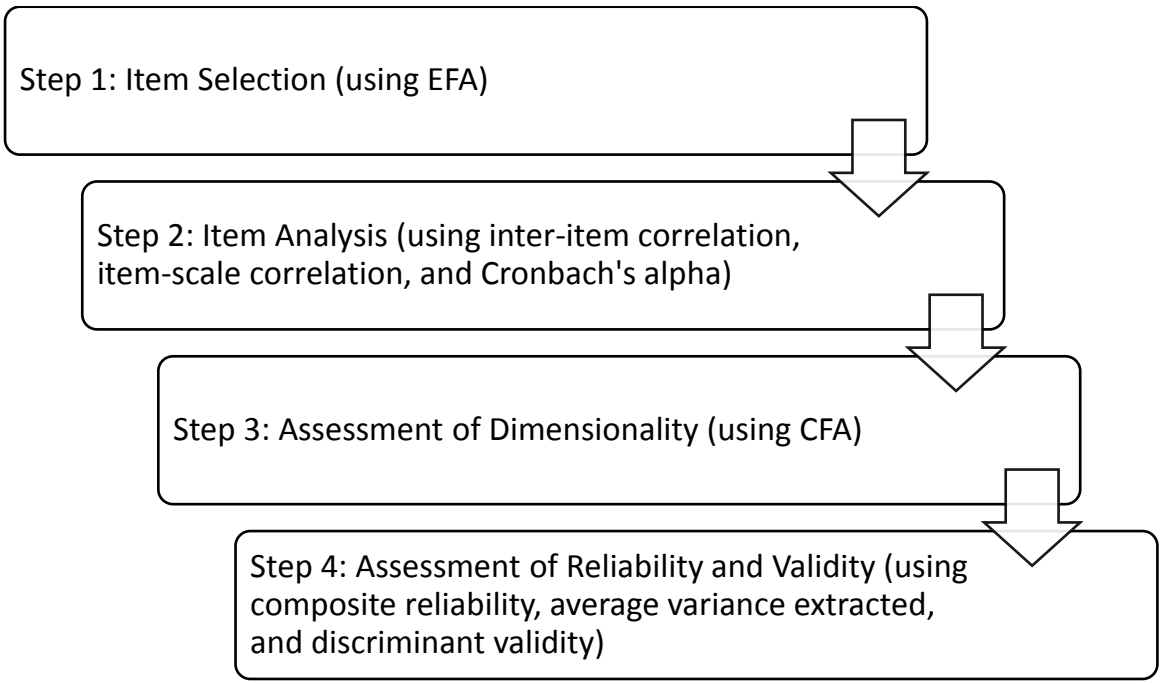
4.8 Analytical Procedures

In this study, because new measures of constructs such as coopetition and uniqueness of existing knowledge-based resources and capabilities are newly developed, it is important to assess the measurement model first before testing the structural model (Hair et al., 2011). Therefore, a two-step analytical procedure is employed, which includes a measurement model assessment and a structural model assessment (Anderson and Gerbing, 1988). In measurement model assessment, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) are used in order to ensure the reliability and validity of measures. In the second step, the conceptual framework is tested using structural equation modelling (SEM).

4.8.1 Measurement Model Assessment

Establishing valid measures is a crucial task before testing hypotheses. To achieve this, rigorous statistical analyses are needed to assess the unidimensionality, reliability and validity of the proposed measures, after which poorly performing items of the measures are identified and eliminated (Siguaw, Simpson, and Baker, 1998). To be more specific, a four-stage procedure in figure 4.2 is used which includes item selection, item analysis, assessment of dimensionality, and assessment of reliability and validity. The psychometric procedure of measure development is based on the guidelines from the measure development literature (e.g., Anderson and Gerbing, 1988; Churchill, 1979; Spector, 1992; Netemeyer et al., 2003; Jöreskog and Sörbom, 1996; and Nunnally and Bernstein, 1994). The four-step procedure of measure development can be viewed as two broad aspects. The first two steps use exploratory factor analysis and item analysis to select and analyse items with the aim of identifying and eliminating poorly performing items. The last two steps use confirmatory factor analysis for the purpose of finalising the scales and establishing dimensionality, reliability, and validity (Netemeyer et al., 2003).

Figure 4.2: Measurement Development Procedure



4.8.1.1 Item Selection using EFA

Clark and Watson (1995) suggest that exploratory factor analysis is the most appropriate analytical approach for initial item selection. Factor analysis enables researchers to identify structures within a set of observed measures (Steward, 1981). More specifically, exploratory factor analysis uses inter-item correlation to determine the underlying dimensions that are responsible for the patterns of correlations observed in the data (Sharma, 1996). EFA is a widely used data reduction and summarisation technique and will be used for the purposes of item selection.

In EFA, large sets of variables are reduced to fewer underlying dimensions (Hair et al., 2011). The underlying dimensions are often referred to as 'factors'. Kerlinger (1964) defines a factor as a construct or a hypothetical entity that is assumed to underlie a set of items. In EFA, variables are grouped based on the level of inter-item correlation with each other. The total variance of a variable is composed of common variance, specific variance, and error variance (Leandre and Duane, 2012). Common variance refers to the variance in a variable that is shared with other variables. Specific variance is unique to that variable and not explained or associated with other variables in the factor analysis. Error variance is the unreliable and inexplicable variation in a variable. The total of specific and error variance is also known as unique variance. EFA uses common variance to determine the underlying dimensions (Hair et al., 2011; Bryman and Cramer, 2009).

Two main factor analysis techniques are often used to identify the underlying dimensions, namely principal component analysis and common factor analysis (Hair et al., 2011). In practice, the results obtained using these two different approaches are usually quite similar (Stevens, 2009). However, it is important to know the differences between these two approaches in order to determine which one is more appropriate for this study. The aim of principal component analysis is to identify the least number of factors that explain the total variance, while common factor analysis is to identify the least number of factors that explain the common variance (Gorsuch, 1997). Researchers often use principal component analysis when they have prior knowledge that the amount of unique variance is relatively small (Diamantopoulos and Schlegelmilch, 2000). When researchers do not have solid knowledge about the

amount of specific and error variance, common factor analysis is often used (Widaman, 1993). Moreover, component analysis is only a data reduction method, which is computed without regard to any underlying structure caused by latent variables (Gorsuch, 1990). In common factor analysis, the shared variance of a variable is partitioned from unique variance, which makes it more preferable. In this study, common factor analysis is more preferable than principal component analysis and will be used in this study.

There are six common factor analysis extraction methods to choose from in SPSS version 20: unweighted least squares, generalised least squares, maximum likelihood (ML), principal axis factoring (PAF), alpha factoring, and image factoring. Among the six methods, ML and PAF provide the best results in general (Osborne and Costello, 2005). When comparing these two methods, the main difference is that ML assigns less weight to the weaker correlations. Thus, it can be expected that ML is less able than PAF to recover the weaker factors (MacCallum et al., 2007). Because the factor analysis at this stage is exploratory in nature, it is helpful to identify all possible factors using PAF.

Another important decision to make is the rotation method. Factors are usually rotated to simplify and clarify the data structure (Field, 2009). Two broad types of rotation methods are orthogonal and oblique rotations. Orthogonal rotation assumes that factors do not correlate with one another and axes (factors) are maintained at 90-degree angles (Dunteman, 1989). Three types of orthogonal rotation are available in SPSS 20: quartimax, varimax and equamax. In contrast, oblique rotations allow the factors to correlate. Three commonly used oblique rotation methods are direct oblimin, quartimin, and promax. Orthogonal rotation is widely used by researchers because it produces more easily interpretable results. However, this approach is problematic because in social sciences, behaviour or attitudes are rarely completely independent of one another. Therefore, oblique rotation methods should theoretically produce a more accurate interpretation of data. Moreover, even if the factors are completely independent to each other, oblique rotation produces nearly the same results as orthogonal approaches (Osborne and Costello, 2005). In this study, direct oblimin is used as the rotation method.

4.8.1.2 Item Analysis

Item analysis is used for the purpose of producing a tentative description of the scale for a later validation (Spector, 1992**;** DeVellis, 2003). This step evaluates the homogeneity of the items to ensure high internal consistency and reliability of them (DeVellis, 2003). To be more specific, item analysis evaluates three aspects of the items measuring the same construct: inter-item correlations, item-scale correlation, and reliability. Inter-item correlations examine the extent to which one item is correlated to all other items in a scale. Item-scale correlation is also known as item-total correlation, which refers to the extent to which an item is correlated with the rest of the items in the scale. Scale reliability is defined as the degree to which scale items are free from random error (DeVellis, 2003). Items measuring the same construct need to have high scores of inter-item correlation, item-scale correlation, and reliability. Items with low or negative coefficients and those that poorly contribute to reliability are considered to be removed from the scales.

Inter-item Correlation

To establish inter-item correlations, a correlation matrix of all items in a scale needs to be examined. Clark and Watson (1995) suggests that a strong inter-item correlation means that the items in a scale share a common cause. In other words, the items are measuring the same construct. It is commonly agreed in the literature that inter-item correlations in a range of 0.4 to 0.5 can be regarded as valid measures of a construct (e.g., Clark and Watson, 1995; DeVellis, 2003). In general, items with scores that are less than 0.2 or 0.3 are bad measures of the construct and can be considered for removal (Churchill, 1979). However, item-scale correlation and reliability also need to be examined before any item being removed (Hair et al., 2011).

Item-scale Correlation

De Vaus (2002) suggests that item-scale correlations can be used to establish unidimensionality of scales. Items that have low scores on correlations with the sum of other items in the scale can be considered for deletion from the scale. Item-scale correlations at this stage provide some initial evidence of scale dimensionality. A full scale dimensionality examination will be conducted in confirmatory factor analysis in

section 4.8.1.3. There are two types of item-scale correlation, which are corrected and uncorrected item-scale correlations (DeVellis, 2003). In corrected item-scale correlation, the total score does not include the item with which it is correlated. Whereas, in uncorrected item-scale correlation, the total score includes the item of interest. The corrected item-scale correlation is more preferable because including the item in the total score inflates the correlation score (Henrysson, 1963). Accordingly, items with low corrected item-scale correlations are considered for removal. A minimum of 0.5 is a common threshold recommended by scholars (DeVellis, 2003; Tabanick and Fidell, 2007).

Scale Reliability Assessment

Scale reliability is defined as the extent to which items in a scale are free from random error and, therefore, provide consistent data (McDaniel and Gates, 2014). It can be calculated as the 'ratio of the variance of the true score to the variance of the observed score' (Netemeyer et al, 2003, p.42). The value of scale reliability generally predicts the dependability and stability of a scale (Bagozzi and Foxall, 1996). Reliability and validity are two pre-requisites of the generalisability of the research results (Nunnally and Bernstein, 1984). Discussion of validity is in section 4.8.1.5. Three commonly used reliability assessments are test-retest, equivalent form, and internal consistency reliability (McDaniel and Gates, 2014).

Test-retest reliability can be achieved by repeating the measurement with the same sample group at a second time under conditions as similar as possible to the original conditions (McDaniel and Gates, 2014). If the results of these two tests are highly similar, the stability aspect of reliability can be obtained (Diamantopoulos and Schlegelmilch, 2000). However, it is often very difficult to have the same sample of respondents agree for a second test. Moreover, the first test may alter respondents' answers to the second. Finally, test-retest reliability is more applicable in longitudinal studies. Because of the cross-sectional nature of this study, test-retest reliability is not an appropriate method.

Equivalent form reliability refers to the ability of two very similar forms of an instrument to produce closely related results (McDaniel and Gates, 2014). However,

this method requires the creation of two identical scales, which is very difficult, if not impossible.

Internal consistency reliability is determined by the extent to which individual items in the scale reflect a common construct (Churchill, 1979). It is concerned with the homogeneity of the items in a scale and can reflect reliability (DeVellis, 2003; Netemeyer et al., 2003). Cronbach's α coefficient is the most commonly used method when assessing internal-consistency reliability (Cortina, 1993). 'The α is basically the ratio of the sum of the covariance among the components of the liner combination (items), which estimates true variance, to the sum of all elements in the variance-covariance matrix of measures, which equals the observed variance' (Nunnally and Bernstein, 1994, p. 212). The value of Cronbach's α ranges from 0 to 1. A higher Cronbach's α indicates high reliability of the scale. In general, it is commonly agreed that scales with a Cronbach's α of greater than 0.9 have excellent internal-consistency (Kline, 2000). Scales with coefficient values between 0.7 and 0.9 have good internal-consistency. Nunnally and Bernstein (1994) suggest that 0.7 should be a threshold criterion. In this study, it is expected that the Cronbach's α coefficients of all scales need to exceed the recommended 0.7 threshold.

4.8.1.3 Assessment of Dimensionality using CFA

After using EFA to determine the number of factors and the underlying factor structure, confirmatory factor analysis (CFA) is used to examine how well the proposed structure (number of latent variables and their item-specification) matches the actual data (Gorsuch, 1997). CFA not only assess the correlations with other items in the same scale, but also correlations with items in the measurement model (Gerbing and Anderson, 1981; Hair et al., 2011). Dimensionality of scales are traditionally established by testing inter-item correlations and item-scale correlations, but Gerbing and Anderson (1988) argue that these techniques cannot provide evidence to external consistency (the correlation between items from different scales). In other words, they cannot discriminate between set of items that present different but correlated factors. Gerbing and Anderson (1988) suggest that CFA provides a stricter interpretation of unidimensionality. Ping (2004) also states that CFA needs to be conducted to empirically validate all items and scales so that

dimensionality, reliability and validity of all the constructs in the measurement model can be established. The unidimensionality of scales can be established in CFA by following two steps: assessment of the model fit and model respecification.

Assessment of Model Fit

Diamantopoulos and Siguaw (2000) suggest that three estimation techniques are commonly used in CFA: ordinary least square (OLS), generalised least square (GLS), and maximum likelihood (ML). The most frequently used technique is maximum likelihood, followed by generalised least squares (Anderson and Gerbing, 1988; Kelloway, 1998). Maximum likelihood estimators are known to be consistent and asymptotically efficient (Bollen, 1989; Hu and Bentler, 1998) and are used in this study.

There are various fit indices available for the assessment of model fit. They can be broadly categorised into two traditions: the assessment of the absolute fit of the model and the assessment of the comparative fit of the model (Bollen and Long, 1993; Tanaka, 1993). The assessment of the absolute fit is concerned with the ability of the model to reproduce the actual covariance matrix. The assessment of the comparative fit compares two or more competing models to evaluate which one produces the better fit to the data (Kelloway, 1998).

In absolute fit indices, chi-square statistic (χ^2) is the most straightforward index (Diamantopoulos and Siguaw, 2000). The value of χ^2 indicates the statistical difference between the covariance matrix implied by the model and covariance matrix implied by data collected. When χ^2 is nonsignificant, there is no significant difference between the model and data, which indicates a good model fit (Bagozzi and Heatherton, 1994). However, the value of χ^2 can be affected by sample size and degrees of freedom (df) (Bentler and Chou, 1987; Anderson and Gerbing, 1988). The χ^2 increases when sample size increases. Degrees of freedom (df) is defined as the difference between the number of known parameters (i.e. the number of estimated parameters fixed to 1.0) and the number of unknown parameters (i.e. the number of parameters that are estimated freely). In large and complex models with high degrees of freedom, χ^2 would tend to be statistically significant, even when there is a reasonably good fit to the data (Marsh and Hocevar, 1985; Hair et al.,

2011). Therefore, a better alternative is the ratio between chi-square and degrees of freedom, which is χ^2/df. If the value is less than 2 or 3, the model can be considered to have a good fit with the data (Byrne, 2010).

Another important absolute fit index is root mean square error of approximation (RMSEA). The formula of RMSEA is as follows:

$$RMSEA = \sqrt{[\chi_M^2 - df_M]/[(N-1)df_M]}$$

χ^2_M is the chi-square for the model

df_M is the degree of freedom for the model

N is the sample size

(Schumacker and Lomax, 2004)

The formula shows that RMSEA is determined by chi-square, degree of freedom, and sample size. It is commonly agreed that RMSEA values less than 0.05 indicate a very good fit to the data (e.g., Steiger, 1990; Bollen and Long, 1993). Moreover, RMSEA values between 0.05 and 0.08 indicate a reasonable fit.

The root mean square residual (RMR) and standardised root mean square residual (SRMR) are the square root of the discrepancy between the sample covariance matrix and the model covariance matrix. The RMR may be relatively difficult to interpret as its range is dependent upon the scales of the items used in the questionnaire. The SRMR is a better index and ranges from 0 to 1, with a value of 0.08 or less being indicative of an acceptable model. The absolute fit indices and critical values of them are presented in Table 4.14.

Table 4.14: Absolute Fit Indices and Critical Values

Absolute Fit indices	Source	Critical Values
Chi-square/*df* ratio	Marsh, Balla, and McDonald (1988)	Less than 2 or 3
Standardised Root Mean Square Residual (SRMR)	Hooper, Coughlan, and Mullen (2008)	Less than 0.08
Root Mean-Square Error of Approximation (RMSEA)	Steiger (1990)	Less than 0.05

Absolute fit indices compare the proposed model against a model that provides a perfect fit to the data. In contrast, comparative fit indices compare the proposed model against a model that is known a priori to provide a poor fit to the data (Kelloway, 1998). The most common baseline model is the 'null' or 'independent' model, in which the variables have no relationships. Commonly used comparative fit indices are normed fit index (NFI), nonnormed fit index (NNFI), comparative fit index (CFI), and relative fit index (RFI).

NFI indicates the percentage improvement of the proposed model over the baseline independent model (Kelloway, 1998). NNFI is similar to NFI except it is adjusted to the degrees of freedom. Both NFI and NNFI range from 0 to 1, with values higher than 0.9 indicate a good fit to the data (Bentler and Bonett, 1980; Kelloway, 1998). A value of 0.9 fit index means that the proposed model is 90% better than the independent model. Bentler's (1990) comparative fit index (CFI) is highly recommended by Kline (2005), Bollen and Long (1993), and Hu and Benter (1995). CFI also indicates the improvement of the theoretical model against the independent model, but it also adjusts issues related to model complexity (Hair et al., 2011) and sample size (Kline, 2005). The value of CFI also ranges between 0 and 1, with higher value indicating better model fit. Values exceeding 0.9 commonly suggests a good fit (Kelloway, 1998). The absolute fit indices and critical values of them are presented in Table 4.15.

Table 4.15: Comparative Fit Indices and Critical Values

Comparative Fit indices	Source	Critical Values
Normed Fit Index (NFI)	Bentler and Bonett (1980)	Larger than 0.9
Nonnormed Fit Index (NNFI)	Tucker and Lewis (1973)	Larger than 0.9
Comparative Fit Index (CFI)	Bentler (1990)	Larger than 0.9

Model Respecification

It is rare that the hypothesised model fits the data on the first attempt (Kelloway, 1998). Further respecification is often required to improve the model fit. There are usually two strategies for model respecification, which are removing nonsignificant paths and adding new paths (Chin et al., 2008). However, removing nonsignificant paths is more preferable because it helps to retain theoretical integrity and consistency (Pedhazur, 1982; Shook et al., 2004). Kelloway (1998) also suggests that theory trimming is a more common approach to model improvement than theory building.

There are several sources of information that can help researchers to determine which items should be removed. First, CFA provides estimated factor loadings (path estimates) which can be used to identify problematic items. Items' factor loadings need to be at least 0.5, but ideally 0.7 to perform adequately (Brown, 2006). In LISREL Output file, factor loadings of items are presented in lambda-x (LX) matrix. Second, residuals and standardised residuals indicate the individual differences between observed covariance terms and the fitted covariance terms (Hu and Bentler, 1995). Relatively large standardised residual indicate that the item has more errors and can potentially be removed (Bentler, 2007). Jöreskog and Sörbom (1993) suggest that items with standardised residuals higher than 2.58 should be considered for removal. Anderson and Gerbing (1988) argue that error terms greater than 2 should considered for removal. In LISREL Output file, residuals and standardised residuals are presented in theta-delta matrix. Third, modification indices (MI) of all fixed parameters specified in the model are provided by LISREL. MI value of a fixed parameter refers to the decrease of χ^2 value if that parameter is freed (Jöreskog and Sörbom, 1993). Kelloway (1998) suggests that parameters with MI values larger than 5 should be freed.

Researchers can use the three model respecification strategies discussed above for model fit improvement. However, it is important to note that any modifications made need to be substantively meaningful and theoretically justified (MacCallum et al., 1992; Kelloway, 1998).

4.8.1.4 Assessment of Construct Reliability (CR)

Coefficient of alpha reliability was assessed using EFA (see section 5.10.1.2). However, scholars (e.g., Gerbing and Anderson, 1988; Bollen, 1989; Nunnally and Bernstein, 1994) argue that Cronbach's α reliability is useful in providing initial evidence of scale reliability, but it is not rigorous because Cronbach's α assumes that scale items are perfectly correlated and have no measurement error. The literature (e.g., Fornell and Larcker, 1981; Gerbing and Anderson, 1988) commonly suggest that assessment of construct (or composite) reliability is needed to further determine the usefulness of a scale. The formula to calculate construct reliability is as follows:

$$\mathrm{CR} = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + \sum Var(e_i)}$$

(Source: Hair et al., 2011)
The above formula can be interpreted as:

$$\mathrm{CR} = \frac{Square\ of\ total\ standardised\ loading}{Square\ of\ total\ standardised\ loading + Measurement\ error}$$

It can be seen from the formula of CR that it considers measurement error, which is different from calculation of Cronbach's α. Diamantopoulos and Siguaw (2000) suggest that value of CR need to be higher than 0.5. However, some scholars (e.g., Fornell and Larcker, 1981; Bagozzi and Yi, 1988) recommend a minimum threshold value of 0.6. Hair et al. (2011) suggest that CR need to exceed 0.7 to ensure that measurement error is minimal. When CR is established for all scales, it is commonly agreed that the scales also have a good convergent validity (e.g., Diamantopoulos and Siguaw, 2000; Fornell and Larcker, 1981; Hair et al., 2011). Convergent validity

refers to the extent to which the construct is closely related to theoretically similar constructs (Campbell and Fiske, 1959).

4.8.1.5 Assessment of Validity

In addition to reliability, a further and important criterion is validity (Bryman, 2004). In short, reliability is concerned with the consistency of a scale, while validity measures the accuracy of a scale (Kerlinger and Lee, 2000). Hair et al. (2011, p.770) define validity as 'the extent to which a set of measured items actually reflects the theoretical latent construct those items are designed to measure. Thus, it deals with the accuracy of measurement'. In other words, validity reflects whether the scale is actually measuring what it is supposed to measure. A simple example would be: a researcher wants to test some students' English abilities. However, he has designed a test that is full of math questions. The test may have the ability to produce consistent results, which means the test has reliability. Whereas, the test does not have validity because it cannot measure what it is designed to measure (students' English abilities). Therefore, it can be seen from the example that validity is more difficult to be obtained than reliability, and it is crucial to ensure the validity of measures so that results are meaningful and generalisable.

In order to ensure validity of scales, three types of validity need to be assessed, which are face validity, convergent validity, and discriminant validity (Peter, 1981; Bagozzi, Yi, and Phillips, 1991)

Face validity is the weakest form among all types of validity. It is determined by subjective assessment of correspondence between scales and theoretical concepts (Nunnally and Bernstein, 1994). When all items in a questionnaire are scrutinised and designed, initial face validity is implicitly established (McDaniel and Gates, 2014). Expert judges and pre-testing procedures can further provide evidence for face validity (Hair et al., 2011). The survey questionnaire was pre-tested using protocols/debriefings and pilot testing (see section 5.6). Therefore, face validity can be established.

Convergent validity, as aforementioned, is concerned with the extent to which the construct is closely related to theoretically similar constructs (Campbell and Fiske, 1959). As discussed in the last section, an adequate CR (construct reliability) also demonstrates convergent validity. Moreover, convergent validity can also be indicated by average variance extracted (AVE) (Fornell and Larcker, 1981). AVE is calculated as a ratio of the amount of variance extracted from items in a scale over the total variance extracted (variance from both items and measurement error) (Netemeyer et al., 2003). The formula of AVE is:

$$\mathrm{AVE} = \frac{\sum \lambda_i^2}{\sum \lambda_i^2 + \sum Var(e_i)}$$

(Source: Fornell and Larcker, 1981)

The formula of AVE can be interpreted as:

$$\mathrm{AVE} = \frac{Sum\ of\ standardised\ loading\ square}{Sum\ of\ standardised\ loading\ square + measurement\ error}$$

Scholars (e.g., Fornell and Larcker, 1981; Ping, 2004; Hair et al., 2011) commonly agree that AVE values higher than 0.5 demonstrate acceptable convergent validity. Netemeyer et al. (2003) argue that values near 0.5 but higher than 0.45 also indicate reasonable level of convergent validity.

Discriminant validity refers to the extent to which items in a construct should correlate higher among them than they correlate with other items of other constructs that are theoretically supposed not to correlate (Ping, 2004; Cozby, 2009). There are two methods that can be used to test for discriminant validity: chi-square difference test and average variance extracted analysis. In chi-square difference test, the chi-square of two nested models are compared (Anderson and Gerbing, 1988). In one model, the correlation between two constructs are constrained, i.e. fixed to 1 (Hair et al., 2011). In the other model, the parameter is freely estimated (Ping, 2004). The idea is that chi-square of the first model should be significantly larger than the chi-square of the second if the two constructs tested have discriminant validity (Bagozzi

and Phillips, 1982). The significance level of the difference between the two models can be calculated using the chi-square and degrees of freedom of the two models.

However, some scholars (e.g., Bagozzi and Phillips, 1982; Anderson and Gerbing, 1988) argue that chi-square difference test does not always demonstrate conclusive evidence of discriminant validity. In situations that two constructs are highly correlated to each other but discriminate, chi-square difference test does not work properly. Therefore, average variance extracted analysis is recommended. In an AVE analysis, the square root of the AVE of each construct is compared with the correlation estimates between each pair of constructs (Hair et al., 2011). The square root of AVE should be higher than correlation estimates to demonstrate discriminant validity (Fornell and Larcker, 1981; Anderson and Gerbing, 1988). Therefore, discriminant validity of all constructs is established by undertaking AVE tests.

4.8.2 Structural Equation Modelling (SEM)

The second stage of data analysis is testing the structural model and hypotheses. In the first stage, CFA is used to test the measurement model. However, CFA is unable to examine the relationships between constructs adequately. Therefore, a structural equation modelling (SEM) technique is adopted to test the theoretical model. SEM is a multivariate technique that combines various aspects of multiple regression and factor analysis to simultaneously measure a series of separate but interdependent relationships between observed variables or/and latent constructs (Hair et al., 2011). SEM is a preferable data analysis technique in business research because it allows multiple relationships to be tested simultaneously and produces useful results for further model modification (Anderson and Gerbing, 1988).

In SEM, there are two types of constructs: endogenous constructs and exogenous constructs. Endogenous constructs are defined as ‘latent, multi-item equivalent to dependent variables’. Exogenous constructs are ‘latent, multi-item equivalent of independent variables’. (Hair et al., 2011, p. 707). Endogenous constructs are assumed to be determined by constructs in the model, while exogenous constructs are determined by constructs outside the model. Based on the categorisation of constructs in SEM, the structural relationships also contain two types. The first type

of structural relationships is between exogenous constructs (ξ) and endogenous constructs (η). The parameter estimates are presented in the gamma (γ) matrix in LISREL output. The second type is between endogenous constructs (η) and endogenous constructs (η). The parameter estimates of their relationships are presented in the beta (β) matrix in LISREL output.

When assessing individual parameter estimates in SEM, item parcelling technique is used. Item parcelling involves 'summing or averaging together two or more items and using the resulting sum or average as the basic unit of analysis in SEM' (Marcoulides and Schumacker, 2001, p. 269). The use of item parcels has become a common practice in applied research areas such as education, psychology, and marketing. Item parcelling technique is popular because of the following reasons. First, item parcels are more reliable than individual items and have more definitive rotational results (Cattell and Burdsal, 1975; Kishton and Widaman, 1994). Second, the distributions of item parcels are more continuous and normally distributed than those of individual items, which is favourable to normal theory-based estimation methods such as maximum likelihood (ML) (Marcoulides and Schumacker, 2001). Third, using item parcels results in fewer model parameters because factor loadings and measurement error variance are only estimated for each parcel instead of for each item (Bagozzi and Heatherton, 1994; Bagozzi and Edwards, 1998). This is especially beneficial when the sample size is relatively small because a higher sample size to number of parameters ratio can be obtained which leads to more stable parameter estimates. Finally, Marcoulides and Schumacker (2001) argue that parcelling solutions provide better model fit than solutions at the item level.

In spite of the advantages of item parcelling discussed above, researchers need to be aware of the limitations of using items parcels. The most important pre-requisites of using item parcelling is that the unidimensionality of the items being parcelled needs to be established first (Cattell, 1956, 1974; Hall et al., 2011). Unidimensionality of the parcelled items need to be demonstrated either through referencing previous studies of dimensionality, or through conducting EFA or CFA on the items (Marcoulides and Schumacker, 2001). Because in this study EFA and CFA are conducted before running SEM, unidimensionality of the parcelled items is established. Another disadvantage of item parcelling is that this practice will not yield

as stringent a test of SEM models as would analyses based on the individual items because less free parameters are being tested (Marcoulides and Schumacker, 2001).

Individual parameter estimates can be interpreted in a similar fashion as regression coefficients (Kline, 1998). In addition, in order to accept the hypotheses, researchers also need to check whether the results are statistically significant. P-value is usually used to indicate the probability that the observed test statistic could have occurred due to chance (McDaniel and Gates, 2014). In other words, p-value indicates the probability of making a Type**I**error, where the null hypothesis is rejected when it should be accepted. If the parameter estimates are not statistically significant, the results are uninterpretable. The significance of parameter estimates can be determined by t-values. Critical t-values for one-tailed (directional) hypotheses are presented in table 4.16 below (Churchill, 1999).

Table 4.16: Critical Values of T-statistic for One-Tailed Tests

Significance level	Critical value of *t* statistic
0.10	1.282
0.05	1.645
0.01	2.326

After running SEM for the proposed model, the structural model fit needs to be assessed. Assessing the structural model fit is similar to assessing the measurement model fit in CFA. Researchers need to pay attention to the modification indices, standardised residual, and R^2 values (Bentler and Chou, 1993). If the standardised residuals are relatively large, there might be a problem with the indicator and it might be considered to be removed (Byrne, 2010). The modification index of a path demonstrates how much the model's chi-square would be reduced if the path was freed (Hair et al., 2011). Researchers also need to pay attention to the values of endogenous constructs' R^2, which refers to the percentage of variance in the endogenous constructs explained by exogenous constructs in the model (Sharma, 1996). In LISREL output, the values of R^2 are presented in 'Squared multiple correlation for reduced form'. R^2 values below 0.10 indicate a poor measurement of the latent variable or that the correlations between examined constructs are weak. Therefore, the model fit can be potentially improved by withdrawing that endogenous

construct from the analysis (Schumacker and Lomax, 2004). However, these respecifications need to be meaningful and theoretically justified.

4.9 Conclusions

This chapter has achieved seven objectives: discuss the choice of cross-sectional research design; choose online questionnaire-based survey as the research method; draw a probability sample from the sample frame; illustrate the process of questionnaire design process; discuss the steps of pre-test and how it helped to improve the quality of the questionnaire; explain the major issues of the main survey; and present the analytical procedures.

In conclusion, this study used a cross-sectional research design because it is more efficient than longitudinal design given the time and resource constraints. A questionnaire-based online survey was used because it is more advantageous than other approaches such as face-to-face, telephone, and mail. A sample of 3000 UK high-tech companies was drawn from Kompass database. The response rate of the main survey was 12.9%. However, only about 60% responses were qualified because the other 40% companies did not or rarely cooperate with competitors. A total of 148 usable responses were received for further quantitative analysis. The analytical procedures are mainly composed of two stages: measurement model assessment and structural model assessment. The measurement model is assessed by using exploratory factor analysis (EFA) in SPSS and confirmatory factor analysis (CFA) in LISREL. The structural model assessment is conducted by using structural equation modelling (SEM) in LISREL.

In the next chapter, the results of quantitative data analysis are discussed.

Chapter 5 - Analysis of Data and Discussion of Results

5.1 Introduction

In this chapter, the process and results of data analysis are presented. A preliminary data analysis is conducted first, including missing value analysis, profile analysis, and respondents' knowledgeability assessment. Second, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) are used to develop the measurement model, in which reliability and validity of constructs are also assessed to ensure psychometric soundness. Finally, Structural Equation Modelling (SEM) is chosen as the statistical method for hypotheses testing. Normality of all scales is assessed and then the results of SEM are presented.

5.2 Preliminary Analysis

The purposes of preliminary analysis include cleaning raw data, preparing data for further analysis, and providing general characteristics of the surveyed firms and respondents. This step is crucial because data cleaning and preparation ensure the completeness and accuracy of the data. Profile analysis and knowledgeability assessment provide researchers a better understanding of the respondents and their businesses.

5.2.1 Missing Value Analysis

As discussed in Chapter 4, a total of 148 usable questionnaires were collected using Qualtrics. Raw data were imported from Qualtrics into the IBM SPSS 20 software package. Before any statistical analysis, missing values in the data were checked. Missing values may occur for a number of reasons. First, errors in data entry may lead to missing values (Hair et al., 2011). To be more specific, researchers may omit some data when manually inputting data from questionnaires to a statistics software package. However, this is not an issue here because data were imported directly into

SPSS from Qualtrics without any form of manual data entry. Second, missing values may happen due to respondents' omission of questions, which can be intentional or unintentional. The main reasons include lack of knowledge, lack of attention, and unwillingness to provide sensitive information (e.g., Koslowski, 2002; Schafer and Graham, 2002; Brown and Kros, 2003). To reduce missing data, the online questionnaire was designed in a way that respondents could not proceed to the next section if any closed-ended questions were left incomplete. Therefore, only open-ended questions such as financial figures, number of employees, age of company, and industry have missing data. The percentage of missing data was less than 1% of the overall dataset. Hair et al. (2011) suggest that less than 5% is acceptable and poses no potential threats to the validity of the results.

There are different methods of missing data treatments. First, a complete case approach can be adopted. In other words, only complete cases are included (Brown and Kros, 2003). This method is simple but its main disadvantage is a reduced sample size (Hulland, Chow, and Lam, 1996). Second, case substitution is a method in which missing data are replaced with data from previous research (Brown and Kros, 2003). In this study, data from previous research are simply not available. Third, mean substitution is a commonly used method because of its simplicity. Missing values are replaced with the sample mean of each specific variable which is missing data (Gold and Benlter, 2000; Koslowski, 2002). However, after using this method, the variation of the dataset becomes smaller than it is supposed to be and may lead to bias in results (Winkler and McCarthy, 2005). Fourth, hot-deck imputation can be used when missing values are replaced with data provided by other respondents whose other answers are statistically similar. However, similar cases may not exist, and even if they do, it is difficult to statistically identify them (Hair et al., 2011). Fifth, regression imputation uses the variable's relationship with other variables to predict missing values (Schafer, 2003). This method requires the development of a predictive equation for the variable where data are missing, but such equations are difficult to develop.

SPSS provides four methods for dealing with missing data: listwise deletion, pairwise deletion, Expectation-Maximisation (EM), and Regression imputation. In listwise deletion a case is dropped from an analysis when it has one or more than one

missing values. Pairwise deletion removes a particular variable when it has one or more than one missing values. These two methods reduce the number of cases and variables respectively, which is not advisable as it can introduce bias in the results. The Expectation-Maximisation (EM) algorithm is one of the most commonly used methods of data replacement (Dempster et al., 1997) and recommended in the literature (e.g., Little, 1988; Little and Rubin, 1989; Little and Schenker 1995) as it does not remove any variables or cases and uses other variables to impute values (the Expectation step), then checks whether those values are most likely (the Maximisation step). Using maximum likelihood estimation, this process continues until it reaches the most likely value for the relevant missing data. Moreover, it has been shown that the EM algorithm leads to minimal bias when the percentage of missing values is low (Olinsky et al., 2003). Regression imputation is a process whereby missing values are replaced with conditional means (Allison, 2001). Imputation of mean values through regression can generate estimates of means but the standard error estimates are generally biased downward (Allison, 2001). As a result, the precision of regression imputation may be low and subsequent analysis can be misleading. Taking all of these factors into account, the EM algorithm is chosen to deal with missing data in this study.

5.2.2 Profile Analysis

In this section, an initial profile analysis is conducted in which key characteristics of the companies and respondents are summarised. The purpose of an initial analysis before the main data analysis is to obtain a basic understanding of the respondents and their companies. In addition, a profile analysis ensures that the surveyed respondents are the target audience and the data obtained from them are of sufficient quality.

5.2.2.1 Company Size

The most widely used measures of company size are number of full-time employees (e.g., Smith et al., 2005; Simsek et al., 2005; Tanriverdi, 2006) and total sales revenue (e.g., Zhao et al., 2011; Ghosh and John, 2005).

The number of employees rages from 0 to 45,000 and the mean is 15,055 (see Table 5.1). The reason why the minimum value is 0 may be because the company does not have full-time employees. According to the analysis of the normal distribution (see Appendix 5.1), there is one outlier in the sample. There is one company that has 450,000 employees. This company is not removed from the sample because it represents multi-national firms and is a valid element of the target population (Hair et al., 2011).

Table 5.1: Number of Employees

Mean	15,055
Standard Deviation	46,051
Median	192
Mode	1
Minimum	0
Maximum	450,000

Table 5.2: Number of Employees (outliers are removed)

Mean	12,097
Standard Deviation	28,821
Median	184
Mode	1
Minimum	0
Maximum	170,000

The sales revenue of last financial year ranges from 1 to £17,000,000,000 and the mean within the sample is £1,759,623,565. The mode within the sample is £2,000,000 (see Table 5.3). Distribution analysis of the data shows that there are seven outliers with sales revenue figures of £17,000,000,000, £16,637,000,000, £16,600,000,000, £14,300,000,000, £14,198,736,890, £13,000,000,000, and £12,052,536,676. The outliers are retained in the sample as they can be multi-national firms and are part of the target population.

Table 5.3: Total Sales Revenue of Last Financial Year

Mean	1,759,623,565
Standard Deviation	3,640,561,654
Median	25,000,000
Mode	2,000,000
Minimum	1
Maximum	17,000,000,000

Table 5.4: Total Sales Revenue of last Financial Year (outliers are removed)

Mean	1,187,947,541
Standard Deviation	2,366,587,711
Median	16,000,000
Mode	2,000,000
Minimum	1
Maximum	12,052,536,675

5.2.2.2 Age of Business

The question concerning age of business is: how many years has your business been operating (approximate number). The age of business range from 0 to 485 (see Table 5.5). The minimum value of 0 can be interpreted in a way that the business's age is less than one year. The business with age of 485 is in the aerospace and defence industry and can be regarded as an outlier. It is virtually impossible for an aerospace company to have an age of 485 years which is likely to be a typo. Therefore, this figure is regarded as a missing value and a new value of 36 is derived using EM algorithm. After replacing the outlier, the age of business rages from 0 to 152. The mode of the sample is 15 years.

Table 5.5: Age of Business

Mean	39.25
Standard Deviation	52.06
Median	25.00
Mode	15.00
Minimum	0
Maximum	485.00

Table 5.6: Age of Business (after replacing outlier with a new value)

Mean	36.02
Standard Deviation	35.61
Median	25.00
Mode	15.00
Minimum	0
Maximum	152.00

5.2.2.3 Coopetition Intensity

The first question in the questionnaire is a screening question which is designed to identify qualified businesses. The wording of the question is: ‘to what extent do you cooperate with your competitors? Please choose one of the following options below’. The 7 options are:

1= we do not cooperate with any of our competitors

2 = we rarely cooperate with competitors

3 = we cooperate with competitors on a small range of aspects of our business

4 = we cooperate with competitors on some aspects of our business

5 = we cooperate with competitors on many aspects of our business

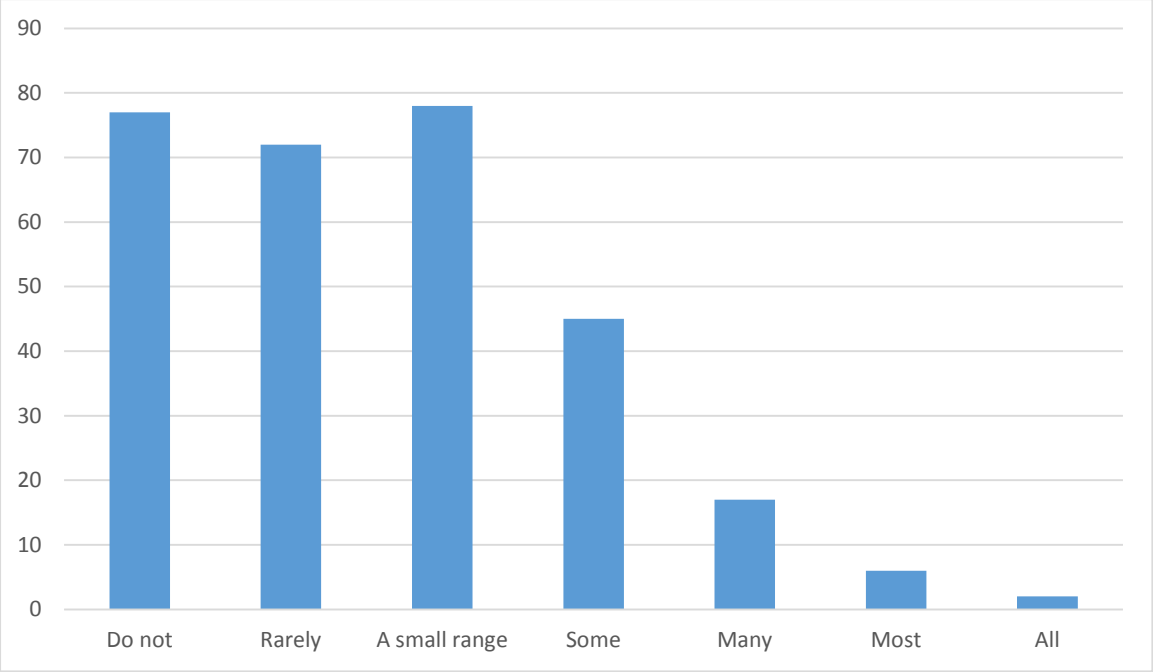
6 = we cooperate with competitors on most aspects of our business

7 = we cooperate with competitors on all aspects of our business

Respondents who select the first and second options are screened out. The survey results showed that there were 77 and 72 respondents selecting the first and second

options respectively. Among the qualified businesses, most of them cooperate with competitors on a small range of or some aspects of their businesses. The breakdown of responses to this question is shown in Figure 5.1 below.

Figure 5.1 Coopetition Intensity of Surveyed Businesses



5.2.2.4 Coopetition Experience

In this question respondents were asked 'how many years has your business had cooperative arrangements with competitors'. The coopetition experience of surveyed businesses ranges from 0 to 50 years. The minimum value of 0 can be regarded as less than 1 year. Three respondents who reported that their businesses had 50 years' experience on coopetition are outliers. However, they are not excluded from the sample because the age of those businesses are 51, 100, and 110 respectively. Thus, it is possible for them to have 50 years' coopetition experience. The mean of the sample is 7.6 years and the mode is 5.

Table 5.7: Coopetition Experience

Mean	7.60
Standard Deviation	9.41
Median	5.00
Mode	5
Minimum	0
Maximum	50

To sum up, the company profile analysis shows that the sample represents a wide range of companies with regard to size, age, coopetition intensity, and coopetition experience. Although outliers exist, they are retained in the sample because they represent valid elements of the target population.

5.2.3 Knowledgeability Assessment

As discussed in Chapter 4 (see section 4.6.1.1), three items were used to measure respondents' knowledgeability to correctly answer the questions in the questionnaire. First, an exploratory factor analysis (EFA) was conducted to confirm the unidimensionality of the scale (see Appendix 5.2). The results of Kaiser-Meyer-Olkin (KMO) Measure and Bartlett's Test of Sphericity showed that the data were factorable and KMO score was 0.775. A single factor was extracted and 89.141% of the total cumulative variance was explained by it. The factor loadings of all three items were above 0.9. The communality values were all above 0.85 which indicated a high level of shared variance among the items. Second, it is necessary to assess the internal consistency reliability of the items. The Cronbach's alpha of the items was 0.959, which indicated a high level of internal consistency reliability. Therefore, a score of the knowledgeability construct was created by summing and averaging the scores of the three items. The mean of the knowledgeability construct was 5.52, median 6, and mode 7 (see Table 5.8). The results demonstrated a high level of respondents' knowledgeability about the researched topic.

Table 5.8: Knowledgeability of Export Managers

Mean	5.518
Standard Deviation	1.408
Median	6
Mode	7
Minimum	1
Maximum	7

5.3 Exploratory Factor Analysis

In this stage, the dimensionality of the constructs is firstly established using exploratory factor analysis (EFA). As discussed in Chapter 4 (see section 4.8.1.1), EFA is an appropriate analytical method for initial item selection/retention and allows researchers to identify structures within a set of indicators (Stewart, 1981; Clark and Watson, 1995). In this study, it is assumed that internally and externally focused coopetition, competitors' opportunism, new innovation and marketing knowledge-based resources and capabilities, and loss of uniqueness of existing knowledge-based resources and capabilities all have uni-dimensional structures. Performance is three-dimensional (efficiency, effectiveness, and adaptiveness). Environmental turbulence is also three-dimensional (technological turbulence, market dynamism and competitive intensity). However, the proposed measurement model should not be taken for granted and needs to be verified firstly using EFA.

Before running EFA, it is necessary to determine the minimum sample size to variable/parameter ratio (Hair et al., 2011). According to Hair et al. (2011), the minimum sample size to variable/parameter ratio needs to be at least 5:1 in order to maximise statistical power. This requirement restricted the number of variables that can be entered into one single EFA because the sample size was 148. To ensure the 5:1 sample size to variable ratio, each EFA can only contain 30 items at most. Therefore, three principal axis factoring (PAF) analyses were performed. The first EFA included the three independent variables: internally focused coopetition, externally focused coopetition and opportunism. The second EFA included the constructs that hypothetically have direct impact on performance measures, which were new innovation knowledge-based resources and capabilities, new marketing knowledge-based resources and capabilities, and loss of uniqueness of existing

knowledge-based resources and capabilities. Last EFA included the performance measures and control variables. All factor analyses were rotated using direct oblimin rotation (oblique rotation) (see section 4.8.1.1).

5.3.1 EFA Subset 1

The first EFA performed included the 6 internally focused coopetition items (IFC1 to IFC6), 5 externally focused coopetition items (EFC1 to EFC5), and 10 competitors' opportunism items (OPP1 to OPP10) (see Appendix 5.3 for coded questionnaire). The KMO and Bartlett's test showed that the data were factorable. The KMO score was 0.888. The total cumulative variance explained was 58.338.

It was expected that three factors would be extracted. The first factor, internally-focused coopetition, was formed by four items: IFC1 (R&D), IFC2 (new product development), IFC3 (technology improvement), and IFC4 (information systems). The second factor, externally-focused coopetition, was formed by five items: EFC1 (distribution), EFC2 (sales), EFC3 (marketing), EFC4 (branding), and EFC5 (customer service). The third factor contained all items of the competitors' opportunism construct. Hair et al. (2011) recommend that when the sample size is 120 and above, factor loadings need to be over 0.5 to have practical significance. When sample size is 150 and above, factor loading threshold can be 0.45. Because the sample size was 148 in this study, 0.5 was chosen as the threshold for significant factor loading. Any items with a factor loading below 0.5 will be considered for removal. Factor loadings IFC5 and IFC6 were less than 0.4. The factor loading of IFC5 was less than IFC6, hence IFC5 was removed first. After removing IFC5, the factor loading of IFC6 was still less than the 0.5 threshold, and hence was also removed.

The removal of these two items resulted in a three-factor solution (KMO=0.885, total cumulative variance explained=63.3%). All items' factor loadings were above the 0.5 threshold. Communalities of the items were close to 50% or above which indicated relatively high percentage of each variable's variance that can be explained by the factors (more details of results are in Appendix 5.4).

5.3.2 EFA Subset 2

The second EFA included 5 items of new innovation knowledge-based resources and capabilities (IRnC1 to IRnC5), 10 items of new marketing knowledge-based resources and capabilities (MRnC1 to MRnC10), and 6 items of loss of uniqueness of existing knowledge-based resources and capabilities (UNI1 to UNI6, see Appendix 5.3). The KMO and Bartlett's test showed that the data were factorable, and KMO score was 0.907. The total cumulative variance explained was 65.4%.

It was expected that three factors would be extracted. Item IRnC5 was removed because its factor loading was less than 0.5 and it cross-loaded on two factors. After removing item IRnC5, the KMO score changed to 0.902 with 65% of total cumulative variance explained. The first factor was formed by IRnC1 to IRnC4, and the second factor formed by MRnC1 to MRnC10. The last factor included all items of uniqueness items. The factor loadings of all remaining items were above 0.5. Communalities of the items were all above 50% except UNI1 (39.8%), all of which demonstrated an acceptable level of proportion of each variable's variance that can be explained by the factor (more details of results are in Appendix 5.5).

5.3.3 EFA Subset 3

The third EFA included measures of performance and environmental turbulence. The KMO and Bartlett's test showed that the data were factorable with a KMO score of 0.850. Total variance explained was 62.4%. It was expected that six factors would emerge, whereas eight factors did. Performance measures were expected to have a three-dimensional structure, including effectiveness (EFE1 to EFE6), efficiency (EFI1 TO EFI4), and adaptiveness (ADP1 to ADP4) (see Appendix 5.3). However, the initial EFA results proposed a four-dimensional structure. Results showed that EFE3 and EFE4 formed a separate factor. Items EFI4 and EFE6 were removed first because of poor factor loadings. However, the removal of these two items still resulted in a four-dimensional performance measure. After a close investigation of the items of effectiveness, EFE1 (achieving customer satisfaction), EFE2 (providing value for customer) and EFE5 (keeping existing customers) were about how effective the business is in maintaining good relationship with customers. EFE3

(attaining desired growth) and EFE4 (securing desired market share) were related to the overall market performance of the business. Therefore, EFE3 and EFE4 were removed.

With regard to environmental turbulence, the initially conceptualised three-dimensional structure was composed of market dynamism (MD1 to MD5), competitive intensity (CI1 to CI6), and technological turbulence (TT1 to TT5). However, the EFA result also reported a four-dimensional structure. TT3 formed a fourth factor only by itself and hence was removed. Factor loadings of MD5, CI3, and CI6 were less than 0.5 and these items were removed. The removal of these four environmental turbulence items resulted in a three-factor solution as expected.

The final result showed a six-factor solution as expected (KMO=0.828, total cumulative variance explained=64.142). Factor loadings of all remaining items were above the 0.5 threshold. Communalities of most items were above 50% except MT4 (37.3%), CI2 (44.1%), and CI5 (44.7%) (More details of results are in Appendix 6.6).

5.4 Item Analysis

After obtaining EFA solutions for the scales, the next step of establishing measurement model was to conduct item analyses for all the scales so as to ensure high internal consistency and reliability (DeVellis, 2003). In this stage, inter-item correlation, corrected item-scale correlation, and reliability of each scale were evaluated. Items with low or negative coefficients and those that poorly contributed to reliability were considered to be removed from the scale.

The results of inter-item correlations and item-scale correlations are presented in Appendix 5.7 and 5.8. The results of inter-item correlations showed that all the items met the minimum recommended threshold value 0.4 (Hair et al., 2011). All items' corrected item-scale correlations were also above the threshold value of 0.5 (DeVellis, 2003). Therefore, all items passed the inter-correlation and item-scale correlation test and were put forward to CFA. The Cronbach's alphas of all scales are presented in Table 5.9.

Table 5.9: Cronbach's Alpha Coefficient

Constructs	Cronbach's alpha
Internally-focused coopetition	0.865
Externally-focused coopetition	0.868
Competitors' opportunism	0.947
New innovation knowledge-based resources and capabilities	0.898
New marketing knowledge-based resources and capabilities	0.949
Loss of uniqueness of existing knowledge-based resources and capabilities	0.877
Efficiency	0.847
Adaptiveness	0.887
Effectiveness	0.866
Market dynamism	0.798
Competitive intensity	0.767
Technological turbulence	0.889

5.5 Confirmatory Factor Analysis

After using EFA to determine the underlying factor structure and assess the correlations with other items in the same scale, CFA was conducted to further evaluate the dimensionality, reliability and validity of the scales (Netemeyer et al., 2003; Devellis, 2003; Ping, 2004). LISREL 8.72 was used to run CFA.

Similar to EFA, it is also necessary to determine the minimum sample size to variable/parameter ratio before running CFA. Hair et al. (2006) suggest that the ratio also needs to be at least five-to-one. There were 61 remaining items after EFA and three separate CFA were conducted.

An important decision that needed to be made next was how to divide all scales into three CFA subsets. Baker and Sinkula (1999) suggest that scales that are conceptually similar should be analysed together to ensure that their items are representing different constructs. Table 5.10 below presents the subsets for CFA.

Table 5.10: CFA subsets

CFA Subsets	Constructs
1	Internally focused coopetition Externally focused coopetition New innovation knowledge-based resources and capabilities New marketing knowledge-based resources and capabilities Loss of uniqueness of existing knowledge-based resources and capabilities
2	Competitors' opportunism Market dynamism Competitive intensity Technological turbulence
3	Efficiency Effectiveness Adaptiveness

On occasions when model fit is poor or item loadings are unacceptable, it is necessary to reduce the model by removing offending items. As discussed in chapter 4 (see section 4.8.1.3), theory trimming is more preferable than theory building because it helps to retain theoretical integrity and consistency (Pedhazur, 1982; Shook et al., 2004). Low estimated factor loadings (path estimates) (lower than 0.5), high standardised residuals (larger than 2.58), and high modification indices (larger than 5) can all help researchers to determine which items should be removed (Brown, 2015; Hair et al., 2011; Worthington and Whittaker, 2006). Items were only removed if it was theoretically acceptable to do so, did not affect the definitional integrity of the construct in its final operationalisation, retained consistent face validity, and made statistically significant improvements to model fit.

5.5.1 CFA Subset 1

The initial results of CFA subset 1 did not provide a good fit to the data (χ^2=1016.28, df=367, RMSEA=0.110, CFI=0.930, NNFI=0.923, SRMR=0.088) and the model required further respecification.

In order to obtain a good measurement model fit to the data, 8 items were deleted based on the CFA results. The sequence of item deletion was: MRnC10, MRnC8, MRnC3, UNI3, IFC4, MRnC2. The model fit indices after each items removal are presented in Table 5.11.

Table 5.11: Model Fit Indices after Item Removal (CFA Subset 1)

	Step 1	**Step 2**	**Step 3**	**Step 4**	**Step 5**	**Step 6**
Item removal	**MRnC10**	**MRnC8**	**MRnC3**	**UNI3**	**IFC4**	**MRnC2**
x^2 **(df)**	876.28 (340)	739.01 (314)	651.54 (289)	565.94 (265)	484.72 (242)	425.87 (220)
x^2**/ df**	2.577	2.354	2.254	2.136	2.003	1.936
RMSEA	0.104	0.096	0.092	0.088	0.083	0.080
CFI	0.941	0.948	0.949	0.955	0.963	0.963
NNFI	0.934	0.942	0.943	0.949	0.958	0.957
SRMR	0.0881	0.0854	0.0820	0.0707	0.0674	0.0650

After removing these 8 items, fit indices indicated a good model fit to the data (χ^2 = 425.87, df=220, RMSEA=0.08, CFI=0.963, NNFI=0.957, SRMR=0.065). All fit indices exceeded recommended thresholds.

5.5.2 CFA Subset 2

The second CFA subset included items of competitors' opportunism and environmental turbulence. The initial results of CFA subset 2 reflected a relatively good model fit to the data (χ^2=393.45, df=203, RMSEA=0.080, CFI=0.951, NNFI=0.944, SRMR=0.717). However, the modification indices indicated that the removal of the following items would further enhance model fit: OPP3, OPP9, OPP8, OPP4, MD4, TT5, OPP6. Removing these items did not have any impact on conceptual integrity or face validity. After removing these items, fit indices demonstrated that CFA subset 2 had a better fit to the data (χ^2=119.01, df=84, RMSEA=0.053, CFI=0.973, NNFI=0.967, SRMR=0.0573).

Table 5.12: Model Fit Indices after Item Removal (CFA Subset 2)

	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Item removal	**OPP3**	**OPP9**	**OPP8**	**OPP4**	**MD4**	**TT5**	**OPP6**
x^2 **(df)**	314.01 (183)	262.14 (164)	217.85 (146)	190.06 (129)	156.88 (133)	133.59 (98)	119.01 (84)
x^2**/ df**	1.716	1.598	1.492	1.473	1.180	1.363	1.418
RMSEA	0.070	0.064	0.058	0.057	0.051	0.050	0.053
CFI	0.956	0.962	0.968	0.967	0.974	0.976	0.973
NNFI	0.949	0.956	0.963	0.960	0.968	0.971	0.967
SRMR	0.0713	0.0706	0.0713	0.0715	0.0614	0.0563	0.0573

5.5.3 CFA Subset 3

The last CFA subset included three dimensions of performance measures: effectiveness, efficiency, and adaptiveness. The initial results indicated a good model fit with all fit indices meeting threshold values (χ^2=47.392, df=32, RMSEA=0.057, CFI=0.989, NNFI=0.985, SRMR=0.0452). Therefore, no changes were made to the measurement model.

5.6 Construct Reliability Analysis

Cronbach's alpha reliability was assessed using EFA (see section 5.4). In this section, construct reliability of all constructs is established to further evaluate the internal consistency of items (Netemeyer et al., 2003). Because there is no known statistical software that can be used to calculate construct reliability, the value has to be calculated manually. The formula of calculating construct reliability is:

$$\mathrm{CR} = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + \sum Var(e_i)}$$

(Source: DeVellis, 2003)

In the formula, e_i refers to the measurement error of x_i items. λ_i denotes the factor loading of x_i. Hair et al. (2011) suggest that construct reliability needs to exceed 0.7 to ensure that measurement error is minimal. The construct reliability coefficients of all constructs are presented in Table 5.13 below. The construct reliability of most

constructs was above 0.8. Only market dynamism and competitive intensity were slightly below 0.8.

Table 5.13: Construct Reliability Assessment

Constructs	Constructs Reliability
Internally focused coopetition	0.857
Externally focused coopetition	0.834
Competitors' opportunism	0.887
New innovation knowledge-based resources and capabilities	0.901
New marketing knowledge-based resources and capabilities	0.910
Loss of uniqueness of existing knowledge-based resources and capabilities	0.855
Efficiency	0.888
Adaptiveness	0.891
Effectiveness	0.871
Market dynamism	0.798
Competitive intensity	0.768
Technological turbulence	0.906

5.7 Construct Validity Assessment

As discussed in chapter 4 (see section 4.8.1.4), convergent validity can be confirmed when the scale's construct reliability is established (Diamantopoulos and Siguaw, 2000; Fornell and Larcker, 1981; Hair et al., 2011). The construct reliability calculated in section 5.6 above was adequate to demonstrate convergent validity. In addition, convergent validity can be further tested by calculating average variance extracted (AVE), the formula of which is:

$$\mathrm{AVE} = \frac{\sum \lambda_i^2}{\sum \lambda_i^2 + \sum Var(e_i)}$$

(Source: Fornell and Larcker, 1981)

Similar to construct reliability, there is no known statistical package that can calculate AVE values of each constructs and they need to be calculated manually. It is commonly agreed that AVE values need to be higher than 0.5 to indicate convergent validity (e.g., Fornell and Larcker, 1981; Ping, 2004; Hair et al., 2011). The AVE

values of all constructs are presented in Table 5.14 below. All AVE values were above the 0.5 threshold. Therefore, convergent validity can be confirmed.

Table 5.14: Average Variance Extracted Values

Constructs	**AVE**
Internally focused coopetition	0.817
Externally focused coopetition	0.794
Competitors' opportunism	0.782
New innovation knowledge-based resources and capabilities	0.834
New marketing knowledge-based resources and capabilities	0.794
Loss of uniqueness of existing knowledge-based resources and capabilities	0.736
Efficiency	0.852
Adaptiveness	0.820
Effectiveness	0.832
Market dynamism	0.756
Competitive intensity	0.673
Technological turbulence	0.874

After establishing convergent validity, the next step is to evaluate discriminant validity for all constructs. As discussed in chapter 5 (see 5.10.1.5), the AVE of each construct should be higher than squared correlation estimates to demonstrate discriminant validity (Fornell and Larcker, 1981; Anderson and Gerbing, 1988). The AVE and squared correlation estimates are presented in Table 5.15 below. The results showed that AVEs of all constructs were higher than squared correlation estimates, which confirmed discriminant validity.

Table 5.15: Discriminant Validity Assessment

		1	2	3	4	5	6	7	8	9	10	11	12
1	IFC	0.817											
2	EFC	0.286	0.794										
3	OPP	0.007	0.180	0.782									
4	IRnC	0.401	0.021	0.133	0.834								
5	MRnC	0.013	0.162	0.061	0.555	0.794							
6	UNI	0.078	0.001	0.172	0.157	0.008	0.736						
7	EFI	0.276	0.097	0.001	0.110	0.085	0.048	0.852					
8	ADP	0.002	0.005	0.001	0.006	0.001	0.022	0.664	0.820				
9	EFE	0.024	0.019	0.007	0.063	0.055	0.019	0.051	0.172	0.832			
10	MD	0.038	0.054	0.000	0.062	0.012	0.035	0.094	0.336	0.119	0.756		
11	CI	0.021	0.044	0.001	0.035	0.040	0.048	0.000	0.016	0.082	0.242	0.673	
12	TT	0.003	0.005	0.026	0.094	0.066	0.037	0.003	0.011	0.010	0.477	0.002	0.874

Note:

Figures on the diagonal represent average variance extracted values.
IFC = internally focused coopetition
EFC = externally focused coopetition
OPP = competitors' opportunism
IRnC = New innovation knowledge-based resources and capabilities
MRnC = New marketing knowledge-based resources and capabilities
UNI = Loss of uniqueness of existing knowledge-based resources and capabilities
EFI = efficiency
ADP = adaptiveness
EFE = effectiveness
MD = market dynamism
CI = competitive intensity
TT = technological turbulence

As discussed in chapter 4 (see section 4.8.2), the item parcelling technique is used to assess individual parameter estimates in structural equation modelling (SEM). Therefore, a score for each latent variable was calculated by averaging the scores of the items belonging to each constructs (Bandalos, 2002). After parcelling items into aggregated constructs, it is necessary to assess the normality of all scales before testing the structural model.

5.8 Scales Normality Assessment

Like many hypothesis testing methods (such as regression), structural equation modelling assumes normal distribution of the variables in the equations. Therefore, it is important to assess whether the variables meet the assumptions of normality before performing structural equation modelling (Bentler and Chou, 1987). Normal distribution is defined as a 'purely theoretical continuous probability distribution in which the horizontal axis represents all possible values of a variable and the vertical

axis represents the probability of those values occurring. The scores on the variable are clustered around the mean in a symmetrical unimodal pattern known as the bell-shaped, or normal, curve' (Hair et al., 2011, p. 40). Non-normality reduces the power of statistical analysis and makes multivariate analysis inappropriate because it may lead to invalidity of results (Mudholkar and Srivastava, 2002). Univariate normality refers to the normality of the distribution for a single variable, and multivariate normality means that the combination of two or more variables is also normal (Malkovich and Afifi, 1973). Therefore, if a variable has multivariate normality, its univariate normality can be inferred. However, when all variables have univariate normality, their combination does not necessarily have multivariate normality. Some scholars (e.g., Sharma, 1996; Chou and Bentler, 1995; Hair et al., 2011) point out that SEM technique with maximum likelihood estimation can provide robust model testing as long as there is no evidence of extreme skewness and kurtosis when assessing univariate normality. Therefore, univariate normality of each construct is assessed in the following section.

The simplest form for normality test is a visual check of the histogram that compares the observed data values with a normal distribution (Hair et al., 2011). The distribution histograms are presented in Appendix 5.9. Despite its simplicity, this approach is problematic for small samples and threshold of normality cannot be established. Therefore, to assess normality in a more rigorous way, statistical tests are needed. A commonly used test is based on the skewness and kurtosis values. 'Kurtosis refers to the peakedness or flatness of the distribution compared with the normal distribution…skewness is used to describe the balance of the distribution' (Hair et al., 2011, p.80). A negative kurtosis value indicates a platykurtic distribution, which is flatter than a normal distribution. A positive kurtosis value denotes a leptokurtic distribution, which is taller or more peaked than a normal distribution. Likewise, a positive skewness value indicates that the distribution is shifted to the left, and a negative value means to the right. Sharma (1996) recommends that Z values for the skewness and kurtosis can be computed and used to determine normality. The formulas are:

$$Z_{kurtosis} = \frac{kurtosis}{\sqrt{\frac{24}{N}}}$$

$$Z_{skewness} = \frac{skewness}{\sqrt{\frac{6}{N}}}$$

If both $Z_{kurtosis}$ and $Z_{skewness}$ values do not exceed the specified critical value, then the normality of distribution can be inferred. The most commonly used critical value is ±1.96 at a 5% significance level. If the Z value of either kurtosis or skewness exceeds the critical value, the distribution is considered to be nonnormal (Hair et al., 2011). The results of $Z_{skewness}$ and $Z_{kurtosis}$ values for all scales are presented in Table 5.16. It can be seen from the results that all scales' $Z_{skewness}$ and $Z_{kurtosis}$ values did not exceed the critical value (±1.96). Therefore, all scales were considered to be normally distributed which allowed the SEM technique to be used.

Table 5.16: Scale Normality Assessment

	Skewness	**Kurtosis**
Internally focused coopetition	.172	-1.192
Externally focused coopetition	.401	-1.006
Competitors' opportunism	-.453	.188
New innovation knowledge-based resources and capabilities	.059	-1.104
New marketing knowledge-based resources and capabilities	.445	-.758
Loss of uniqueness of existing resources and capabilities	-.544	-.063
Efficiency	-.014	-.323
Adaptiveness	.114	-.708
Effectiveness	-.108	-.604
Market dynamism	-.231	.078
Competitive intensity	-.279	-.168
Technological turbulence	-.578	.048

5.9 Structural Equation Modelling Results

After establishing the unidimensionality and assessing normality for all the scales, the next step is to test the structural model using the item parcelling technique. When performing item parcelling, the error variance for each variable needs to be calculated first using the formula $[(1 – \alpha)* \sigma^2]$ (Jöreskog and Sörbom, 1993). In the formula, α is the construct reliability and σ the standard deviation. The values of calculated error variances were set in the LISREL Simplis file.

The results of the structural model demonstrated a good fit to the data (χ^2=451.69, df=300, RMSEA=0.0586, CFI=0.960, NNFI=0.945, SRMR=0.0561). It is important to note that good structural model fit is not sufficient to support proposed hypotheses (Barrett, 2007). The individual parameter estimates need to be examined against the corresponding predictions (positive or negative) in order to accept or reject the proposed hypotheses (Hair et al., 2011). In addition, the parameter estimates need to be statistically significant, which can be determined by the t-values (Byrne, 2010). As a matter of rigid scientific practice, the significance level is set to 5%. The parameter estimates of structural relationships between exogenous constructs (ξ) and endogenous constructs (η) are presented in the gamma (γ) matrix in LISREL output. The parameter estimates of structural relationships between endogenous constructs (η) and endogenous constructs (η) are presented in the beta (β) matrix. The coefficients of each relationship and their t-values are presented in Table 5.17 below. The results of hypotheses testing are shown in Table 5.18.

Table 5.17: SEM Results

	New Innovation	New Marketing	Loss of Uniqueness

	knowledge-based Resources and Capabilities		knowledge-based Resources and Capabilities		of Existing Knowledge-based Resources and Capabilities	
	Gamma (γ)	t-value	Gamma (γ)	t-value	Gamma (γ)	t-value
Internally-focused Coopetition	**0.633**	**6.609*** **	0.116	1.211	**0.280**	**3.917*** **
Externally-focused Coopetition	**-0.145**	**-1.302***	**0.403**	**3.586*** **	-0.031	-0.374
Competitors' Opportunism	**0.365**	**3.419*** **	**0.247**	**2.287** **	**0.415**	**5.022*** **
	Efficiency		Effectiveness		Adaptiveness	
	Beta (β)	t-value	Beta (β)	t-value	Beta (β)	t-value
New Innovation Knowledge-based Resources and Capabilities	**0.331**	**2.529*** **	**0.251**	**1.992** **	0.080	0.640
New Marketing Knowledge-based Resources and Capabilities	**-0.292**	**-2.271** **	**-0.235**	**-1.893** **	-0.024	-0.200
Loss of Uniqueness of Existing Knowledge-based Resources and Capabilities	**-0.219**	**-2.256** **	**-0.139**	**-1.483***	**-0.150**	**-1.615** **
	Efficiency		Effectiveness		Adaptiveness	
	Gamma (γ)	t-value	Gamma (γ)	t-value	Gamma (γ)	t-value
Market Dynamism	**0.307**	**2.067** **	**0.345**	**2.362*** **	**0.580**	**3.910*** **
Competitive Intensity	-0.022	-0.198	**-0.286**	**-2.620*** **	-0.125	-1.157
Technological Turbulence	-0.054	-0.526	0.100	0.994	-0.103	-1.023
Size	-0.054	-0.469	**-0.243**	**-2.140** **	0.026	0.226
Age	-0.096	-0.748	-0.034	-0.268	-0.107	-0.856

NOTE:

One-tailed tests are used due to directional hypotheses
* significant at 10% level (t-Value > 1.28)
** significant at 5% level (t-Value > 1.645)
*** significant at 1% level (t-Value > 2.326)

Table 5.18 Summary of Hypotheses Testing

Number	Hypothesis	Hypothetical Relationship	Results
H1a	Internally focused coopetition and new innovation knowledge-based resources and capabilities	Positive	Positive
H1b	Internally focused coopetition and new marketing knowledge-based resources and capabilities	Positive	Non-significant
H2a	Externally focused coopetition and new marketing knowledge-based resources and capabilities	Positive	Positive
H2b	Externally focused coopetition and new innovation knowledge-based resources and capabilities	Positive	Non-significant
H3	Internally focused coopetition and loss of uniqueness of existing knowledge-based resources and capabilities	Positive	Positive
H4	Externally focused coopetition and loss of uniqueness of existing knowledge-based resources and capabilities	Positive	Non-significant
H5a	Competitors' opportunism and new innovation knowledge-based resources and capabilities	Negative	Positive
H5b	Competitors' opportunism and new marketing knowledge-based resources and capabilities	Negative	Positive
H6	Competitors' opportunism and loss of uniqueness of existing knowledge-based resources and capabilities	Positive	Positive
H7a	New innovation knowledge-based resources and capabilities and efficiency	Positive	Positive
H7b	New innovation knowledge-based resources and capabilities and effectiveness	Positive	Positive
H7c	New innovation knowledge-based resources and capabilities and adaptiveness	Positive	Non-significant
H8a	New marketing knowledge-based resources and capabilities and efficiency	Positive	Negative
H8b	New marketing knowledge-based resources and capabilities and effectiveness	Positive	Negative
H8c	New marketing knowledge-based resources and capabilities and adaptiveness	Positive	Non-significant
H9a	Loss of uniqueness of existing knowledge-based resources and capabilities and efficiency	Negative	Negative
H9b	Loss of uniqueness of existing knowledge-based resources and capabilities and effectiveness	Negative	Non-significant
H9c	Loss of uniqueness of existing knowledge-based resources and capabilities and adaptiveness	Negative	Negative

5.10 Additional Analysis

Due to the novelty of this research, some other constructs that might impact on the model proposed above have also been operationalised and included in the questionnaire. These additional constructs include competitive aggressiveness, trust, and power imbalance. They have not been included in the main quantitative data analysis because the sample size is relatively small and including all constructs would sacrifice the statistical power of collected data. However, these constructs have been suggested to be relevant and important in conceptual papers of coopetition research (Khanna et al., 1998; Hong and Snell, 2013; Fernandez et al., 2014). Therefore, in this section, a series of new relationships will be modelled and discussed investigating the effects of these non-hypothesised constructs on the main model. The analysis is not undertaken on the whole model but rather smaller subparts in SPSS to explore some preliminary findings. The items used to measure competitive aggressiveness, trust, and power imbalance are presented in Table 5.19, Table 5.20, and Table 5.21 below.

Table 5.19: Measurement Items of Competitive Aggressiveness

To what extent do you agree or disagree with each of the following statements? Strongly disagree (1), Disagree (2), Slightly disagree (3), Neutral (4), Slightly agree (5), Agree (6), Strongly agree (7)
We make a special effort to take business from competitors.
We try to outdo and out-manoeuvre the competition as best as we can.
My company is intensely competitive.
Our actions towards competitors can be termed aggressive.

Table 5.20: Measurement Items of Trust

Thinking about your cooperative arrangements **with your competitors**, to what extent do you agree or disagree with the following statements? *Strongly disagree (1), Disagree (2), Slightly disagree (3), Neutral (4), Slightly agree (5), Agree (6), Strongly agree (7)*
A good faith relationship has developed over time in my firm's dealings with competitors.
We understand each other well.
We have never had the feeling of being misled in our interactions with competitors.
We can always rely on our competitors to do their part.
Our competitors are always frank and truthful in their dealings with us.
Our competitors are very knowledgeable about everything relevant to our alliance.
Our competitor would go out of its way to make sure our firm is not damaged or harmed in this relationship.
In this relationship, we feel like our competitor cares what happens to us.
Our competitors look out for our interests in this alliance.
We feel like our competitor is on our side.
We know that our competitors are capable and competent.

Table 5.21: Measurement Items of Power Imbalance

	1 2 3 4 5 6 7	
Our success depends on our competitors' success		Our competitors' success depends on our success
We contribute more to helping competitors to achieve their objectives		Our competitors contribute more to helping us to achieve our objectives
We have more power over our competitors		Our competitors have more power over us
Our actions have more impact on the successes of our competitors		Our competitors' actions have more impact on our successes
We are more useful to our competitors		Our competitors are more useful to us

5.10.1 Hypotheses

In the additional moderation tests, it is proposed that competitive aggressiveness, mutual trust, and power imbalance moderate the relationship between (both internally and externally focused) coopetition and new knowledge-based resources and capabilities.

It is suggested that when a company is competitively aggressive when collaborating with a competitor, a 'learning race' emerges, where the company simultaneously looks for a maximum absorption of distinctive competencies from its partner and tries to protect its own core resources and capabilities (Kale et al., 2000). In addition, competitive behaviour in coopetition can help companies to achieve greater productive efficiency and may generate entrepreneurial rents by promoting the creativity and innovation (Quintana-Garcia & Benavides-Velasco, 2004). Therefore, the following two hypotheses are proposed:

Hypothesis 10a: When competitive aggressiveness moderates the relationship between internally focused coopetition and new innovation knowledge-based resources and capabilities, the relationship between those two constructs becomes stronger.

Hypothesis 10b: When competitive aggressiveness moderates the relationship between externally focused coopetition and new marketing knowledge-based

resources and capabilities, the relationship between those two constructs becomes stronger.

Coopetition scholars also stress the importance of establishment of mutual trust in the relationship. First, inter-firm trust is one of the critical factors in the competitors' willingness to collaborate (Tortoriello et al., 2011). Second, because coopetitive relationships may involve transformation of confidential information, development of trust and long-term commitment appears to be a critical key factor for successful coopetitive strategies (Chin et al., 2008). Ketchen et al. (2004) also suggest that trust and successful maintenance of the relationship are important for coopetition relationships because they need to be sustained to be able to obtain the positive outcomes, which include learning from the partner and gaining access to partner's resources and capabilities. Therefore, it is proposed that when mutual trust is at presence, the relationship between competitors becomes stronger and they are more willing to share critical information and capabilities with each other, which means more knowledge-based resources and capabilities can be developed and accumulated. Thus, the following two hypotheses are proposed.

Hypothesis 11a: When mutual trust moderates the relationship between internally focused coopetition and new innovation knowledge-based resources and capabilities, the relationship between those two constructs becomes stronger.

Hypothesis 11b: When mutual trust moderates the relationship between externally focused coopetition and new marketing knowledge-based resources and capabilities, the relationship between those two constructs becomes stronger.

The relationship between collaborative competitors is not always balanced. Generally speaking, stronger firms have greater resources and capabilities than weaker firms for assimilating knowledge (Dröge et al., 2003), devoting to product innovation (Eisenhardt and Tabrizi, 1995) and achieving better performance. In contrast, smaller or weaker firms are more likely to face resource scarcity and have stronger needs for survival. Therefore, they tend to rely more on their partners for their own survival and firm success. Stronger partners also have a tendency to behave opportunistically so that they can extract a higher share of the total value

created (Casciaro and Piskorski, 2005). Sometimes stronger coopetitors use their power to force weaker partners to act in a way which is only to their own best interest at the expense of others (Bouncken and Kraus, 2013; Pellegrin-Boucher et al., 2013). It is also possible that the more powerful players become less committed to the cooperation over time once they have achieved their own objectives (Bouncken and Bogers, 2015). In conclusion, when the collaborative relationship is not balanced, the stronger partner is more likely to gain more knowledge-based resources and capabilities from coopetition than the weaker ones. Therefore, the following two hypotheses are proposed.

Hypothesis 12a: Power imbalance moderates the relationship between internally focused coopetition and new innovation knowledge-based resources and capabilities. When a firm has stronger power, the relationship between those two constructs becomes stronger.

Hypothesis 12b: Power imbalance moderates the relationship between externally focused coopetition and new marketing knowledge-based resources and capabilities. When a firm has stronger power, the relationship between those two constructs becomes stronger.

5.10.2 Analysis and Results

In order to confirm a third variable making a moderation effect on the relationship between an independent variable and a dependent variable, it is necessary to show that the nature of the relationship changes as the values of the moderating variable change. This is in turn achieved by including an interaction effect in the model and checking to see whether such an interaction is significant and helps explain the variation in the dependent variable better than before.

As aforementioned, the moderation tests will be conducted in IBM SPSS rather than in LISREL so as to obtain some preliminary results. In SPSS, moderation can be checked and tested using the regular linear regression menu item. In order to test moderation in SPSS, researchers need to dummy code categorical variables, center the variables as well as create the interaction effect(s) manually. However, the

PROCESS tool developed by Andrew F. Hayes can center the variables and create the interaction terms automatically. Therefore, PROCESS will be used in this analysis.

To infer that moderation is occurring, there needs to be a significant effect by the new interaction term. The moderation effect can also be determined by examining the simple slopes, which shows the results of three different regressions when the values of the moderator are low, at mean value, and high. The results of moderation tests using SPSS PROCESS are presented in tables below.

Table 5.22: Moderation Test Result of H10a

	coeff	se	t	p	LLCI	ULCI
constant	3.1955	.1072	29.8200	.0000	2.9837	3.4073
AGG	.2287	.0827	2.7640	.0065	.0651	.3922
IFC	.5068	.0660	7.6776	.0000	.3763	.6373
int_1	.0370	.0500	.7397	.4607	-.0619	.1359
Product terms key:						
int_1 IFC x AGG						
Conditional effect of X on Y at values of the moderator(s):						
AGG	Effect	se	t	p	LLCI	ULCI
-1.2839	.4593	.0888	5.1699	.0000	.2837	.6349
.0000	.5068	.0660	7.6776	.0000	.3763	.6373
1.2839	.5543	.0952	5.8199	.0000	.3661	.7426

Table 5.23: Moderation Test Result of H10b

	coeff	se	t	p	LLCI	ULCI
constant	2.9355	.1004	29.2417	.0000	2.7371	3.1339
AGG	.2443	.0693	3.5279	.0006	.1074	.3812
EFC	.5318	.0647	8.2252	.0000	.4040	.6596
int_1	.1361	.0428	3.1788	.0018	.0515	.2208
Product terms key:						
int_1 EFC x AGG						
Conditional effect of X on Y at values of the moderator(s):						
AGG	Effect	se	t	p	LLCI	ULCI
-1.2839	.3571	.0835	4.2762	.0000	.1920	.5221
.0000	.5318	.0647	8.2252	.0000	.4040	.6596
1.2839	.7066	.0862	8.1948	.0000	.5362	.8770

According to the moderation results presented above, H10a is not supported, but H10b is. The result shows that competitive aggressiveness does not have a moderation effect on the relationship between IFC (internally focused coopetition) and IRnC (new innovation knowledge-based resources and capabilities), but it moderates the relationship between EFC (externally-focused coopetition) and MRnC (new marketing knowledge-based resources and capabilities). To be more specific, based on the simple slope analysis, when the level of competitive aggressiveness changes from low to medium, the relationship between EFC and MRnC becomes stronger. However, when the level of competitive aggressiveness changes from medium to high, the relationship between EFC and MRnC does not change much.

Table 5.24: Moderation Test Result of H11a

	coeff	se	t	p	LLCI	ULCI
constant	3.2215	.1159	27.8027	.0000	2.9924	3.4505
TRUST	.0139	.1272	.1096	.9129	-.2375	.2654
IFC	.5071	.0723	7.0163	.0000	.3643	.6500
int_1	-.0436	.0633	-.6880	.4926	-.1687	.0816
Product terms key:						
int_1 IFC x TRUST						
Conditional effect of X on Y at values of the moderator(s):						
TRUST	Effect	se	t	p	LLCI	ULCI
-1.0219	.5516	.0905	6.0969	.0000	.3728	.7305
.0000	.5071	.0723	7.0163	.0000	.3643	.6500
1.0219	.4626	.1031	4.4852	.0000	.2587	.6664

Table 5.25: Moderation Test Result of H11b

	coeff	se	t	p	LLCI	ULCI
constant	2.9825	.1083	27.5488	.0000	2.7685	3.1965
TRUST	-.0182	.1190	-.1531	.8785	-.2535	.2170
EFC	.5276	.0731	7.2144	.0000	.3831	.6722
int_1	-.1450	.0706	-2.0552	.0417	-.2845	-.0056
Product terms key:						
int_1 EFC x TRUST						
Conditional effect of X on Y at values of the moderator(s):						
TRUST	Effect	se	t	p	LLCI	ULCI
-1.0219	.6758	.0980	6.8977	.0000	.4822	.8695
.0000	.5276	.0731	7.2144	.0000	.3821	.6722
1.0219	.3794	.1072	3.5382	.0005	.1675	.5914

The results of H11a and H11b are interesting. H11a is not supported, which means mutual trust does not moderate the relationship between IFC and IRnC. Interestingly, the result of H11b contradicts the hypothesis. More specifically, the simple slope analysis shows that when the level of mutual trust changes from low to medium, the relationship between EFC and MRnC only marginally increases. However, when the level of mutual trust changes from medium to high, the relationship between EFC and MRnC becomes weaker.

Table 5.26: Moderation Test Result of H12a

	coeff	se	t	p	LLCI	ULCI
constant	3.1879	.1095	29.1044	.0000	2.9714	3.4044
POWER	.1110	.1486	.7468	.4564	-.1827	.4047
IFC	.5045	.0658	7.6719	.0000	.3745	.6345
int_1	.0684	.0663	7.0324	.3036	-.0626	.1994
Product terms key:						
int_1 IFC x POWER						
Conditional effect of X on Y at values of the moderator(s):						
POWER	Effect	se	t	p	LLCI	ULCI
-.8597	.4457	.0859	5.1869	.0000	.2758	.6155
.0000	.5045	.0658	7.6719	.0000	.3745	.6345
.8597	.5633	.0881	6.3964	.0000	.3892	.7374

Table 5.27: Moderation Test Result of H12b

	coeff	se	t	p	LLCI	ULCI
constant	2.9166	.1066	27.3682	.0000	2.7059	3.1272
POWER	.1509	.1631	.9252	.3564	-.1714	.4732
EFC	.5058	.0705	7.1720	.0000	.3664	.6452
int_1	.0559	.0790	.7070	.4807	-.1003	.2120
Product terms key:						
int_1 EFC x POWER						
Conditional effect of X on Y at values of the moderator(s):						
POWER	Effect	se	t	p	LLCI	ULCI
-.8597	.4578	.1032	4.4377	.0000	.2539	.6617
.0000	.5058	.0705	7.1720	.0000	.3664	.6452
.8597	.5538	.0924	5.9952	.0000	.3712	.7364

According to the results above, H12a and H12b both are not supported, which shows that power imbalance does not moderate the relationship between IFC and IRnC, nor the relationship between EFC and MRnC.

5.10.3 Discussion of Results

Before discussing and interpreting the results of the additional analysis above, it is important to acknowledge that the analysis is only exploratory in nature and findings may not be reliable or valid. To obtain more robust and conclusive results, the reliability and validity of the moderators firstly need to be tested in exploratory factor analysis and confirmatory factor analysis. Structural equation modelling also can be used to test the moderation effect in LISREL to obtain higher validity.

H10a and H10b

Results show that competitive aggressiveness does not moderate the relationship between IFC and IRnC (p=.4607). However, the simple slope analysis shows that the relationship between IFC and IRnC only becomes slightly stronger when the value of competitive aggressiveness is at a medium level. The reason might be that when competitors are collaborating on innovation-related activities, they tend to use formal contracts or procedures to protect their own confidential information, patents, and innovation outcomes. Therefore, no matter how competitively aggressive the partner is, the innovation-related resources and capabilities they could gain from coopetition are limited by the formal contracts.

In contrast, competitive aggressiveness moderates the relationship between EFC and MRnC ($p<0.05$). The simple slope analysis shows that the relationship becomes much stronger when aggressiveness changes from a low level to a medium level, but does not change when aggressiveness changes from medium to high level. It is possible that when aggressiveness increases, a firm's intention of learning from its competitor becomes stronger and thus its absorption of knowledge also increases. However, when a firm's aggressiveness increases to a high level, it may be detected by its competitor who could then be alerted and withhold its knowledge sharing activities so as to protect its own knowledge base and reduce knowledge leakage.

Lado et al. (1997) also suggest that firms with competitive behaviour tend to look for private benefits and such as attitude may culminate in dysfunctional outcomes. Partners may erect barriers around their distinctive competencies and then make the cooperation difficult. It is important to acknowledge that there might be other factors that are influencing the relationship and the reason why aggressiveness only moderate the link between EFC and MRnC to a certain degree remains unclear, which requires further research.

H11a and H11b

Results show that mutual trust does not moderate the relationship between IFC and IRnC. The reason could be similar as how the results of H10a is interpreted. However, how it moderates the link between EFC and MRnC is rather surprising. When the level of mutual trust changes from low to medium, the relationship between EFC and MRnC only marginally increases, whereas when the level of mutual trust changes from medium to high, the relationship becomes weaker. The result contradicts with most views in coopetition literature, which stresses the importance of mutual trust in a coopetitive relationship (e.g. Tortoriello et al., 2011; Chin et al., 2008; Ketchen et al., 2004). It is commonly agreed that mutual trust is an important foundation of coopetition and it encourages the exchange of resources and capabilities among the partners. However, one can argue that the measurement items of mutual trust are rather subjective and can only reveal the focal firms' trust on their partners, while their partners' trust on them cannot be reflected. Statistical results from such one-sided trust could be biased and misleading.

H12a and H12b

Both H12a and H12b are not supported, which shows that power imbalance neither moderates the link between IFC and IRnC, nor the link between EFC and MRnC. It seems the amount of resources and capabilities that a firm can acquire is not influenced by the power advantage it has over its partner(s). Even though that stronger firms may have the ability to dominate the relationship and extract a higher share of the total value created (Casciaro and Piskorski, 2005), bigger firms may also have the concerns of losing their reputation in their industries, which may neutralise their opportunistic behaviour. This means that power advantage by itself

does not necessarily lead to more resources and capabilities, but it is possible that firms which behave opportunistically may use their power advantage to appropriate more value from coopetition.

5.11 Conclusion

In this chapter, the quantitative data are analysed and results are discussed. First, a profile analysis was conducted to describe the surveyed companies' characteristics. Second, the results of a two-stage analytical model were presented. The scales of the constructs were purified using both exploratory factor analysis and confirmatory factor analysis. Some items were removed in this process in order to obtain a better model fit, given that the theoretical integrity of the constructs was not affected. Finally, the conceptual model and hypotheses proposed in chapter 3 were tested using structural equation modelling. Even though not all hypotheses were supported, the results uncovered some interesting findings that shed new lights on the coopetition literature, which entailed important theoretical and managerial contributions. In the following chapter, the research results will be discussed, followed by theoretical and managerial contributions, as well as a systematic discussion of limitations of this study and future research directions.

Chapter 6: Discussion and Conclusions

In this chapter, discussion of results is presented first, followed by summary of the whole research and contributions. In the end, the research limitations and future research directions are also discussed.

6.1 Discussion of Results

6.1.1 Hypotheses Testing: H1a, H1b, and H3

Hypotheses 1a, 1b, and 3 refer to the effects of internally focused coopetition on new innovation knowledge-based resources and capabilities, new marketing knowledge-based resources and capabilities, and loss of uniqueness of existing knowledge-based resources and capabilities. According to the results of SEM, H1a and H3 are supported, while H1b is not. To be more specific, internally-focused coopetition is positively related to new innovation knowledge-based resources and capabilities ($\gamma = 0.633, p < 0.01$), and loss of uniqueness of existing resources and capabilities ($\gamma = 0.280, p < 0.01$). Internally focused coopetition does not have a significant impact on new marketing knowledge-based resources and capabilities ($\gamma = 0.116, p > 0.1$).

The support for hypotheses 1a and 3 reflect the paradoxical nature of coopetitive relationships. When high-tech companies cooperate with competitors on business activities that are far away from customers (e.g., R&D and NPD), they can gain access to new innovation knowledge-based resources and capabilities. However, because innovation capability is a key success factor in high-tech industries, cooperating with competitors on business activities such as R&D and NPD can also lead to knowledge leakage and a loss of uniqueness of their own knowledge-base. Scholars of strategic alliances using KBV have identified the sharing of knowledge (including technology, know-how and organisational capability) as firms' dominant objective when forming alliances (e.g. Khanna et al., 1998; Dyer and Nobeoka, 2000; Kale et al., 2000). However, the outcome may be a 'competition for learning' where each alliance member seeks to learn at a faster rate than its partner in order to achieve a positive balance of trade in knowledge (Hamel, 1991). This can destabilise the relationship (Inkpen and Beamish, 1997), unless the alliance partners are successful in building 'relational capital' that can reconcile reciprocal learning with

the protection of their own core knowledge assets (Kale et al., 2000), which is often difficult to achieve. Firms usually face the dilemma of knowledge sharing and knowledge protection when collaborating with partners (Hackney et al., 2008). These findings are also in line with the literature that coopetition enables companies to have access to competitors' knowledge and expertise which they can then internalise into their own company (Bengtsson and Kock, 2000; Quintana-Garcia and Benavides-Velasco, 2004; Ritala and Hurmelinna-Laukkanen, 2009; Ritala, 2012), while coopetition can also lead to knowledge leakage which negatively impact on the competitive advantages of the companies (Cassiman et al., 2009).

It was hypothesised that internally focused coopetition is positively related to the generation of new marketing knowledge-based resources and capabilities. This hypothesis is made based on the assumption that companies may get to know their competitors' marketing strategies better even when they only cooperate in activities far away from customers. In other words, generation of new marketing-related knowledge can be a by-product of internally-focused coopetition through informal channels such as casual talks among employees from the two companies. However, this hypothesis is not supported. This can be interpreted in several ways. First, it may be because high-tech companies are highly cautious and sensitive to possible knowledge leakage. When they form a cooperative relationship with a competitor on innovation activities, they are aware they may lose their unique knowledge, skills and competitiveness. Therefore, they carefully design the cooperative agreement with competitors to precisely define the boundaries of the agreement in order to avoid unnecessary knowledge spillover. Second, because marketing-related activities are often visible to the public, companies may already know their competitors' basic marketing strategies even before the coopetition. The informal talks among employees from the competing companies may involve some discussion around marketing strategies, but at a superficial level. Therefore, respondents did not report that they have developed new marketing-related knowledge and capabilities during the internally focused coopetition.

6.1.2 Hypotheses Testing: H2a, H2b, and H4

Hypotheses 2a, 2b, and 4 refer to the effects of externally focused coopetition on new innovation knowledge-based resources and capabilities, new marketing knowledge-based resources and capabilities, and loss of uniqueness of existing knowledge-based resources and capabilities. According to the results of SEM, H2b is supported, while H2a and H4 are not. To be more specific, externally focused coopetition is positively related to new marketing knowledge-based resources and capabilities ($\gamma = 0.403, p < 0.01$), while has no significant impact on new innovation knowledge-based resources and capabilities ($\gamma = -0.145, p > 0.05$) and loss of uniqueness of existing knowledge-based resources and capabilities ($\gamma = -0.031, p > 0.1$).

As expected, when companies cooperate with competitors on externally-focused business activities such as sales, marketing and branding, they can obtain new marketing knowledge-based resources and capabilities from the cooperative arrangements. Similar to H1b, H2a is not supported. The reason could be that high-tech companies are cautious about sharing their innovation-related knowledge when only cooperating with competitors on business activities close to customers. In addition, KBV theorists argue that tacit knowledge (skills, know-how, and contextual knowledge) is difficult to be articulated and communicated between individuals and organisations, and is manifest only in its application (Kogut and Zander, 1992; Nonaka, 1994). Since a firm's innovation knowledge and capabilities are typical tacit knowledge which is held by individuals, firms cannot have access to such knowledge when they are only collaborating with their competitors on downstream business activities (such as marketing, sales, and branding). It is interesting to see that H4 is not supported, which shows that externally focused coopetition does not harm a company's uniqueness. The reason could be that high-tech companies mostly regard their innovation-related knowledge as the source of their uniqueness and competitiveness, while marketing knowledge of their industries is relatively easier to have access through various channels such as industry report, competitors' visible marketing behaviour, and suppliers and customers. Therefore, cooperating with competitors on externally-focused activities does not harm a company's uniqueness of their knowledge base.

6.1.3 Hypotheses Testing: H5a, H5b, and H6

The results of hypotheses 5a, 5b, and 6 are very interesting. The results of H5a and H5b contradict the hypothesised negative relationships between competitors' opportunism and new innovation and marketing knowledge-based resources and capabilities. It is reported that competitors' opportunism has a strong positive relationship with new innovation knowledge-based resources and capabilities ($\gamma = 0.365, p < 0.01$). Competitors' opportunism also positively impacts on new marketing knowledge-based resources and capabilities ($\gamma = 0.247, p < 0.05$). Hypothesis 6 was supported, showing that competitors' opportunism positively impacts on the loss of uniqueness of existing knowledge-based resources and capabilities ($\gamma = 0.415, p < 0.01$).

As discussed in Chapter 2 and 3, competitors' opportunistic behaviour is a critical issue when firms appropriate and integrate knowledge generated from the coopetitive relationships (Levy et al., 2003; Baumard, 2009; Bouncken and Kraus, 2013; Pellegrin-Boucher et al., 2013). However, the results of this study contradict the literature and the hypotheses, and have shown strong relationships between competitors' opportunistic behaviour and the new innovation and marketing knowledge-based resources and capabilities a firm can obtain from coopetition. After a careful investigation of the scale used to measure competitors' opportunism, the reasons behind these results have become clear. The measures of competitors' opportunism are perceptual in nature. In other words, they are designed to reflect the perceived level of opportunism from competitors, rather than the actual or objective level of opportunism. When companies think that their cooperative competitors are behaving opportunistically, they are more likely to do the same by appropriating and internalising more value generated from the coopetitive relationships, through either formal or informal ways. This is highly in accordance to the prisoners' dilemma described in game theory (see Chapter 2 section 2.3.3). The strategy and results of the prisoners' dilemma are presented in the matrix below:

Prisoner B / Prisoner A	Stays silent	Betrays
Stays silent	Each serves 1 year	Prisoner A: 3 years
Betrays	Prisoner A: goes free Prisoner B: 3 years	Each serves 2 years

Therefore, no matter what the other decides, a rational prisoner gets a better payoff by betraying the other. If B stays silent, A should betray, because going free is better than serving 1 year. If B betrays, A should also betray, because serving 2 years is better than 3 years. For B, it is the same strategy.

In the real situation where competitors cooperate with each other, assuming competitors A and B are cooperating, if both are cooperative, the benefits both can gain are labelled as 2. If A is opportunistic while B is cooperative, A gains 3 and B 0, vice versa. If both are opportunistic, each will gain 1. The strategies and results can be shown in the matrix below:

Company B / Company A	Cooperative	Opportunistic
Cooperative	A: 2 B: 2	A: 0 B: 3
Opportunistic	A: 3 B: 0	A: 1 B: 1

Therefore, when the company perceives that their competitive partner is behaving opportunistically, the most advantageous strategy is to do the same and appropriate as much value from the total value created as possible. This could be the reason why there is a positive relationship between perceived opportunism and knowledge generation.

According to KBV of inter-firm alliance, inter-partner learning is considered as the purpose of alliance formation (Inkpen, 2002). The idea of knowledge transfer from one partner to another is discussed by Hamel (1991) as internalisation of partner's knowledge by firm. In this situation, collaborative firms compete to internalise more rapidly than their partners, which is sometimes called a 'learning race' (Khana et al.,

1998). Firms not only internalise jointly created knowledge, but also their partners' tacit knowledge in their own knowledge base (Zeng and Hennart, 2002). Therefore, the results of H5a and H5b reveal that when firms perceive that their competitive partner has a high level of opportunism and is internalising their knowledge, they could also do the same and accelerate their own speed of knowledge acquisition. This could lead to faster knowledge absorption in the short-term, but in the mean time they are also quickly losing the uniqueness of their own knowledge base.

H6 was supported. As expected, the more opportunistic competitors are, the more uniqueness of the company's existing resources and capabilities could be lost. This result reflects that coopetition is a double-edged sword. Competitors' opportunistic behaviour can motivate companies to learn more from their competitors and absorb more knowledge, while at the same time this is achieved at the expense of the uniqueness of their own knowledge-based resources and capabilities.

6.1.4 Hypotheses Testing: H7a, H7b, and H7c

Hypotheses 7a, 7b, and 7c refer to the effects of new innovation knowledge-based resources and capabilities on three dimensions of business performance, i.e. efficiency, effectiveness, and adaptiveness. H7a and H7b are supported. Specifically, new innovation knowledge-based resources and capabilities is positively related to both efficiency ($\beta = .331$, $p < 0.01$) and effectiveness ($\beta = .251$, $p < 0.05$), while there is no significant relationship between new innovation knowledge-based resources and capabilities and adaptiveness.

The support of hypothesis H7a is in accordance with the literature. Through coopetition, businesses can develop innovation knowledge-based resources and capabilities at a faster pace and achieve economies of scale (Miotti and Sachwald, 2003; Walley, 2007). If businesses chose to develop the innovation-related resources and capabilities by themselves or through purchasing from other companies, the process becomes either time-consuming or too costly, which can result in inefficiency. High-tech industries are often characterised with short product lifecycles and high R&D expenses (Gnyawali and Park, 2009, 2011; Bouncken and

Fredrich, 2012), which means that accumulating innovation resources and capabilities in a fast and less costly way is important to the financial performance.

Hypothesis H7b is also supported, indicating that there is also a positive relationship between new innovation knowledge-based resources and capabilities and business effectiveness. Effectiveness generally measures the business's ability to create, maintain, and enhance customer relationships. New innovation knowledge-based resources and capabilities acquired from coopetition can lead to multi-feature products at reasonable prices (Bouncken and Kraus, 2013), which are favoured by both existing and new customers.

Hypothesis H7c is not supported, indicating that new innovation-related resources and capabilities generated from coopetition does not have an impact on a business's adaptiveness. It was expected that new knowledge on innovation should help the business to develop new products for the purpose of reacting to changes in the environment. The reasons why the relationship is non-significant can be twofold. First, because high-tech companies constantly face environmental changes such as new regulations, new needs of customers, new technologies and threat from new entrants, the new knowledge on innovation accumulated from past coopetitive projects may not be applicable to the changes now. Second, as discussed in Chapter 2 (see section 2.2.5), competitors are more likely to form cooperative relationships in the early exploratory stages of the innovation process (Oliver, 2004; Nieto and Santamaria, 2007). In this regard, the knowledge on innovation developed through coopetition may not be readily applicable to imminent internal or external changes that the company needs to adapt to.

6.1.5 Hypotheses Testing: H8a, H8b, and H8c

It is surprising and interesting to find out that H8a, H8b, and H8c are not supported. However, instead of the hypothesised positive relationships, results show that new marketing knowledge-based resources and capabilities are negatively related to efficiency ($\beta = -.292$, $p<0.05$) and effectiveness ($\beta = -.235$, $p<0.05$), while have no significant relationship with adaptiveness ($\beta = -.024$, $p>0.1$).

A careful review of the marketing literature has provided some evidence to the results of H8a. After developing new marketing knowledge through coopetition, companies may either refine their current marketing strategies (marketing exploitation), or develop new marketing strategies (marketing exploration). However, marketing mix decisions' effects on financial performance are not always immediately and fully realised in the period in which the changes take place, which is termed as 'lagged effects' (Kotler, 1971; Parsons and Schultz, 1976). Lagged effects of marketing strategies may be resulted from various reasons such as execution delays, noting delays, purchase delays, recording delays, and customer holdover effects (Kotler, 1971; Doyle and Saunders, 1985). Therefore, costs associated with development and implementation of marketing strategies take place ahead of the realisation of economic benefits. Because respondents were asked to report their business performance over the last financial year, lagged effects of marketing strategies are likely to occur. It would be beneficial and meaningful to collect data on the business's financial performance (efficiency) over a longer term, in order to more accurately determine the dynamic relationship between new marketing knowledge generated from coopetition and efficiency.

Results of H8b demonstrate that new marketing knowledge-based resources and capabilities negatively impact on effectiveness. After a careful investigation of the items used to measure effectiveness, it has been found out that the three remaining items of effectiveness are 'achieving customer satisfaction', 'providing value for customers' and 'keeping current customers', which are concerned with maintaining good relationships with existing customers. The negative relationship can therefore be explained using findings in the strategy and organisational learning literature. Marketing exploration strategies are defined as 'strategies that primarily involve challenging prior approaches to interfacing with the market, such as a new segmentation, new positioning, new products, new channels, and other marketing mix strategies', while in contrast, marketing exploitation strategies refer to 'strategies that primarily involve improving and refining current skills and procedures associated with existing marketing strategies, including current marketing segments, positioning, distribution, and other marketing mix strategies' (Kyriakopoulos and Moorman, 2004, p. 221). It is possible companies may have the excitement from developing new marketing knowledge through coopetition, and thus want to use the new marketing

knowledge to perform marketing exploration strategies so that they can appeal to new customers and attain new growth opportunities. However, learning theorists suggest that marketing exploration strategies tend to limit the amount of exploitation and vice versa (e.g., March, 1991) because these two different strategies often compete for limited internal resources and lead to opposite organisational cultures and structures (Kyriakopoulos and Moorman, 2004). Companies that pursue both strategies are viewed as lacking focus and internal fit (e.g., Miller and Friesen, 1986), and decision-makers need to address the trade-offs between marketing exploration and exploitation strategies. Levinthal and March (1993) suggest that the short-term positive feedback associated with marketing exploration strategies can create 'learning traps'. When firms see signs of successes in exploration, they are likely to abandon a balance between the two approaches. Therefore, when companies focus on exploring new marketing mix strategies with the new knowledge developed from coopetition, the resources and management commitment allocated on exploitative marketing strategies become less, which results in the negative relationship between new marketing knowledge and retaining existing customers.

It is surprising to notice that both innovation and marketing knowledge-based resources and capabilities gained from coopetition have no significant impact on a business's adaptiveness to the external environment. It is traditionally viewed that the availability of resources or slack resources encourages flexibility and adaptiveness (e.g., Grewal and Tansuhai, 2001). The findings for H8c imply this may not be as straightforward and may involve a temporal (time) dimension. That is, developing or gaining access to 'new' resources and capabilities through coopetition may take time to be used and implemented, or, adaptiveness may not result due to the need to use these resources and capabilities through strategy. It is also possible that other unknown factors are more strongly influencing a business's adaptiveness, such as (potential and realised) absorptive capacity, company structure (centralisation and formalisation), and ability to experiment, which requires further research to clarify the findings.

6.1.6 Hypotheses Testing: H9a, H9b, and H9c

Hypotheses H9a and H9c were supported. Results showed that loss of uniqueness of existing knowledge-based resources and capabilities is negatively related to a business's efficiency ($\beta = -.219$, $p<0.05$) and adaptiveness ($\beta = -.15$, $p<0.05$), while has no significant impact on effectiveness ($\beta =-.139$, $0.05<p<0.1$).

The results confirmed the importance of uniqueness of existing knowledge-based resources and capabilities in high-tech industries. Uniqueness act as a critical source of competitive advantage and once key knowledge and capabilities have been learned by competitors and applied on their products or marketing practices, the value of such knowledge and capabilities would largely decrease. Developing new unique resources and capabilities requires time, investment and commitment, which is disadvantageous to efficiency. Competitors' imitation may pose new threats to the focal business as it would be difficult to obtain a differentiated positioning, making it harder to react and adapt to changes in the external environment.

The relationship between uniqueness and business effectiveness is not significant at a 5% significance level, whereas the relationship is negative if a 10% significance level is chosen. It is important to highlight again that in this study, business effectiveness is measured as 'retaining existing customers'. It is possible that a firm has established its reputation among its existing customers who tend to be loyal. Losing uniqueness may not strongly influence their choice of purchase in the short term, while their perception may change in the long term after they find alternative products or services that have similar features from competing brands. However, the impact of losing uniqueness on attracting new customers is not examined in this study, and arguably losing uniqueness may have a stronger influence on new customers than existing customer, which requires further research to clarify.

6.2 Research Summary

In this study, the pitfalls and paybacks of the inter-firm coopetition strategy are examined. More specifically, this study uses a knowledge-based perspective and a game theoretical perspective to investigate whether cooperating with competitors

can help firms to develop new knowledge-based resources and capabilities, while in the meantime whether firms also lose the uniqueness of their existing knowledge-base. Additionally, the effects of gaining new knowledge and losing uniqueness of existing knowledge on business performance are also evaluated. The development of the conceptual framework and hypotheses (see Chapter 3) is based on the literature review (see Chapter 2) and the author's reasoning.

The concept of coopetition has drawn much attention and research interest in the last two decades in strategy and management literature. In early studies, coopetition is defined as the phenomenon of simultaneous cooperation and competition in inter-organisational relationships (Brandenburger and Nalebuff, 1996; Lado et al., 1997; Bengtsson and Kock, 1999, 2000). More recently, scholars have expanded the coopetition concept that carries meaning across different levels of analysis, including individual level (e.g., Hutter et al., 2011; Baruch and Lin, 2012), intra-firm level (e.g., Luo, 2005; Ritala et al., 2009), inter-firm level (e.g., Bengtsson and Kock, 1999, 2000; Luo et al., 2007; Daidj and Jung, 2011), and network level (e.g., Gnyawali et al., 2006; Peng and Bourne, 2009). Despite that different levels of analysis share some similarities, definitions, theories, characteristics, and findings of them drastically vary (Dorn et al., 2016). The focus of this study is inter-firm coopetition, which is defined as 'the notion that two organisations simultaneously cooperate in some activities, such as research and development or purchasing, as they compete with each other in, for example, sale activities' (Dahl, 2014, p. 272).

Coopetition scholars have predominantly agreed that companies cooperate in input activities (e.g., logistics, production, and R&D) and compete in output activities (e.g., sales, branding, and marketing) (Bengtsson and Kock, 2000; Luo, 2007; Rusko, 2011). However, more recent studies have criticised this view and argued that cooperating in output activities is also a common practice among competitors (Lindström and Polsa, 2016; Chiambaretto et al., 2016). Cooperating with competitors in input and output activities can be inherently different with regard to their individual effects on acquisition of new knowledge-based resources and capabilities and loss of uniqueness of a firm's existing knowledge base. Therefore, in this study, coopetition is categorised into ***internally focused coopetition*** (the phenomenon where a business cooperates with competitors in business activities far

from customers and competes in business activities close to customers) and ***externally focused coopetition*** (the phenomenon where a business cooperates with competitors in business activities close to customers and competes in business activities far from customers).

In high-tech markets, the most important determinant of a firm's performance is its marketing and innovation capabilities (Dutta et al., 1999). The innovation capabilities determine whether a firm can develop innovations constantly, and the marketing capabilities reflect its ability to commercialise the innovation into products that meet market demands. Therefore, from a knowledge-based perspective, the effects of internally focused coopetition and externally focused coopetition on acquisition of new innovation knowledge-based and marketing resources and capabilities are examined. Moreover, coopetition also grants competitors access to the focal firm's tacit knowledge, which may lead to a loss of uniqueness of the firm's existing knowledge base. Therefore, the effects of internally and externally focused coopetition on loss of uniqueness of existing knowledge-based resources and capabilities are also investigated.

From a game theoretical perspective, competitors have strong incentives for opportunism when sharing resources and knowledge (Levy et al., 2003; Bouncken and Kraus, 2013). Competitors' opportunism may only enable their partners partial access to their resources and knowledge, while in the meantime illegally transfer their partners' core knowledge for individual benefits. Therefore, how competitors' opportunism impacts on acquisition of new innovation knowledge-based and marketing resources and capabilities is hypothesised, as well as its impacts on uniqueness of a firm's existing knowledge base.

Most extant quantitative coopetition studies use firm as the unit of analysis when investigating the coopetition outcomes (e.g., Mention, 2011; Luo, 2007; Ritala, 2012; Wu, 2014; Bouncken and Fredich, 2012). However, it is possible that a firm is composed of multiple businesses and the coopetition strategy only takes place in one of the businesses. Therefore, using business as the unit of analysis is more appropriate when investigating performance outcomes of coopetition. With regard to the business performance dimensions of this study, a three-dimensional

conceptualisation of business performance is adopted, consisting of efficiency, effectiveness, and adaptiveness (Ruekert et al., 1985). Consequently, how new innovation knowledge-based and marketing resources and capabilities and loss of uniqueness of existing knowledge-based resources and capabilities impact on these three dimensions of business performance is investigated.

A quantitative study with UK high-tech firms is designed to test the proposed relationships. Online survey is chosen the data collection method and the data analysis employs a two-stage approach suggested by Anderson and Gerbing (1988), which includes a measurement model assessment and a structural model assessment (see Chapter 4).

The results of data analysis were presented in Chapter 5, which revealed important research findings which are summarised below.

First, results show that firms can develop new knowledge-based resources and capabilities through coopetition. More specifically, internally focused coopetition positively impacts on new innovation knowledge-based resources and capabilities (H1a), while externally focused coopetition is positively related to new marketing knowledge-based resources and capabilities (H2b).

It is hypothesised that internally focused coopetition is positively related to the generation of new marketing knowledge-based resources and capabilities (H1b), and externally focused coopetition is also positively related to the generation of new innovation knowledge-based resources and capabilities (H2a). These two hypotheses are proposed because knowledge leakage may occur both intentionally or unintentionally. For example, when a firm cooperates with a competitor in R&D, the frequent interactions among employees from the two firms may lead to unintentional leakage of marketing knowledge, or one of them may intentionally learn from the other's best marketing practices. However, no significant relationships had been found in these hypotheses, indicating that firms might be highly cautious and sensitive to potential knowledge leakage and have carefully designed the cooperative agreements in order to precisely define the boundaries of the agreement.

Second, the results of H3 and H4 are interesting when compared with each other. When high-tech firms perform internally focused coopetition (cooperating with competitors in input activities), they are likely to lose the uniqueness of their existing knowledge-based resources and capabilities (H3). In contrast, high-tech firms do not lose the uniqueness of their existing resource and capability base when they perform externally focused coopetition (cooperating with competitors in output business activities) (H4). Even though internally focused coopetition grant firms access to competitors' resources and capabilities, firms also lose the uniqueness of their own knowledge-based resources and capabilities. Simply put, in working with competitors they get access to knowledge-based resources and capabilities, also hence the degradation in uniqueness in innovation-related resources and capabilities. However, marketing knowledge do not seem to be unique to high-tech firms because it is relatively easy to be acquired and is usually visible through competitors' marketing actions. Therefore, no significant relationship is identified between externally focused coopetition and loss of uniqueness.

Third, it is interesting that the results of H5a and H5b contradict to the hypotheses. It is hypothesised that competitors' opportunism reduces the knowledge-based resources and capabilities a firm can gain from the coopetitive relationship. However, results show that competitors' opportunism actually increases a firm's acquisition of new knowledge-based resources and capabilities. The results can be explained from a game theoretical perspective. When the company perceive that their competitive partner is behaving opportunistically, the most advantageous strategy is to do the same and to absorb as much competitors' knowledge-based resources and capabilities as possible. H6 was supported, showing that competitors' opportunism leads to the loss of uniqueness of existing knowledge-based resources and capabilities.

Fourth, the new innovation knowledge-based resources and capabilities developed in coopetition had a positive impact on business efficiency (H7a) and effectiveness (H7b), while no significant relationship with adaptiveness (H7c). The positive effect on efficiency might be because that the new innovation resources and capabilities enable businesses to develop new products at a faster speed and achieve economies of scale. Business effectiveness is also enhanced because new

innovation knowledge-based resources and capabilities can help to build multi-feature products at reasonable prices (Bouncken and Kraus, 2013), which are favourable to both existing and new customers. The non-significant relationship with adaptiveness could be because that the resources and capabilities gained from previous coopetition may not be applicable to imminent changes in the business environment, or, the new innovation resources and capabilities may take time to be used and implemented. A business's adaptiveness arguably is a dynamic ability which requires constant monitoring of the environment and refinement of existing strategies, while coopetition is often project-based which can only provide limited contribution to a business's adaptability.

Fifth, it was surprising to find out that the new marketing knowledge-based resources and capabilities developed in coopetition were negatively related to business efficiency (H8a) and effectiveness (H8b), and had no significant relationship with adaptiveness (H8c). Marketing literature suggests that marketing strategies usually have lagged effects on performance because of execution delays, noting delays, purchase delays, recording delays, and customer holdover effects (Kotler, 1971; Doyle and Saunders, 1985), which implies that investments on marketing strategies take place ahead of the realisation of economic benefits. Therefore, new marketing knowledge-based resources and capabilities could be negatively related to business efficiency over the last financial year because marketing inputs might have taken place while outputs have not been realised yet.

New marketing knowledge-based resources and capabilities are also negatively related to business effectiveness. The measurement items of business effectiveness are concerned with maintaining good relationships with existing customers. It is possible that after gaining new marketing resources and capabilities through coopetition, businesses are more likely to perform marketing exploration strategies in order to appeal to new customers and attain new growth opportunities. However, the short-term positive feedback may create 'learning traps' and lead to over-commitment on marketing exploration strategies. Therefore, the amount of resources and management commitment that can be allocated on explorative marketing strategies becomes less, which hence negatively impacts on the business's ability of

maintaining relationships with existing customers. Nevertheless, this finding is in need of further research.

Finally, results suggested that losing uniqueness of existing knowledge-based resources and capabilities have negative effects on business efficiency (H9a) and adaptiveness (H9c). The results imply that losing uniqueness of existing knowledge-based resources and capabilities could put a high-tech firm in a highly disadvantageous position. Competitors may use their partner's unique knowledge to develop imitative products or conduct similar marketing strategies, posing new threats to the partner. The partner may need to re-develop its unique knowledge base, which requires more resource and managerial input. Therefore, fewer resources can then be allocated to monitoring and adapting to the external environment, which creates adaptiveness problems.

The current study makes important theoretical contributions to the body of coopetition literature. It also provides several noteworthy managerial implications to company decision makers. These are therefore discussed in the following section.

6.3 Theoretical Contribution

This study makes several important contributions to the coopetition literature.

6.3.1 Contribution to Conceptualisation and Operationalisation of Coopetition

This study also criticised the view that competitors only cooperate on business activities far from the customer (e.g., R&D, production, and logistics) and then compete on business activities close to the customer (e.g., sales and marketing). The vast majority of extant coopetition studies are based on this assumption, whereas it only reflects part of the holistic picture. Competitors have also been found to cooperate in output activities, while this phenomenon has largely been neglected. Only recently a few studies have started to make a distinction between these two types of inter-firm coopetition and investigate how competitors cooperate in output activities (e.g., Lindström, and Polsa, 2016). However, to the author's best knowledge, none of the studies so far have examined these two types of coopetition

in terms of their relationships with other key variables in coopetition research. Thus, two new terms have been created in this study, which are *internally focused coopetition* and *externally focused coopetition*. The former represents the phenomenon of cooperating with competitors in business activities far from customers (input activities), and the latter refers to the phenomenon of cooperating with competitors in business activities close to customers (output activities). This new typology of coopetition advocates scholars to be more precise and focused on their chosen type of coopetition, as these two distinct types of coopetition entail their own characteristics and outcomes.

In existing quantitative coopetition studies, the coopetition construct is mostly operationalised as coopetition propensity (e.g., Luo, 2007; Peng et al., 2012; Ritala, 2012; Wu, 2014) or as a multiplicative measure of cooperation and competition (e.g., Bouncken and Fredrich, 2012; Kim et al., 2013; Bengtsson et al., 2016). As discussed in section 2.2.7, existing indicators of coopetition propensity are rather incomplete and using a multiplicative measure of cooperation and competition is theoretically erroneous. Following the new typology of coopetition, internally focused coopetition and externally focused coopetition are two distinct constructs and need to be measured separately. In the current study, we contribute to the literature a revised measurement system for capturing internally focused coopetition and externally focused coopetition. The reliability and validity of the new measurement scales of internally and externally focused coopetition are good and are established in Chapter 5. The development of new scales of these two types of coopetition sheds light on the conceptualisation and operationalisation of the coopetition construct.

6.3.2 Contribution to Knowledge-related Outcome Research

This study contributes to understanding how coopetition can affect the uniqueness of the firm's resources and capabilities. Resource-based theory (e.g., Barney, 1991) establishes that uniqueness and heterogeneity in resources and capability bases across competitors are important sources of competitive advantage. Research suggests that coopetition grants firms access to their competitors' knowledge, resources, and capabilities (e.g., Stuart and Sorenson, 2003; Owen-Smith and Powell, 2004; Quintana-Garcia and Benavides-Velasco, 2004; Ritala and

Hurmelinna-Laukkanen, 2009; Ritala, 2012), while firms also face the dilemma that they must share their own resources and capabilities with competitors to achieve common goals (e.g., Gnyawali and Park, 2011; Mention, 2011). Early studies suggest that firms may lose uniqueness in their knowledge base when cooperating with competitors (Okhuysen and Eisenhardt, 2002; Luo, 2005). However, the results of this study reveal that in high-tech industries, firms only lose uniqueness in their existing knowledge-based resources and capabilities when cooperating with competitors in input activities (such as R&D and new product development), but not when cooperating in output activities (such as sales and marketing). This finding is important because it indicates that different types of coopetition have different outcomes from a knowledge-based perspective and thus can affect bases for competitive advantage in dissimilar ways. Internally focused coopetition grants a firm innovation knowledge-based resources and capabilities, but to achieve this, the firm also need to exchange its core knowledge and capability base with competitors, thus sacrificing uniqueness. In contrast, externally focused coopetition grants a firm marketing knowledge-based resources and capabilities, and the uniqueness of the firm's own knowledge-based resources and capabilities is not affected.

Another important theoretical contribution is the establishment and operationalisation of the '*loss of uniqueness of existing knowledge-based resources and capabilities'* construct. Previous coopetition studies only conceptualise that losing uniqueness of a firm's core resources and capabilities might be a negative outcome of coopetition, while no studies have provided empirical evidence to support the assumption. This is the first study that develops measures for this important construct and tests how different types of coopetition impact on it, which provides important reference for future coopetition research.

6.3.3 Contribution to Opportunism Research

Coopetition literature predominantly supports the assumption that when competitors behave opportunistically, the focal firm can gain fewer resources and capabilities from the coopetitive relationship (e.g., Ritala and Hurmelinna-Laukkanen, 2009; Nielsen and Lassen, 2012; Bouncken and Kraus, 2013; Lechner et al., 2016). Competitors' opportunistic behaviour may only fulfil part of the cooperative

agreement and grant partners partial access to their resources and knowledge (Lechner et al., 2016). Lee and Johnson (2010) also note that competitors may also terminate the cooperation once they have accumulated the knowledge they need, which could also substantially reduce the resources and capabilities the partners can acquire.

However, the results of this quantitative study demonstrate some interesting findings that contradict the hypotheses. Results show that competitors' opportunism actually increases the development of new knowledge-based resources and capabilities for the focal firm. From a theory perspective, this increases our understanding of how perceived opportunism works in coopetition arrangements beyond what can be derived from alliance research. Indeed, opportunism is under researched in the coopetition context. It is often assumed to be a negative issue but predominantly features in conceptual research (Casciaro and Piskorski, 2005; Lechner et al., 2016) and lacks empirical testing in the coopetition literature. While coopetitive arrangements could collapse faster from opportunism, we find that the focal firm accelerates efforts to extract new resources and capabilities from the arrangement before this happens as a result of perceived opportunism on behalf of partners. Theory extensions on opportunism should now reflect potential benefits that may arise and not just normatively assume it is negative alone. Researchers may need to investigate both short-term and long-term effects of opportunism when studying coopetition as they could be different. Opportunism may accelerate short-term development of new knowledge for coopetitive firms. However, in the long run, since the coopetitive arrangement could be terminated earlier than planned which reduces the total collective value created, the value each partner can appropriate could accordingly be reduced. In addition, the results of this research imply that it would be helpful to include both self-opportunism and partner's opportunism in the questionnaire and survey both firms. The data provided by both firms can then be compared which draws a clearer picture on how opportunism works in coopetitive relationships.

6.3.4 Contribution to Coopetition Performance Outcome Research

This study contributes to understanding the performance implications of coopetition for creating new innovation knowledge-based and marketing resources and capabilities. Indeed, opposite effects are found that raise questions as to how companies can gain from coopetition. Results indicate that innovation knowledge-based resources and capabilities gained in coopetition are positively related to business efficiency and effectiveness. This finding is in line with current theoretical knowledge on the benefits of coopetition. However, marketing knowledge-based resources and capabilities are negatively related to business efficiency and effectiveness. This is counter to existing theory and research in this area. Theory then needs to be revised to better account for these findings and to explain how firms involved in externally focused coopetition to develop marketing resources and capabilities can then derive performance benefits. It could well be time to incorporate other theories, such as contingency or resource orchestration to better explain the coopetition–performance relationship.

Since respondents are asked to report their business performance over the last financial year, the negative impact on efficiency may be due to the ‘lagged effects’ of marketing strategies (Kotler, 1971; Parsons and Schultz, 1976), in which costs associated with development and implementation of marketing strategies take place ahead of the realisation of economic benefits. This implies that in future research, a longitudinal study is more preferable so that the long-term effect of marketing resources and capabilities on business efficiency can be investigated. In addition, the measurement scale of effectiveness needs to be revised. It is possible that business effectiveness is a multi-dimensional construct and entails at least two basic dimensions, namely ‘retention of existing customers’ and ‘development of new customers’. These two effectiveness outcomes are related to marketing exploitative strategy and marketing explorative strategy respectively (Kyriakopoulos and Moorman, 2004). Business decision-makers need to address the trade-offs between these two strategies and focusing on one strategy tends to limit the application of the other strategy (March, 1991). A recent study by Sanou et al. (2016) indicates that coopetition leads to creation of new customers. Therefore, it is possible that the new marketing resources and capabilities developed in coopetition are mainly used for

the development and implementation of marketing explorative strategies (developing new customers), which hence limits the resources and managerial commitment that can be allocated on marketing exploitative strategies (retaining existing customers). However, to obtain conclusive results, additional research needs to be implemented in the future.

6.3.5 Contribution to Importance of Uniqueness of Existing Knowledge-based Resources and Capabilities

The results of this study reveal that in high-tech industries, uniqueness of a business's existing knowledge-based resources and capabilities plays a vitally important role in business performance, as loss of uniqueness is negatively related to business efficiency and adaptiveness (increased losses in uniqueness leads to reductions in performance). The findings are in line with the theoretical foundations of knowledge-based view, which argues that the basis of a firm's competitive advantage is formed by the unique, relatively immobile and tacit knowledge possessed by individuals in the firm (Grant, 1996b) but extends this as we confirm that degradations to the uniqueness of the firm's knowledge-based resources and capabilities will harm performance. Taken together with the results of internal/externally focused coopetition, we extend literature to understand how coopetition affects uniqueness and the performance outcomes of this from the point of view of efficiency, effectiveness and adaptiveness. Thus far, existing research have failed to provide research evidence for the effect of loss of uniqueness in the resource and capability base of a firm on these dimensions with existing treatises mostly discussing this around advantage or profitability. Simply put, research tends to normatively believe loss of uniqueness will happen from coopetition and will affect performance without explicitly substantiating this with data. This study contributes to clarifying understanding on this issue. Coopetition does not necessarily lead to a loss of uniqueness but does in situations where the coopetition arrangement is based on internally focused coopetition or when perceived opportunism is high.

The importance of resource and capability uniqueness has been acknowledged in the strategy and management literature. Since uniqueness of resources, knowledge,

and capabilities is critical to firm competitive advantage and success, it is often necessary to evaluate whether various strategies can lead to an increase or loss of uniqueness. Therefore, this study makes a theoretical contribution in that 'loss of uniqueness of existing knowledge-based resources and capabilities' is operationalised in the coopetition context for the first time. In coopetition research, knowledge management/protection is a crucial topic. In future studies, scholars could investigate whether different knowledge protection mechanisms or governance structures can reduce the loss of uniqueness, using the new measurement scale proposed in this study.

6.4 Managerial Contribution

The managerial implications of this paper can be considered supportive of strategic decision-making.

6.4.1 Coopetition as a Viable Strategy

Understanding the logics of coopetition strategy provides companies a new source of resources, knowledge, and capabilities. Firms sometimes face difficulties such as lack of resources, inadequacy of marketing, lack of skilled workers, weakness in access to external information, and difficulty in coping with government regulations. All these difficulties may hinder both the development of new products and commercialisation of new products. Cooperating with competitors provides a potential solution to the difficulties, as companies can obtain access to competitors' resources and capabilities by exchanging their own. The idea and logic behind this is that companies do not have to own others' resources to achieve their own goals. They can benefit from others' resources as long as they have access to them. Coopetition can take place in any business activities, ranging from input activities such as R&D, NPD and production, to output activities such as sales and marketing. However, results of this study reveal that cooperating with competitors in different business activities has distinct implications. When firms cooperate with competitors in input activities, the new knowledge-based resources and capabilities gained from coopetition can help firms to achieve more efficiency and effectiveness, whereas firms also lose the uniqueness of their existing resources and capabilities which may

oppositely influence performance. In contrast, cooperating with competitors in output activities do not lead to uniqueness sacrifices.

In the coopetition process, companies can not only obtain access to relevant resources and capabilities, but also learn from competitors to absorb their best practices and internalise them into own company. Companies are also advised to pay attention to the existing coopetitive actions in their industries. Because of the potential advantages associated with this strategy, companies within coopetition are more likely to gain an advantageous position than outsiders. Therefore, being isolated might lead to competitive disadvantage and it is important to carefully evaluate the reasons, potential benefits and risks of their competitors' established coopetition.

6.4.2 Potential Pitfalls of Coopetition

Although coopetition enables companies to have access to new knowledge-based resources and capabilities, a key issue for coopetition is the notion that, there is duality in every relationship, coopetition is by no exception. Hence, managers also need to be aware of the potential pitfalls of coopetition strategy.

First, obtaining access to competitors' resources and capabilities is usually achieved through sharing, which implies companies also need to share their own unique resources, knowledge, and capabilities. The results of this study show that uniqueness of a high-tech firm's knowledge-based resources and capabilities is crucial to business success in that performance decreases as losses to uniqueness increase. Therefore, it is advised that before engaging in coopetition, companies need to scrutinise 1) what their unique resources and core capabilities are, 2) whether they will lose the uniqueness and value of these resources and capabilities after coopetition, 3) whether losing uniqueness will put themselves in a disadvantageous position in the long-term because of competitors' imitation and creation of stronger competitors. One interesting finding of this study is that for high-tech firms, cooperating with competitors in input business activities (e.g., R&D and NPD) leads to loss of uniqueness, but cooperating in output business activities (e.g., sales and marketing) do not. This finding implies that high-tech firms' core

competitiveness is more related to their innovation competences. In this sense, cooperating with competitors only in output activities is likely to be a safer strategy if protection of core knowledge is the priority.

Second, competitors tend to have strong incentives for opportunism. Competitors' opportunistic behaviour can be reflected in different forms. The measurement scale of opportunism used in this study has provided some examples, such as exaggerating needs, altering facts, and over-promising. In addition, competitors may also become less committed to the cooperation over time once they have achieved their own objectives. It is also possible that competitors illegally transfer core knowledge or force partners to act in a way to the best interest of themselves. From a game theoretical perspective, when firms *perceive* that their competitors are behaving opportunistically, their best strategy is to do the same and appropriate as much value as possible, or to violate the cooperate agreement and 'steal' knowledge from competitors. In this situation, the positive relationship between competitors' opportunism and development of new resources and capabilities should not be interpreted as that opportunism is favourable in coopetition. Instead, it only reveals that when firms 'fight back' against competitors' opportunism, they are more likely to gain more knowledge-based resources and capabilities than still being cooperative and taking no reaction to competitors' opportunism. The collective effort could then deteriorate and become a 'learning race', in which every player only fights for private benefits instead of mutual objectives. This might be the reason why above 50% of coopetitive relationships fail to produce the desired results (Park and Ungson, 2001; Lunnan and Haugland, 2008). However, arguably in situations where both parties are highly cooperative, the collective value created and private value allocated are both maximised. Competitors' opportunism can also further degrade a firm's uniqueness of knowledge-based resources and capabilities. From a game theoretical perspective, the joint value creation can only be maximised if both parties are principled and cooperative. As long as one party starts to behave opportunistic and get detected by the partner, a vicious circle begins and both parties cannot achieve the desirable outcomes. Therefore, it is vitally important to choose trustworthy partners and be clear on what to share with competitors to avoid unnecessary knowledge leakage. It is also important to set up governance structures such as regulative policy, the division of work, and the control of information flows (Andersen

and Drejer, 2009). It is also beneficial to use the legal management in coopetition through equity, contracts, clauses, leadership negotiations, and patents rights (Salvetat et al., 2013). Companies can also set up a dedicated alliance function to facilitate knowledge management, create external visibility, provide internal co-ordination legitimacy to set alliance priorities, draw on company resources to solve alliance problems (Dyer et al., 2001). Game theory also suggests that a long-term relationship between partners can also reduce the likelihood of opportunism.

Third, pitfalls also arise from desired objectives. If managers of the focal firm engage in coopetition in order to develop marketing resources and capabilities then they must be ready to accept a longer-term view as these do not instantly generate performance benefits (and indeed create decreases in the immediate term). As such it could be easy to drift into myopic and short term thinking because performance gains are not being instantly delivered but rather a base is being created for the future longevity of the firm (though we accept that this point requires longitudinal research to corroborate).

6.4.3 Usage of Knowledge-based Resources and Capabilities

For high-tech firms, the innovation knowledge-based resources and capabilities have different short-term effects on business performance when compared with marketing ones. The new innovation knowledge-based resources and capabilities gained from coopetition have a positive impact on business efficiency and effectiveness, at least in the short-term. However, marketing knowledge-based resources and capabilities do not. It is advised that companies need to be careful about possible ‘learning traps’ with the new marketing knowledge gained from coopetition. The new marketing resources, knowledge, and capabilities are often used to develop new marketing mix strategies for attracting new customers. It is important to find the balance between developing new customers (marketing exploration) and retaining existing customers (marketing exploitation). Allocating too many resources on developing new customers tend to limit or degrade a firm’s ability in maintaining relationships with existing customers. In addition, competitors’ complex marketing actions involve many different types of information and time is needed to understand them. When the focal firm (learner) is still trying to analyse and learn about competitors’ complex

actions, competitors may have already seized the market leadership. The delay in the focal firm's later marketing actions may not lead to desirable market performance, even though it may have gained a substantial amount of marketing knowledge (may also be fragmented pieces of knowledge) from the competitor.

6.4.4 Business Performance Evaluation

In this study, business performance is measured on three dimensions: efficiency, effectiveness and adaptiveness. The results of this study have shown that a business's performance on these dimensions could be different. Therefore, using a single performance measure (e.g. profit) can be problematic and cannot reveal the underlying problems. When markets change or an unforeseen event arises, businesses which do not have holistic measures on their performance are easily exposed to threats. The items of efficiency, effectiveness and adaptiveness used in this study can also be used as a checklist when businesses evaluate their own performance. However, due to certain limitations of this study, some other performance dimensions are not included in the survey which are also useful when assessing performance. First, both short-term and long-term performance measures need to be established. Results of this study have shown that marketing knowledge-based resources and capabilities have a negative impact on short-term performance, whereas the long-term value is not assessed. Second, employees' satisfaction and inter-department rapport can also be included, especially when the business is engaged in coopetition. It is aforementioned (see section 2.2.6.2) that coopetition may lead to potential internal tensions, as individual in the functions that cooperate with competitors can be perceived as 'traitors' because they cooperate with 'the enemy'. Therefore, maintaining morale and intra-firm harmony is critical when assess the performance of coopetition. Third, the performance of a business also can be benchmarked against competitors, especially when in coopetition. Comparing business performance improvement against both the collaborative and non-collaborative competitors can provide insightful information on performance.

6.5 Research Limitations

Although this study makes some noteworthy contributions for coopetition literature, the study has some obvious limitations. The first four limitations identified below are methodological and the last five are related to the research results.

First, this study applied a cross-sectional research design and as such suffers from the limitation in not allowing causality to be asserted from the data (Covin et al., 1997; Menon et al., 1999; Berthon et al., 2001; Morgan et al., 2003; Vorhies and Morgan, 2003). Using a longitudinal research design is more preferable in future coopetition research not only because of the design's inherent advantages such as evidence of time order of occurrence and reducing common method variance (Podsakoff and Organ, 1986, Filipescu et al., 2013), but also because coopetition is an evolving relationship and knowledge-based resources and capabilities may have lagged effects on business performance which cannot be detected when using a cross-sectional design. Even though longitudinal studies have also found difficulties in inferring causality (Finkelstein and Hambrick, 1990), it could complement this study and further test how gaining knowledge-based resources and capabilities and losing uniqueness of existing ones affect business performance over the long-term.

A second limitation of this study is the determination of respondents. A single respondent from each firm was surveyed to obtain data. It is suggested that using multiple respondents from every firm surveyed may increase the reliability of the scales (Slater et al., 2009) and validate the results. However, research has found that senior managers provide data as reliable and valid as multiple informants and objective data can do (Zahra and Covin, 1993; Justin Tan and Litschert, 1994). In addition, COOs (Chief Operating Officers) and MDs (Managing Directors) are chosen as the key informants of this survey research. Therefore, respondents may provide data about the entire firm, while this study uses business as the unit of analysis. One can argue that using heads of businesses as the informants is more appropriate. Most importantly, in this study, the coopetition relationship is only depicted from one firm's perspective, yet this is only one side of the story. It would be very beneficial to obtain data from both parties and scrutinise and triangulate their views of the relationship.

Third, a larger sample would have been beneficial, but the time and financial constraints of the project did not allow for a longer data collection period. If possible, the measures used in this research should be replicated on different samples to provide additional evidence of their psychometrical soundness. However, a major challenge of using quantitative studies in the field of coopetition research is that not all companies cooperate with competitors. Researchers need to first identify qualified companies which are engaged in coopetition, and then ask for agreement for participating in the survey, which makes obtaining a large sample very difficult.

Fourth, following on from the third limitation, this study examined high-tech firms in the UK and it cannot be completely ruled out that different results may have emerged if different samples are used, such as companies in service industries or in stable and deregulated industries. Therefore, the findings may only be generalised to the corresponding population, but not to firms in other industries or other countries. For instance, anecdotal evidence from industry suggests Israeli companies appear more open to working with competitors and on a more frequent basis. In this sense, future studies should seek to examine the findings of this study in different contexts to develop richer insights into the coopetition strategy beyond the Western horizon and provide more generalisable results.

Fifth, it was conceptualised that inter-firm coopetition has two distinct forms, namely internally focused coopetition and externally focused coopetition. The distinction is based on whether the cooperative activities are close to or far from customers. However, there are also support activities, such as government lobbying, maintenance and repair, human resource management, and accounting that competitors may also cooperate in. These support activities were neglected in this study but may also provide interesting insights to coopetition research. Moreover, coopetition was operationalised as the extent to which competitors cooperate on different business activities, while the intensity of competition is ignored (Bengtsson and Raza-Ullah, 2016). Since a coopetitive relationship is composed of simultaneous cooperation and competition, evaluating the intensity of competition is indispensable. In future research, scholars could first ask respondents to indicate the extent to which they cooperate with competitors in certain business activities, and then ask them to indicate the intensity of competition in other business activities. Hence, a

more complete picture that captured both competitive and cooperative elements could be obtained.

Sixth, one of the interesting findings is that competitors' opportunism actually increases the knowledge-based resources and capabilities the focal firm can gain from coopetition. This result was interpreted and explained using prisoners' dilemma as competitors' opportunism is measured perceptually, which indicates that the results of the opportunism scale actually reflect the focal firm's perceived level of competitors' opportunism. Therefore, it would be interesting to obtain more objective data on competitors' opportunism, although it can be very challenging as opportunism is a latent construct. However, if data from both parties can be collected, respondents from both parties can be asked to report their competitors' opportunism and their self-opportunism, so that results can be cross-validated.

Seventh, in this study, it was identified that marketing knowledge-based resources and capabilities gained from coopetition were negatively related to business efficiency and maintenance of relationships with existing customers in the short-term. This study is unable to provide conclusive answers to explain this phenomenon. Marketing knowledge-based resources and capabilities developed in coopetition may have long-term positive effects on business performance, which is related to the notion that longitudinal studies are more preferable than cross-sectional ones as discussed above.

Eighth, the factors that affect (improve) business adaptiveness remain unknown. This study shows that both marketing and innovation knowledge-based resources and capabilities have no significant impact on business adaptiveness. Interpreting non-significant relationships is a challenging task, as there might be other unknown factors influencing adaptiveness or moderating the link between resources and capabilities and adaptiveness.

Ninth, after the quantitative study, no qualitative test of the findings was conducted with the Chief Operating Officers or Managing Directors to develop further explanations and implications, which in turn creates a limitation for this study. Although managerial implications are drawn for strategy practitioners and decision-

makers from the results of this study, the practicality and usefulness of the model and results are still not ascertained. Christensen and Raynor (2003) argue that theories are often frowned upon by managers as they are often impractical and difficult to implement. Therefore, a follow-up qualitative study in the form of either case study or in-depth interviews can facilitate a better understanding of the research results and how to make the theories useful in the strategic decision making process.

6.6 Future Research Directions

6.6.1 Research Design

First, it was discussed above that longitudinal studies would contribute valuable insights to the chosen topic, as private learning, knowledge accumulation, dynamics of interactions among partners, and respondents' perceptions and understandings all evolve over time. In addition, the knowledge-based resources and capabilities gained from coopetition may also have lagged effects on business performance, which can only be detected when longitudinal studies are adopted. In extant coopetition studies, longitudinal studies are scarce. Some studies that claim to be longitudinal tend to portray the process over time but are based on retrospective data (e.g., Lechner and Dowling, 2003; Lechner and Leyronas, 2009). Therefore, more longitudinal studies in real time are needed to understand how various aspects of coopetition evolve in the process.

Second, existing coopetition studies predominantly use the focal firm as the unit of analysis even when a dyadic relationship or a network context is being studied. Although it would be challenging to adopt a dyadic or network level of analysis, it would significantly advance the understanding of the coopetition phenomenon. For example, terminating the coopetitive relationship might be seen as a failure from one partner's perspective, but the other partner may have gained enough resources and capabilities from the relationship and achieved its own objectives. The respondent from one firm may report that they are honest and cooperative to their partners, but the partners may still feel threatened by opportunism and do not have trust. Investigating from one firm's perspective can only reflect one side of the story, hence

more studies that examine coopetition from both or multiple parties' perspective are needed.

Third, having the right informant is critical in quantitative studies. It is advocated in this study to use business as the unit of analysis, since a firm could be composed of multiple businesses and coopetition only takes place in one of them. It is necessary to first examine how coopetition affects various aspects on a business level, and then investigate the outcomes of knowledge transfer and resource sharing across different business units within the firm. Hence, arguably the head of the business where coopetition takes place might be the most suitable respondent in a firm. However, it is very difficult to determine which business unit of a firm is engaged in coopetition before data collection, especially when questionnaire-based survey is used as the research method.

Fourth, the quantitative study is conducted among UK high-tech firms, hence the findings can only be generalised to the corresponding population. It would be interesting to test the proposed model under a different industry or country context. For example, investigating how competitors in FMCG or tourism industries cooperate may lead to entirely different results. Additionally, despite the high prevalence of family firms in virtually every economy (Kraus et al., 2011), studies on how family firms use the coopetition strategy remain scarce. Studying coopetition under this context would be interesting because on one hand, family firms are often confronted with limited resources (Sirmon and Hitt, 2003), which could drive them into coopetition, while on the other hand, family firms also possess a strong identity and a unique social system (Habbershon et al., 2003; Denison et al., 2004), which could hinder their willingness to cooperate with competitors.

6.6.2 Constructs and Hypotheses

First, as suggested by Bengtsson and Raza-Ullah (2016), the field of coopetition largely suffers from conceptual clarity, coherence, and rigor. The coopetition concept is either poorly understood or used in a vague manner. The term coopetition is often stretched and sometimes used to describe virtually every relationship. As discussed in Chapter 2 (see section 2.2.2), defining coopetition as a relationship where

competition and cooperation simultaneously exist (Bengtsson and Kock, 2003) makes almost every inter-firm interaction coopetition. One could ask: if coopetition does not have any distinct characteristics compared to other inter-firm interactions such as strategic alliances and joint venture, then why invent this new terminology? Therefore, in future coopetition studies, the boundaries need to be made clear and a more focused definition is needed.

Second, coopetition scholars have predominantly focused on investigating how competitors cooperate in business activities far from the customer (internally focused coopetition). Research on how competitors cooperate in business activities close to the customer (externally focused coopetition) remain scarce. Only recently a few studies have started to investigate this phenomenon (Lindström and Polsa, 2016; Chiambaretto et al., 2016). In the current study, these two types of coopetition are integrated into one conceptual model, and it is interesting to find out that they respectively lead to different knowledge-based resources and capabilities and have different effects on uniqueness of a firm's existing knowledge-based resources and capabilities. The business performance outcomes also differ in terms of efficiency and effectiveness (as maintenance of existing customers in this study). It is advised that in future coopetition research, scholars need to pay more attention to this typology and be specific on which type of coopetition they are investigating, as findings on one type may not be generalised to the other. It is also needed to integrate these two types into one conceptual model and contrast their effects on critical aspects such as tension, trust, capability, and knowledge. The management of these two types of coopetition may also be different.

Third, in a turbulent and dynamic environment, a firm's adaptiveness to the external environment is critical to its success. Even though some conceptual studies of coopetition have implicitly suggested that coopetition may result in more adaptiveness (e.g., Sanou et al., 2016), research in this area remains scarce. The results of this study suggest that the new marketing and innovation knowledge-based resources and capabilities developed through coopetition have no significant impact on adaptiveness. Therefore, there might be other more important factors that are influencing a business's adaptiveness, such as (potential and realised) absorptive capacity, company structure (centralisation and formalisation), and ability

to experiment. It will be worthwhile to investigate how coopetition affects adaptiveness coupled with these factors.

Fourth, after knowing that coopetition is a relatively fragile relationship, being filled with tension, opportunism and mistrust, it is important to develop mechanisms and governance structures to protect core competencies, skills and knowledge from unintended transfer. Recently coopetition scholars have started to investigate the control mechanisms such as using a common information system specially designed for the project, and transforming appropriable information into non-appropriable information by aggregating data and withholding details such as calculation methods and cost structures (Fernandez and Chiambaretto, 2016). Existing literature in the field of alliance management can also provide some insights to coopetition management. For example, Dyer et al. (2001) suggest firms to develop a dedicated alliance function to improve knowledge management, create external visibility, provide internal co-ordination legitimacy, draw on company resources and solve alliance problems. Tiwana (2008) argues that increasing inter-firm modularity lowers the need for inter-firm knowledge sharing, which helps a firm to safeguard knowledge against misappropriation. All these established findings in alliance management literature could be transplanted to the coopetition context and it would be interesting to see how these knowledge protection mechanisms work in coopetitive relationships.

6.7 Closing Remarks

Coopetition is a double-edged sword. This study shows that firms can benefit from the alliance with competitors as it grants firms access to new knowledge-based resources and capabilities, which may not be available elsewhere. However, the success of coopetition is not guaranteed. Research has shown that above 50% of coopetitive relationships fail to produce desired results. Various potential pitfalls are embedded in coopetitive relationships. Coopetitive relationships are established to achieve mutual goals and to exchange resources, knowledge, and capabilities. Enabling competitors to have access to a firm’s critical knowledge may lead to potential imitation and loss of uniqueness. Moreover, competitors have strong incentives for opportunism. Unless the coopetitive relationship is eventually

transformed into a merger or acquisition, partners still remain to be competitors when the coopetitive relationship comes to an end. Hence, it is common that partners prioritise their private interest over common interest and perform opportunistically in a coopetitive relationship. The results of this study show that competitors' opportunism can further degrade a firm's uniqueness of resources and capabilities. Firms also need be careful of 'learning traps'. New information gained from competitors can be valuable, but they also tend to be fragmented and substantial in quantity. Firms need to establish the ability to process the new information and scrutinise its criticality and usefulness. It is also necessary to find a balance between developing new strategies with the additional knowledge and implementing existing strategies. Overall, coopetition can be a lucrative strategy for firms and more studies will be needed to reveal the critical success factors and how to develop mechanisms to better manage it.

Appendices

Appendix 4.1 Initial Information Email

Dear Mr./Ms. XXX

COOPETITION PERFORMANCE STUDY

Thank you for agreeing to participate in our research.

Forming mutually beneficial partnerships with other organisations is never an easy process and it's especially difficult to develop collaborative relationships with competitors. Collaborating with competitors is an art, all too often accidental and finding the right balance is key to success. The researchers at both Loughborough and Durham Universities have been studying coopetition for several years and now one step away from unveiling the secret source of success.

This final step cannot be accomplished without your help. Your response to our questionnaire will help us complete this research. Once finalised we will send you a copy of the full report and we are convinced you will not be disappointed.

In line with Loughborough and Durham Universities ethical policies on best research practice, we can assure you that any information you provide will be treated with the strictest confidence. We also assure you that data collected will be anonymised, amalgamated and that the results of the study will be used for academic purposes only.

The survey link can be found below and it should take approximately 20 minutes to complete.
https://qtrial2013.qualtrics.com/SE/?SID=SV_0uiONYgetokhLLL

We thank you for your involvement in this national study. If you have any questions or need more information, please contact us by emailing j.cai@lboro.ac.uk

Yours sincerely

Mr. Joy Cai (Doctoral Candidate in Marketing) & Prof Anne Souchon (Chair in International Marketing)
School of Business and Economics
Loughborough University

Dr Paul Hughes (Senior Lecturer in Strategy)
Business School
Durham University

Appendix 4.2 First Reminder Email

COOPETITION PERFORMANCE STUDY

Dear Mr./Ms. XXX

Recently, I wrote to you asking for your assistance with a Loughborough University School of Business and Economics study examining UK companies' coopetition strategy.

This study is a critical part of my PhD project, so I would greatly appreciate it if you could complete it.

Please find below a link to the questionnaire:

https://qtrial2013.qualtrics.com/SE/?SID=SV_0uiONYgetokhLLL

In return for your help, all final results and recommendations will be sent to you.

If you have any questions, please do not hesitate to contact me.

Yours sincerely,

Mr. Joy Cai (Doctoral Candidate in Marketing) & Prof Anne Souchon (Chair in International Marketing)

School of Business and Economics

Loughborough University

Dr Paul Hughes (Senior Lecturer in Strategy)

Business School

Durham University

Appendix 4.3 Second Reminder Email

Dear Mr./Ms. XXX

Recently, I wrote to you asking for your assistance with a Loughborough University School of Business and Economics study examining UK companies' coopetition strategy.

This study forms a critical part of my PhD project, so I would greatly appreciate it if you could complete it.

Please find below a link to the questionnaire:

https://qtrial2013.qualtrics.com/SE/?SID=SV_0uiONYgetokhLLL

In return for your help, all final results and recommendations will be sent to you.

If you have any questions, please do not hesitate to contact me.

Yours sincerely,

Mr. Joy Cai (Doctoral Candidate in Marketing) & Prof Anne Souchon (Chair in International Marketing)

School of Business and Economics

Loughborough University

Dr Paul Hughes (Senior Lecturer in Strategy)

Business School

Durham University

Appendix 4.4 Full Version of the Online Questionnaire

Loughborough University

Cooperating with your competitors----impact on business performance

Why fill this questionnaire in?

- Receive a full research report when we finish the study (if you choose to)
- Understand how to improve your firm's performance via collaboration
- Better understand to manage relationship with your competitors
- Identify areas where your organisation may be underperforming

Thank you so much for agreeing to participate in this study. Its success rests upon completed questions, so please do not miss any out. There are no right or wrong answers. You may notice that some questions are very similar; this is deliberate, and helps with statistical analysis. In line with Loughborough University and Durham University ethical policies on best research practice, we can assure you that any information you provide will be treated with the strictest confidence. We can also assure you that, data collected will be amalgamated, and that the results of the study will be used for academic purposes only, and no individual firm results will ever be disclosed.

Also, please click "Next" at the bottom of each page to move to the next section (there are 8 pages, which should take between 20 and 30 minutes to complete). Please be advised to complete the questionnaire in one session, as it cannot be saved.

The questionnaire is about your "COOPETITION" practices. By "coopetition", we mean whether, and how, you cooperate with your competitors in the same industry who serve the same groups of customers.

Once again, we are extremely grateful that you have taken time out of your busy schedules to take part in this study. If you have any questions or need more information, please contact us by emailing j.cai@lboro.ac.uk

Mr. Joy Cai (Doctoral Candidate in Marketing) & Prof Anne Souchon (Chair in International Marketing)

School of Business and Economics

Loughborough University

Dr Paul Hughes (Senior Lecturer in Strategy)

Business School

Durham University

To what extent do you cooperate with your competitors? Please choose one of the following options below.

1 = we do not cooperate with any of our competitors

2 = we rarely cooperate with competitors

3 = we cooperate with competitors on a small range of aspects of our business

4 = we cooperate with competitors on some aspects of our business

5 = we cooperate with competitors on many aspects of our business

6 = we cooperate with competitors on most aspects of our business

7 = we cooperate with competitors on all aspects of our business

If 'we do not cooperate with any of our competitors' is chosen, then only answer one question 'why you do not cooperate with competitors' and then skip to end of Survey.

(Skip pattern if 1 is chosen) Could you please tell us why you do not cooperate with competitors? (this is the only remaining question of this survey)

Coopetition Focus

To what extent do you agree or disagree with the following statements? Strongly disagree (1), Disagree (2), Slightly disagree (3), Neutral (4), Slightly agree (5), Agree (6), Strongly agree (7)

Over the last year, we closely collaborate with some of our competitors on:

- R&D
- New product development
- Technology improvement
- Information systems
- Procurement
- Manufacturing

- Distribution
- Sales
- Marketing
- Branding
- Customer service

Competitors' Opportunism

Thinking about your cooperative arrangements **with your competitors**, to what extent do you agree or disagree with the following statements? *Strongly disagree (1), Disagree (2), Slightly disagree (3), Neutral (4), Slightly agree (5), Agree (6), Strongly agree (7)*

1. On the whole, our competitors exaggerate needs to get what they desire.

2. Our competitors breach cooperative agreements to their benefit.

3. Overall, our competitors alter facts to get what they want.

4. Good faith bargaining is not a hallmark of our competitors' negotiation style.

5. Our competitors have benefited from our relationship to our detriment.

6. To accomplish their own goals, sometimes our competitors promise to do things without actually doing them later.

7. Our competitors are not always honest with us.

8. On occasion, our competitors lie about certain things in order to protect their interests.

9. Our competitors try to take advantage of "holes" in our contracts to further their own interests.

10. Our competitors sometimes use unexpected events to extract concessions from our firm

New Knowledge-based Resources and Capabilities

On a scale of (1) Not at all, to (7) Extremely, please indicate the extent to which you have developed the following capabilities as a result of your cooperative arrangements with competitors.

- Research and Development
- New product development
- Innovation
- Information technology
- New product launches

- Environmental scanning
- Marketing planning
- Marketing implementation
- Marketing communication
- Brand management
- Public relations
- Relationship-building with customers
- Understanding of customers
- Distribution
- Supply chain management

Loss of Uniqueness of Existing Knowledge-based Resources and Capabilities

Please rate the extent to which you agree or disagree with the following statements: From engaging in cooperative arrangements with our competitors...

1. ...we have sacrificed unique information and knowledge to our competitors.

2. ...our resource-base is no longer unique in comparison to our competitors.

3. ...we no longer possess unique knowledge over and above our competitors.

4. ...we have provided competitors with knowledge that they found difficult to develop by themselves.

5. ...we have given up uniqueness in our resource-base.

6. ...we have provided competitors with knowledge that may help them imitate us.

Performance

Efficiency

Please rate your business' performance over the last year in terms of: Very bad (1) to very good (7)

1. Earning profits?

2. Achieving better results at lower cost?

3. Achieving efficiency in business activities?

4. Performing business activities right the first time?

Effectiveness

Please indicate the extent to which your business has met the following objectives over the last year. Very ineffective (1) to very effective (7)

1. Achieving customer satisfaction?

2. Providing value for customers?

3. Attaining desired growth?

4, Securing desired market share?

5. Keeping current customers?

6. Attracting new customers?

Adaptiveness: Very bad (1) to very good (7).

1. Adapting your business strategy adequately to changes in the business environment of your organisation?

2. Adapting your business strategy adequately to changes in competitors' business strategies?

3. Adapting your business strategy quickly to the changing needs of customers?

4. Reacting quickly to new market threats?

Environmental Turbulence

To what extent do you agree or disagree with the following statements? Strongly disagree (1), Disagree (2), Slightly disagree (3), Neutral (4), Slightly agree (5), Agree (6), Strongly agree (7)

Market dynamism:

1. In our kind of business, customers' product preferences change quite a bit over time.
2. Our customers tend to look for new products all the time.
3. We are witnessing demand for our products and services from customers who never

bought them before.
4. New customers tend to have product-related needs that are different from those of our existing customers.
5. We cater to many of the same customers that we used to in the past.

Competitive intensity

6. Competition in our industry is cutthroat.
7. There are many 'promotion wars' in our industry.
8. Anything that one competitor can offer, others can match readily.
9. Price competition is a hallmark of our industry.
10. One hears of a new competitive move almost every day.
11. Our competitors are relatively weak.

Technological turbulence

12. The technology in our industry is changing rapidly.
13. Technological changes provide big opportunities in our industry.
14. It is very difficult to forecast where the technology in our industry will be in the next 2 to 3 years.
15. A large number of new product ideas have been made possible through technological breakthroughs in our industry.
16. Technological developments in our industry are rather minor.

Size

1. What was your company's annual turnover over the last financial year? (in British Pounds)

2. How many full-time employees does your business currently have (approximate number)?

Age

1. How many years has your business been operating (approximate number)?

Industry

1. Which industry (industries) is your company operating in?

Experience of Respondent

1. What is your job title (position)?

2. How many years of working experience do you have?

3. How many years of working experience do you have with your current business?

Respondent Knowledge

To what extent do you feel you possess the knowledge regarding the questions asked in this questionnaire?

1. My job role qualifies me to answer questions about the cooperative arrangements with competitors in my company.

2. I am competent to answer the above questions.

3. I am confident that my answers reflect the company's situation.

Social Desirability (Reynolds, 1982) To what extent do you agree or disagree with the following:

1. No matter who I'm talking to, I'm always a good listener

2. I am always courteous even to people who are disagreeable

3. I have never taken advantage of anyone

4. I would never try to get even rather than forgive and forget

5. I never feel resentful when I don't get my way

Thank you very much for your help. Your input will be invaluable to our research. You are also welcome to contact us (j.cai@lboro.ac.uk) if you want to discuss the value of our research to your company. The results of our research will be sent to you via Email once our project is finished and hope that can help you with your business. Please leave your Email address in the box below to receive full report.

Appendix 4.5 Non-Response Analysis: Early-late Respondents T-test

Constructs/Variables	Number of cases	Mean	Standard deviation	Standard error mean
Coopetition				
1	50	3.295	1.371	.194
2	50	2.974	1.297	.183
Threat of opportunism				
1	50	3.782	1.177	.166
2	50	3.862	1.046	.148
Knowledge-based				
R&C	50	2.865	1.393	.197
1	50	3.124	1.476	.209
2				
Loss of Uniqueness				
1	50	3.647	1.178	.167
2	50	3.473	1.081	.153
Efficiency				
1	50	4.905	0.810	.114
2	50	5.195	0.972	.137
Adaptiveness				
1	50	5.055	0.856	. 121
2	50	5.065	0.893	. 126
Effectiveness				
1	50	5.515	0.844	. 119
2	50	5.445	0.843	. 119

Note:

1 – early respondents

2 – late respondents

Constructs/ variables	t-test for Equality of the Means						
	t	df	Sig. (2-tailed)	Mean difference	St. Error difference	95% Confidence interval of the difference	
						Lower	Upper
Coopetition focus							
1	1.203	98	.232	0.321	.267	-.209	.851
2	1.203	97.700	.232	0.321	.267	-.209	.851
Threat of opportunism							
1	-.359	98	.720	-.080	.223	.522	.362
2	-.359	96.661	.720	-.080	.223	.522	.362
Knowledge-based R&C							
1	-.901	98	.370	-.259	.287	-.829	.311
2	-.901	97.674	.370	-.259	.287	-.829	.311
Loss of Uniqueness							
1	-.767	98	.445	-.173	.226	-.275	.622
2	-.767	97.293	.445	-.173	.226	-.275	.622
Efficiency							
1	-1.621	98	.108	.290	.179	-.645	.065
2	-1.621	94.898	.108	.290	.179	-.645	.065
Adaptiveness							
1	-.057	98	.955	-.010	.175	-.357	.337
2	-.057	97.823	.955	-.010	.175	-.357	.337
Effectiveness							
1	0.415	98	.679	.070	.169	-.265	.405
2	0.415	98.000	.679	.070	.169	-.265	.405

Note:

1 – Equal variance assumed

2 – Equal variance is not assumed

Appendix 5.1 Normal Distribution Histograms of Company Characteristics

Figure: Number of Employees

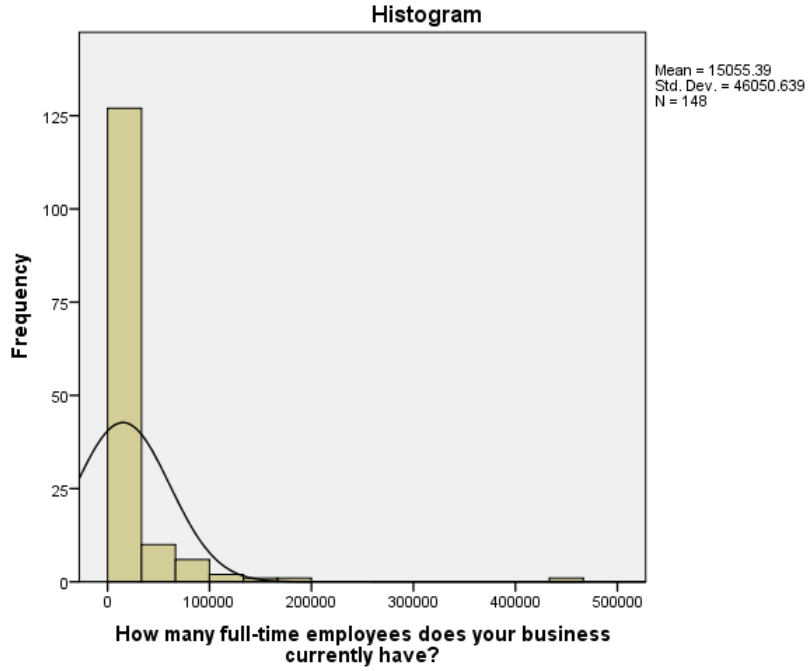
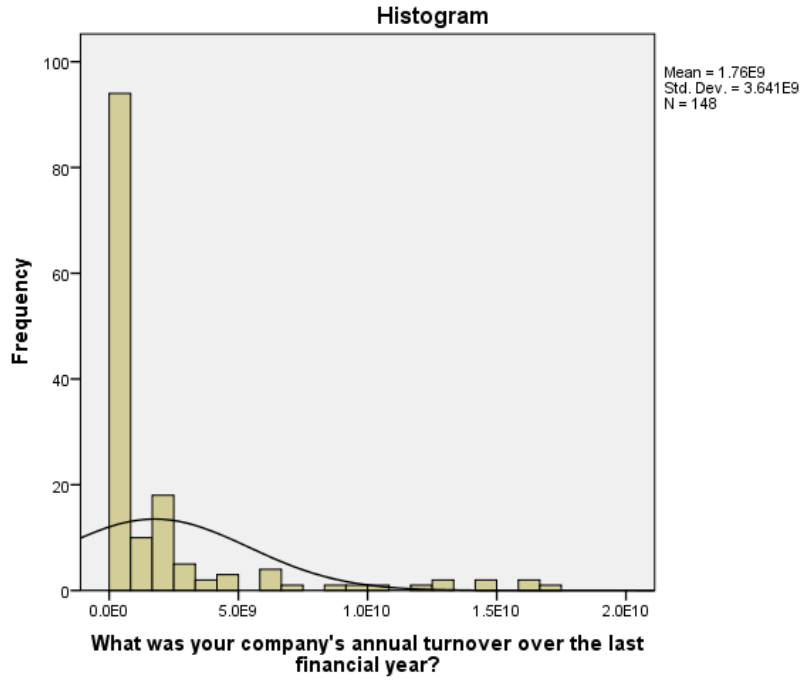


Figure: Annual Turnover over the Last Year



Appendix 5.2 Knowledgeability Assessment

Kaiser-Meyer-Olkin Measure		.775
Barlett's Test of Sphericity	Approx. Chi-Square	500.489
	df	3
	Sig.	.000

Communalities	
RK1: My job role qualifies me to answer questions about the cooperative arrangement with competitors in my company	.889
RK2: I am competent to answer the above questions	.859
RK3: I am confident that my answers reflect the company's situation	.926

Total variance extracted: Extraction sums of squared loadings			
Component	Total	% of Variance	Cumulative %
1	2.674	89.141	89.141

Factor loadings (Component matrix)	
Variable	Component 1
RK1	.943
RK2	.927
RK3	.962

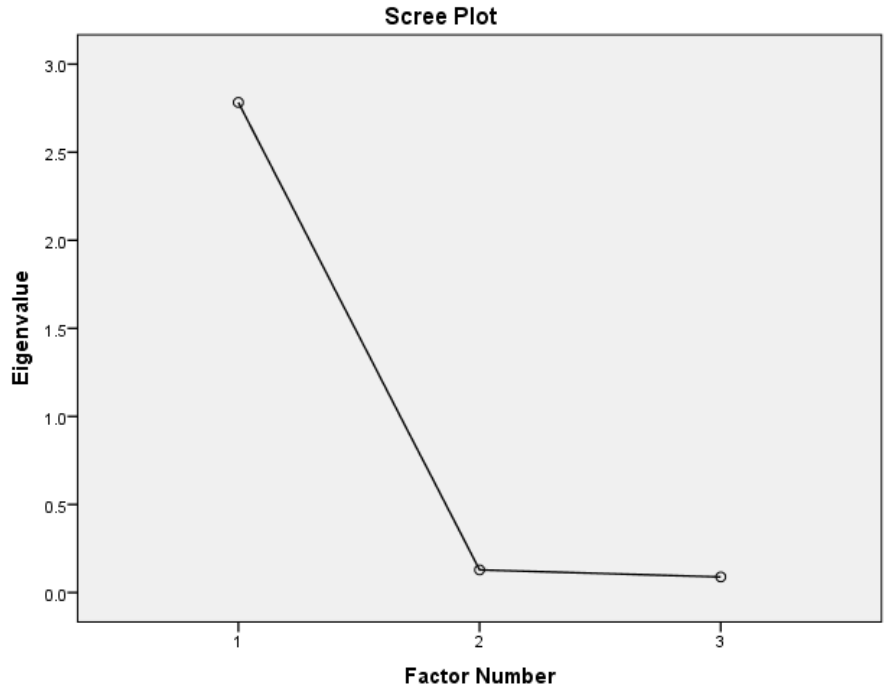


Table: Inter-Item correlation

Variables	RK1	RK2	RK3
RK1	1.000	.873	.908
RK2	.873	1.000	.892
RK3	.908	.892	1.000

Table: Item-total statistics

Variables	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
RK1	.915	.844	.936
RK2	.903	.819	.950
RK3	.930	.866	.932

Appendix 5.3 Coded Online Questionnaire

Cooperating with your competitors----impact on business performance

Why fill this questionnaire in?

- Receive a full research report when we finish the study (if you choose to)
- Understand how to improve your firm's performance via collaboration
- Better understand to manage relationship with your competitors
- Identify areas where your organisation may be underperforming

Thank you so much for agreeing to participate in this study. Its success rests upon completed questions, so please do not miss any out. There are no right or wrong answers. You may notice that some questions are very similar; this is deliberate, and helps with statistical analysis. In line with Loughborough University and Durham University ethical policies on best research practice, we can assure you that any information you provide will be treated with the strictest confidence. We can also assure you that, data collected will be amalgamated, and that the results of the study will be used for academic purposes only, and no individual firm results will ever be disclosed.

Also, please click "Next" at the bottom of each page to move to the next section (there are 8 pages, which should take between 20 and 30 minutes to complete). Please be advised to complete the questionnaire in one session, as it cannot be saved.

The questionnaire is about your ''COOPETITION'' practices. By "coopetition'', we mean whether, and how, you cooperate with your competitors in the same industry who serve the same groups of customers.

Once again, we are extremely grateful that you have taken time out of your busy schedules to take part in this study. If you have any questions or need more information, please contact us by emailing j.cai@lboro.ac.uk

Mr. Joy Cai (Doctoral Candidate in Marketing) & Prof Anne Souchon (Chair in International Marketing)
School of Business and Economics
Loughborough University

Dr Paul Hughes (Senior Lecturer in Strategy)
Business School
Durham University

To what extent do you cooperate with your competitors? Please choose one of the following options below. 【CO1】

1 = we do not cooperate with any of our competitors
2 = we rarely cooperate with competitors
3 = we cooperate with competitors on a small range of aspects of our business
4 = we cooperate with competitors on some aspects of our business
5 = we cooperate with competitors on many aspects of our business
6 = we cooperate with competitors on most aspects of our business
7 = we cooperate with competitors on all aspects of our business

If 'we do not cooperate with any of our competitors' is chosen, then only answer one question 'why you do not cooperate with competitors' and then skip to end of Survey.

(Skip pattern if 1 is chosen) Could you please tell us why you do not cooperate with competitors? (this is the only remaining question of this survey)

Coopetition Focus

To what extent do you agree or disagree with the following statements? Strongly disagree (1), Disagree (2), Slightly disagree (3), Neutral (4), Slightly agree (5), Agree (6), Strongly agree (7)

Over the last year, we closely collaborate with some of our competitors on:

- R&D 【IFC1】
- New product development【IFC2】
- Technology improvement【IFC3】
- Information systems 【IFC4】
- Procurement【IFC5】
- Manufacturing 【IFC6】

- Distribution【EFC1】
- Sales【EFC2】
- Marketing【EFC3】
- Branding【EFC4】
- Customer service【EFC5】

Competitors' Opportunism

Thinking about your cooperative arrangements **with your competitors**, to what extent do you agree or disagree with the following statements? *Strongly disagree (1), Disagree (2), Slightly disagree (3), Neutral (4), Slightly agree (5), Agree (6), Strongly agree (7)*

1. On the whole, our competitors exaggerate needs to get what they desire. 【OPP1】

2. Our competitors breach cooperative agreements to their benefit. 【OPP2】

3. Overall, our competitors alter facts to get what they want. 【OPP3】

4. Good faith bargaining is not a hallmark of our competitors' negotiation style. 【OPP4】

5. Our competitors have benefited from our relationship to our detriment. 【OPP5】

6. To accomplish their own goals, sometimes our competitors promise to do things without actually doing them later. 【OPP6】

7. Our competitors are not always honest with us. 【OPP7】

8. On occasion, our competitors lie about certain things in order to protect their interests. 【OPP8】

9. Our competitors try to take advantage of "holes" in our contracts to further their own interests. 【OPP9】

10. Our competitors sometimes use unexpected events to extract concessions from our firm 【OPP10】

New Knowledge-based Resources and Capabilities

On a scale of (1) Not at all, to (7) Extremely, please indicate the extent to which you have developed the following capabilities as a result of your cooperative arrangements with

competitors.

Research and Development【IRnC1】

New product development【IRnC2】

Innovation【IRnC3】

Information technology【IRnC4】

New product launches【IRnC5】

Environmental scanning【MRnC1】

Marketing planning【MRnC2】

Marketing implementation【MRnC3】

Marketing communication【MRnC4】

Brand management【MRnC5】

Public relations【MRnC6】

Relationship-building with customers【MRnC7】

Understanding of customers【MRnC8】

Distribution【MRnC9】

Supply chain management【MRnC10】

Loss of Uniqueness of Existing Knowledge-based Resources and Capabilities

Please rate the extent to which you agree or disagree with the following statements: From engaging in cooperative arrangements with our competitors...

1. ...we have sacrificed unique information and knowledge to our competitors. 【UNI1】

2. ...our resource-base is no longer unique in comparison to our competitors. 【UNI2】

3. ...we no longer possess unique knowledge over and above our competitors. 【UNI3】

4. ...we have provided competitors with knowledge that they found difficult to develop by themselves. 【UNI4】

5. ...we have given up uniqueness in our resource-base. 【UNI5】

6. ...we have provided competitors with knowledge that may help them imitate us. 【UNI6】

Performance

Efficiency

Please rate your business' performance over the last year in terms of: Very bad (1) to very good (7)

1. Earning profits? 【EFI1】

2. Achieving better results at lower cost? 【EFI2】

3. Achieving efficiency in business activities? 【EFI3】

4. Performing business activities right the first time? 【EFI4】

Effectiveness

Please indicate the extent to which your business has met the following objectives over the last year. Very ineffective (1) to very effective (7)

1. Achieving customer satisfaction? 【EFE1】

2. Providing value for customers? 【EFE2】

3. Attaining desired growth? 【EFE3】

4, Securing desired market share? 【EFE4】

5. Keeping current customers? 【EFE5】

6. Attracting new customers? 【EFE6】

Adaptiveness: Very bad (1) to very good (7).

1. Adapting your business strategy adequately to changes in the business environment of your organisation? 【ADP1】

2. Adapting your business strategy adequately to changes in competitors' business

strategies? 【ADP2】

3. Adapting your business strategy quickly to the changing needs of customers? 【ADP3】

4. Reacting quickly to new market threats? 【ADP4】

Environmental Turbulence

To what extent do you agree or disagree with the following statements? Strongly disagree (1), Disagree (2), Slightly disagree (3), Neutral (4), Slightly agree (5), Agree (6), Strongly agree (7)

Market dynamism:

1. In our kind of business, customers' product preferences change quite a bit over time. 【MD1】
2. Our customers tend to look for new products all the time. 【MD2】
3. We are witnessing demand for our products and services from customers who never bought them before. 【MD3】
4. New customers tend to have product-related needs that are different from those of our existing customers. 【MD4】
5. We cater to many of the same customers that we used to in the past. 【MD5】

Competitive intensity

6. Competition in our industry is cutthroat. 【CI1】
7. There are many 'promotion wars' in our industry. 【CI2】
8. Anything that one competitor can offer, others can match readily. 【CI3】
9. Price competition is a hallmark of our industry. 【CI4】
10. One hears of a new competitive move almost every day. 【CI5】
11. Our competitors are relatively weak. 【CI6】

Technological turbulence

12. The technology in our industry is changing rapidly. 【TT1】

13. Technological changes provide big opportunities in our industry. 【TT2】
14. It is very difficult to forecast where the technology in our industry will be in the next 2 to 3 years. 【TT3】
15. A large number of new product ideas have been made possible through technological breakthroughs in our industry. 【TT4】
16. Technological developments in our industry are rather minor. 【TT5】

Size

1. What was your company's annual turnover over the last financial year? (in British Pounds) 【SZ1】
2. How many full-time employees does your business currently have (approximate number)? 【SZ2】

Age

1. How many years has your business been operating (approximate number)? 【AGE】

Industry

1. Which industry (industries) is your company operating in? 【IND】

Experience of Respondent

1. What is your job title (position)? 【ER1】
2. How many years of working experience do you have? 【ER2】
3. How many years of working experience do you have with your current business? 【ER3】

Respondent Knowledge

To what extent do you feel you possess the knowledge regarding the questions asked in this questionnaire?

1. My job role qualifies me to answer questions about the cooperative arrangements with competitors in my company. 【RK1】

2. I am competent to answer the above questions. 【RK2】

3. I am confident that my answers reflect the company's situation. 【RK3】

Social Desirability (Reynolds, 1982) To what extent do you agree or disagree with the following:

1. No matter who I'm talking to, I'm always a good listener【SD1】

2. I am always courteous even to people who are disagreeable【SD2】

3. I have never taken advantage of anyone【SD3】

4. I would never try to get even rather than forgive and forget【SD4】

5. I never feel resentful when I don't get my way【SD5】

Thank you very much for your help. Your input will be invaluable to our research. You are also welcome to contact us (j.cai@lboro.ac.uk) if you want to discuss the value of our research to your company. The results of our research will be sent to you via Email once our project is finished and hope that can help you with your business. Please leave your Email address in the box below to receive full report.

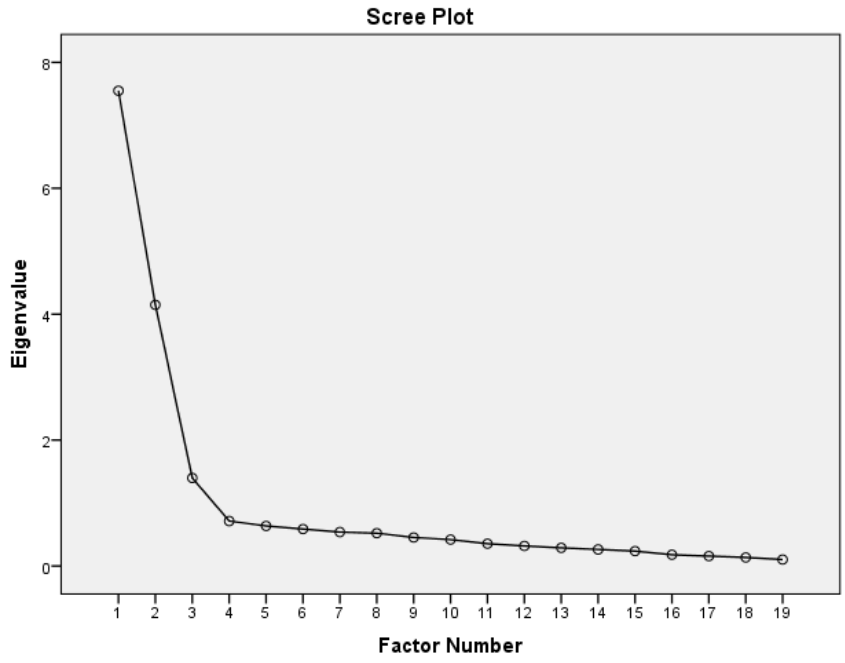
Appendix 5.4 EFA results: Internally and Externally Focused Coopetition and Competitors' Opportunism

Kaiser-Meyer-Olkin Measure		.885
Barlett's Test of Sphericity	Approx. Chi-Square	2030.864
	df	171
	Sig.	.000

Communalities	
IFC1: R&D	.519
IFC2: New product development	.718
IFC3: Technology improvement	.783
IFC4: Information systems	.511
EFC1: Distribution	.534
EFC2: Sales	.529
EFC3: Marketing	.778
EFC4: Branding	.656
EFC5: Customer service	.470
OPP1: On the whole, our competitors exaggerate needs to get what they desire.	.559
OPP2: Our competitors breach cooperative agreements to their benefit.	.699
OPP3: Overall, our competitors alter facts to get what they want.	.740
OPP4: Good faith bargaining is not a hallmark of our competitors' negotiation style.	.677
OPP5: Our competitors have benefited from our relationship to our detriment.	.520
OPP6: To accomplish their own goals, sometimes our competitors promise to do things without actually doing them later.	.692
OPP7: Our competitors are not always honest with us.	.777
OPP8: On occasion, our competitors lie about certain things in order to protect their interests.	.638
OPP9: Our competitors try to take advantage of "holes" in our contracts to further their own interests.	.643
OPP10: Our competitors sometimes use unexpected events to extract concessions from our firm	.581

Total variance extracted: Extraction sums of squared loadings			
Component	Total	% of Variance	Cumulative %
1	7.196	37.872	37.872
2	3.794	19.970	57.843
3	1.036	5.454	63.296

Factor loadings (Pattern matrix)			
Variables	Factor		
	1	2	3
IFC1:			.726
IFC2			.813
IFC3			.891
IFC4			.598
EFC1		.592	
EFC2		.722	
EFC3		.913	
EFC4		.700	
EFC5		.651	
OPP1	.715		
OPP2	.803		
OPP3	.838		
OPP4	.822		
OPP5	.717		
OPP6	.833		
OPP7	.896		
OPP8	.805		
OPP9	.805		
OPP10	.763		



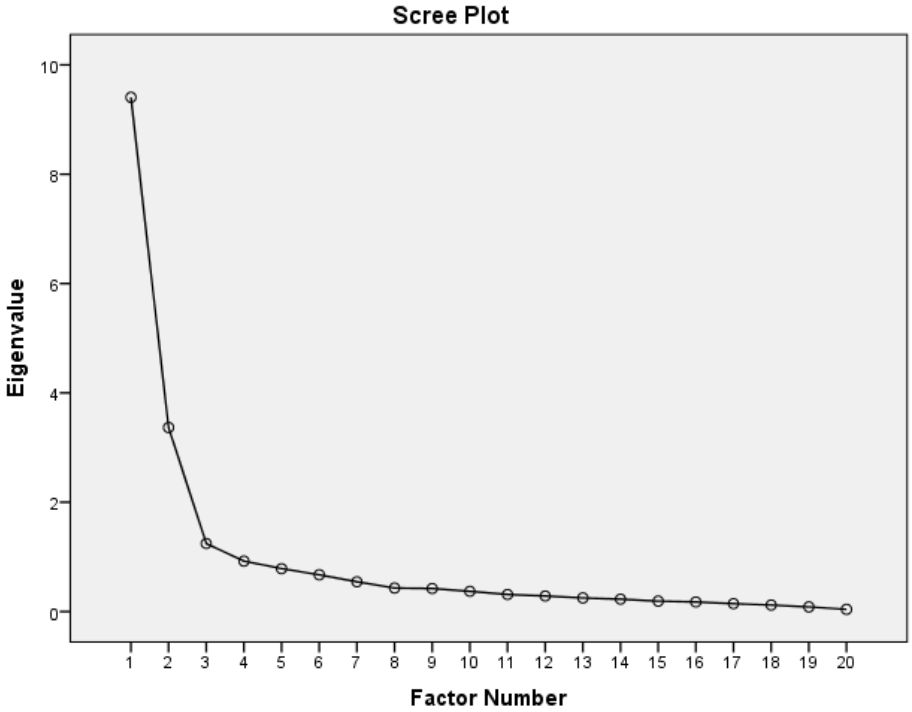
Appendix 5.5 EFA results: New Knowledge-based Resources and Capabilities and Loss of Uniqueness

Kaiser-Meyer-Olkin Measure		.902
Barlett's Test of Sphericity	Approx. Chi-Square	2616.737
	df	190
	Sig.	.000

Communalities	
IRnC1: Research and Development	.564
IRnC2: New product development	.745
IRnC3: Innovation	.766
IRnC4: Information technology	.627
MRnC1: Environmental scanning	.534
MRnC2: Marketing planning	.813
MRnC3: Marketing implementation	.824
MRnC4: Marketing communication	.782
MRnC5: Brand management	.717
MRnC6: Public relations	.631
MRnC7: Relationship-building with customers	.589
MRnC8: Understanding of customers	.588
MRnC9: Distribution	.660
MRnC10: Supply chain management	.582
UNI1: ...we have sacrificed unique information and knowledge to our competitors.	.398
UNI2: ...our resource-base is no longer unique in comparison to our competitors.	.676
UNI3: ...we no longer possess unique knowledge over and above our competitors.	.694
UNI4: ...we have provided competitors with knowledge that they found difficult to develop by themselves.	.561
UNI5: ...we have given up uniqueness in our resource-base.	.732
UNI6: ...we have provided competitors with knowledge that may help them imitate us.	.508

Total variance extracted: Extraction sums of squared loadings			
Component	Total	% of Variance	Cumulative %
1	9.081	45.405	45.045
2	3.007	15.033	60.438
3	.904	4.522	64.960

Factor loadings (Pattern matrix)			
Variables	Factor		
	1	2	3
IRnC1			-.628
IRnC2			-.740
IRnC3			-.597
IRnC4			-.536
MRnC1	.730		
MRnC2	.863		
MRnC3	.901		
MRnC4	.890		
MRnC5	.713		
MRnC6	.762		
MRnC7	.651		
MRnC8	.600		
MRnC9	.854		
MRnC10	.827		
UNI1		.527	
UNI2		.834	
UNI3		.862	
UNI4		.581	
UNI5		.867	
UNI6		.677	



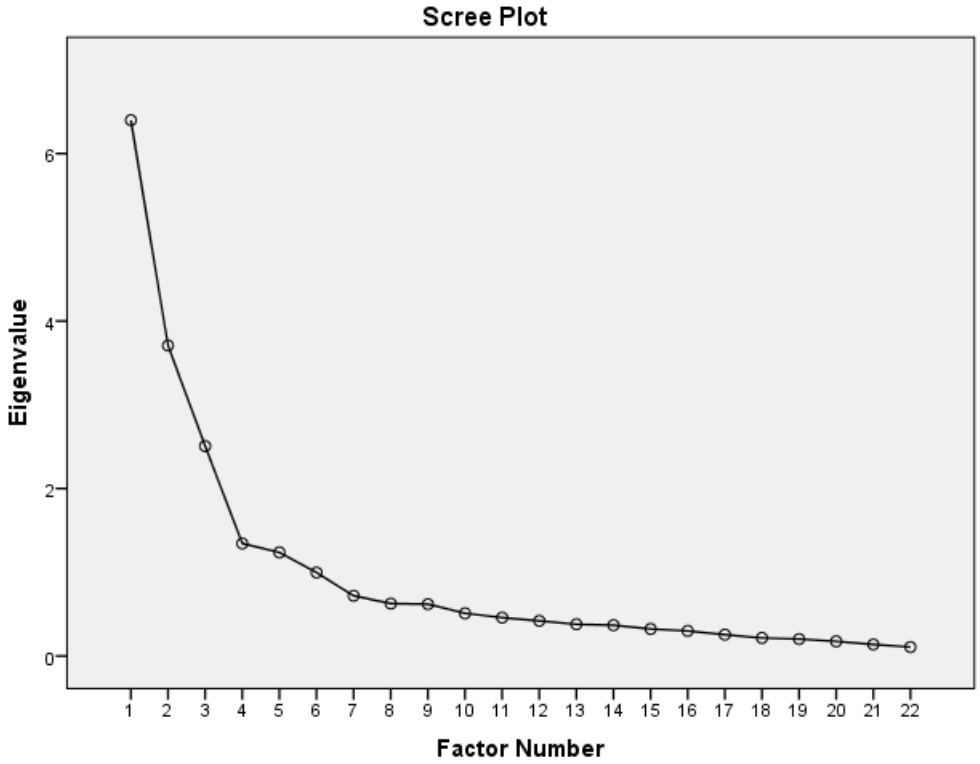
Appendix 5.6 EFA results: Performance and Environmental Turbulence

Kaiser-Meyer-Olkin Measure		.828
Barlett's Test of Sphericity	Approx. Chi-Square	1914.968
	df	231
	Sig.	.000

Communalities	
EFE1: Achieving customer satisfaction?	.839
EFE2: Providing value for customers?	.708
EFE5: Keeping current customers?	.562
EFI1: Earning profits?	.628
EFI2: Achieving better results at lower cost?	.898
EFI3: Achieving efficiency in business activities?	.699
ADP1: Adapting your business strategy adequately to changes in the business environment of your organisation?	.742
ADP2: Adapting your business strategy adequately to changes in competitors' business strategies?	.754
ADP3: Adapting your business strategy quickly to the changing needs of customers?	.714
ADP4: Reacting quickly to new market threats?	.582
MD1: In our kind of business, customers' product preferences change quite a bit over time.	.547
MD2: Our customers tend to look for new products all the time.	.725
MD3: We are witnessing demand for our products and services from customers who never bought them before	.511
MD4: New customers tend to have product-related needs that are different from those of our existing customers	.373
CI1: Competition in our industry is cutthroat	.516
CI2: There are many 'promotion wars' in our industry	.441
CI4: Price competition is a hallmark of our industry	.541
CI5: One hears of a new competitive move almost every day	.447
TT1: The technology in our industry is changing rapidly	.698
TT2: Technological changes provide big opportunities in our industry	.913
TT4: A large number of new product ideas have been made possible through technological breakthroughs in our industry	.666
TT5: Technological developments in our industry are rather minor	.607

Total variance extracted: Extraction sums of squared loadings			
Component	Total	% of Variance	Cumulative %
1	6.093	27.697	27.697
2	3.368	15.308	43.005
3	2.112	9.600	52.605
4	.991	4.505	57.110
5	.897	4.076	61.186
6	.650	2.956	64.142

Factor loadings (Pattern matrix)						
Variables	Factor					
	1	2	3	4	5	6
EFE1					.928	
EFE2					.806	
EFE5					.628	
EFI1						-.709
EFI2						-.935
EFI3						-.728
ADP1	.758					
ADP2	.781					
ADP3	.676					
ADP4	.794					
MD1				-.628		
MD2				-.801		
MD3				-.565		
MD4				-.617		
CI1			.706			
CI2			.586			
CI4			.748			
CI5			.609			
TT1		.744				
TT2		.865				
TT4		.776				
TT5		.809				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Eigenvalue
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2
4
6
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Factor Number

Appendix 5.7 Inter-item Correlations

Internally-focused Coopetition				
	IFC1	IFC2	IFC3	IFC4
IFC1	1			
IFC2	.667	1		
IFC3	.613	.715	1	
IFC4	.454	.569	.671	1

Externally-focused Coopetition					
	EFC1	EFC2	EFC3	EFC4	EFC5
EFC1	1				
EFC2	.537	1			
EFC3	.615	.715	1		
EFC4	.538	.569	.671	1	
EFC5	.532	.463	.510	.635	1

Competitors' Opportunism										
	OPP1	OPP2	OPP3	OPP4	OPP5	OPP6	OPP7	OPP8	OPP9	OPP10
OPP1	1									
OPP2	.643	1								
OPP3	.611	.849	1							
OPP4	.590	.746	.763	1						
OPP5	.556	.593	.589	.597	1					
OPP6	.660	.658	.684	.655	.632	1				
OPP7	.661	.665	.695	.693	.617	.779	1			
OPP8	.568	.628	.683	.617	.546	.640	.819	1		
OPP9	.530	.624	.640	.607	.550	.651	.672	.652	1	
OPP10	.547	.553	.594	.619	.585	.585	.667	.589	.783	1

New Innovation Knowledge-based Resources and Capabilities

	IRnC1	IRnC2	IRnC3	IRnC4
IRnC1	1			
IRnC2	.689	1		
IRnC3	.685	.796	1	
IRnC4	.583	.651	.716	1

New Marketing Knowledge-based Resources and Capabilities										
	MRnC 1	MRnC 2	MRnC 3	MRnC 4	MRnC 5	MRnC 6	MRnC1 7	MRnC1 8	MRnC 9	MRnC1 0
MRnC1	1									
MRnC2	.628	1								
MRnC3	.646	.928	1							
MRnC4	.656	.879	.934	1						
MRnC5	.594	.797	.783	.766	1					
MRnC6	.585	.693	.689	.699	.721	1				
MRnC7	.466	.629	.641	.635	.626	.619	1			
MRnC8	.472	.659	.637	.629	.636	.616	.838	1		
MRnC9	.613	.633	.643	.600	.614	.620	.616	.578	1	
MRnC1 0	.643	.588	.593	.544	.532	.570	.593	.501	.840	1

Loss of Uniqueness of Existing Resources and Capabilities						
	UNI1	UNI2	UNI3	UNI4	UNI5	UNI6
UNI1	1					
UNI2	.447	1				
UNI3	.404	.789	1			
UNI4	.542	.460	.408	1		
UNI5	.468	.674	.721	.564	1	
UNI6	.482	.505	.493	.622	.623	1

Efficiency			
	EFI1	EFI2	EFI3
EFI1	1		
EFI2	.744	1	
EFI3	.629	.770	1

Adaptiveness				
	ADP1	ADP2	ADP3	ADP4
ADP1	1			
ADP2	.767	1		
ADP3	.689	.698	1	
ADP4	.612	.624	.631	1

Effectiveness			
	EFE1	EFE2	EFE5
EFE1	1		
EFE2	.769	1	
EFE5	.663	.610	1

Market Dynamism				
	MD1	MD2	MD3	MD4
MD1	1			
MD2	.666	1		
MD3	.452	.537	1	
MD4	.404	.462	.458	1

Competitive Intensity				
	CI1	CI2	CI4	CI5
CI1	1			
CI2	.441	1		
CI4	.534	.419	1	
CI5	.389	.465	.469	1

Technological Turbulence

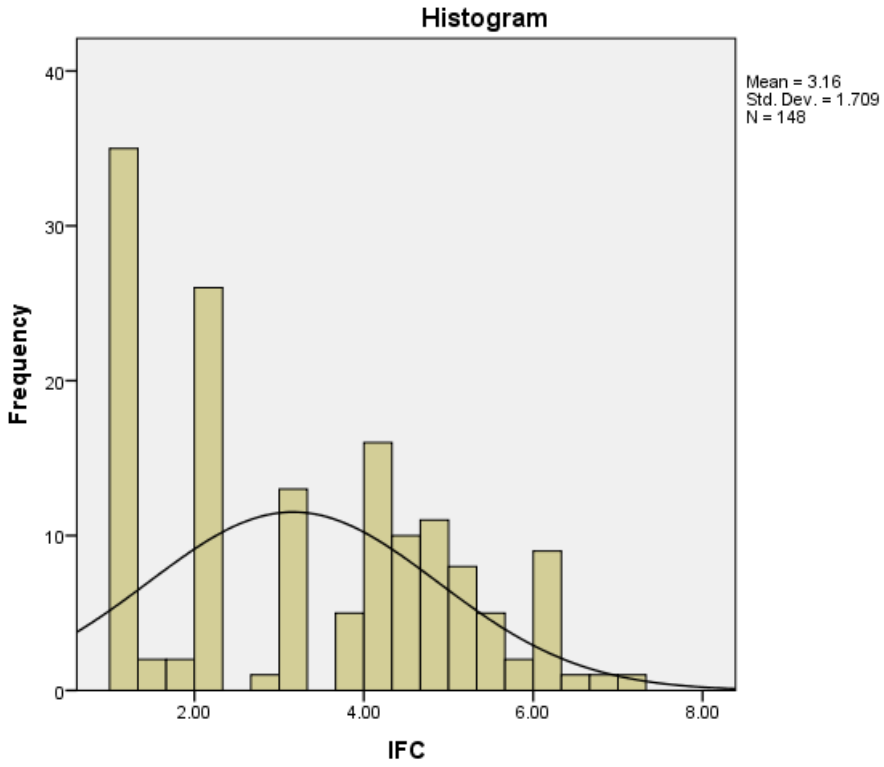
	TT1	TT2	TT4	TT5
TT1	1			
TT2	.825	1		
TT4	.643	.779	1	
TT5	.557	.629	.627	1

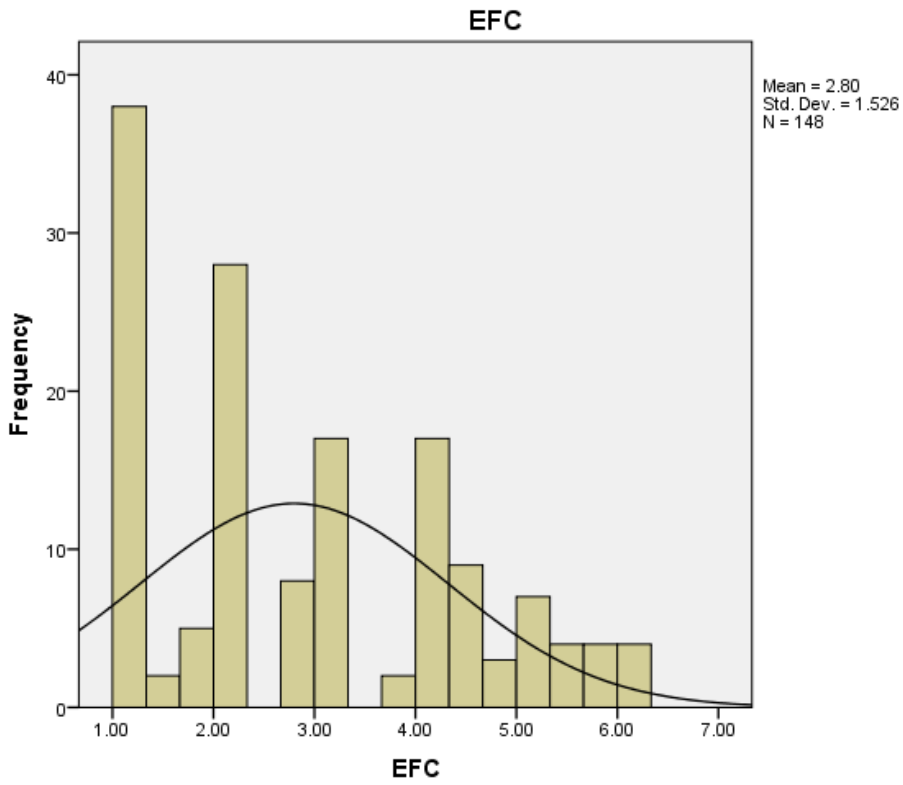
Appendix 5.8 Corrected Item-scale Correlations

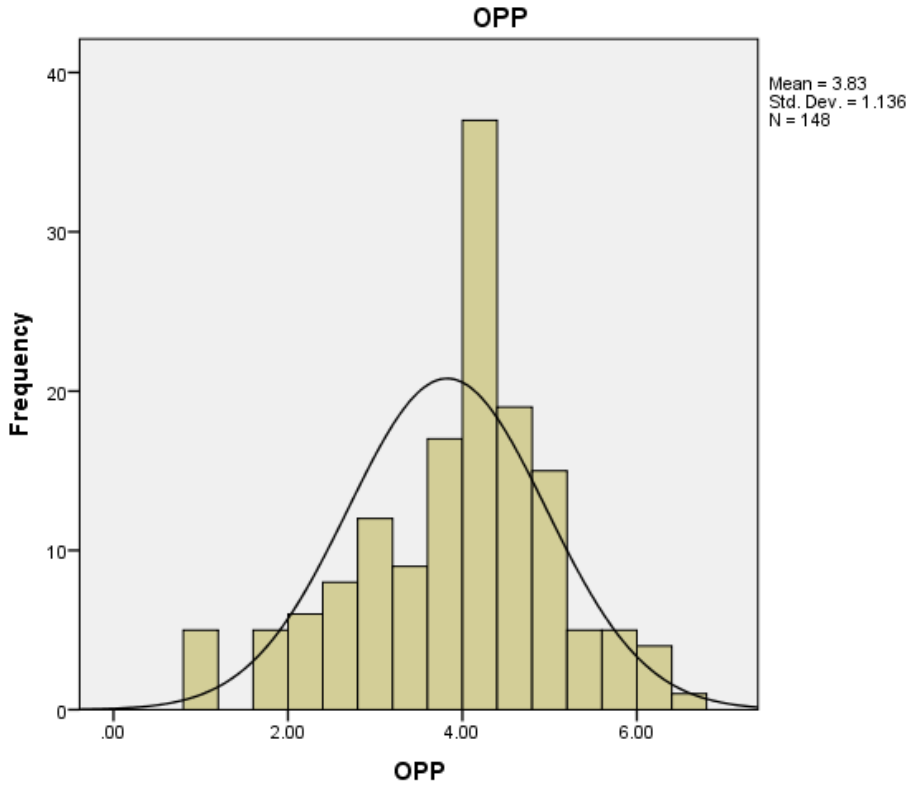
Scales	Scale items	Corrected Item-scale Correlation
Internally focused coopetition	IFC1	.660
	IFC2	.768
	IFC3	.791
	IFC4	.643
Externally focused coopetition	EFC1	.672
	EFC2	.660
	EFC3	.765
	EFC4	.738
	EFC5	.636
Competitors' opportunism	OPP1	.715
	OPP2	.804
	OPP3	.826
	OPP4	.793
	OPP5	.702
	OPP6	.802
	OPP7	.851
	OPP8	.772
	OPP9	.769
	OPP10	.742
New innovation knowledge-based resources and capabilities	IRnC1	.723
	IRnC2	.809
	IRnC3	.840
	IRnC4	.720
New marketing knowledge-based resources and capabilities	MRnC1	.701
	MRnC2	.865
	MRnC3	.875
	MRnC4	.850
	MRnC5	.811
	MRnC6	.775
	MRnC7	.756
	MRnC8	.740

	MRnC9	.769
	MRnC10	.717
Loss of uniqueness of existing resources and capabilities	UNI1	.576
	UNI2	.721
	UNI3	.703
	UNI4	.646
	UNI5	.778
	UNI6	.682
Efficiency	EFI1	.720
	EFI2	.807
	EFI3	.628
Adaptiveness	ADP1	.783
	ADP2	.793
	ADP3	.761
	ADP4	.691
Effectiveness	EFE1	.749
	EFE2	.744
	EFE5	.743
Market dynamism	MD1	.641
	MD2	.728
	MD3	.605
	MD4	.494
Competitive intensity	CI1	.573
	CI2	.550
	CI4	.598
	CI5	.552
Technological turbulence	TT1	.756
	TT2	.858
	TT4	.773
	TT5	.663

Appendix 5.9 Distribution Histograms of All Scales



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10
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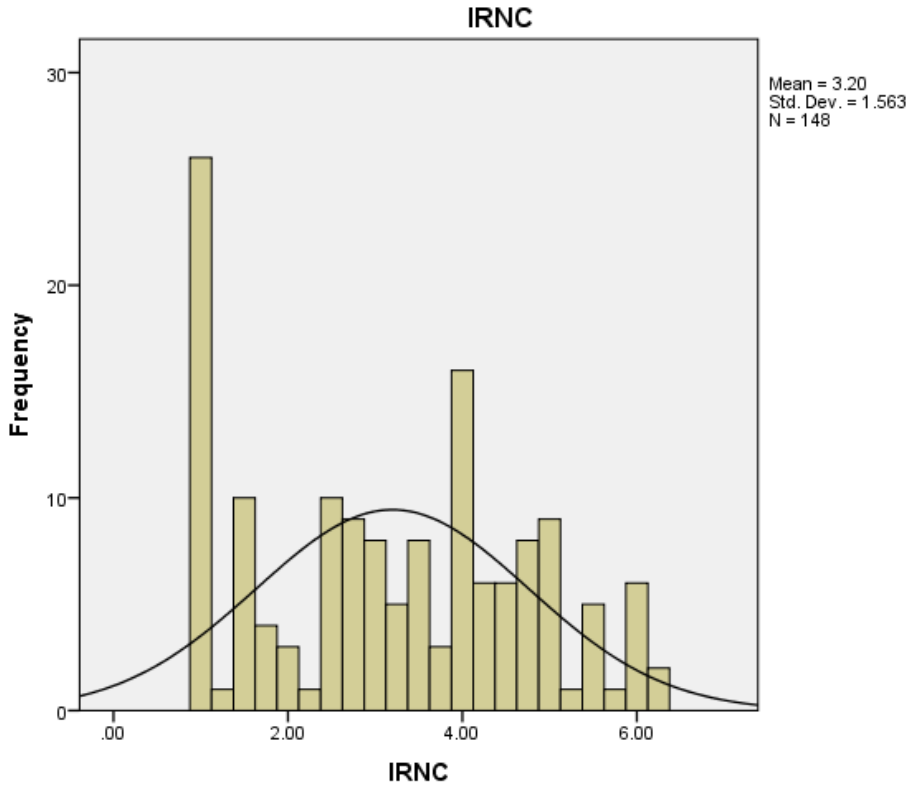
4.00
6.00
OPP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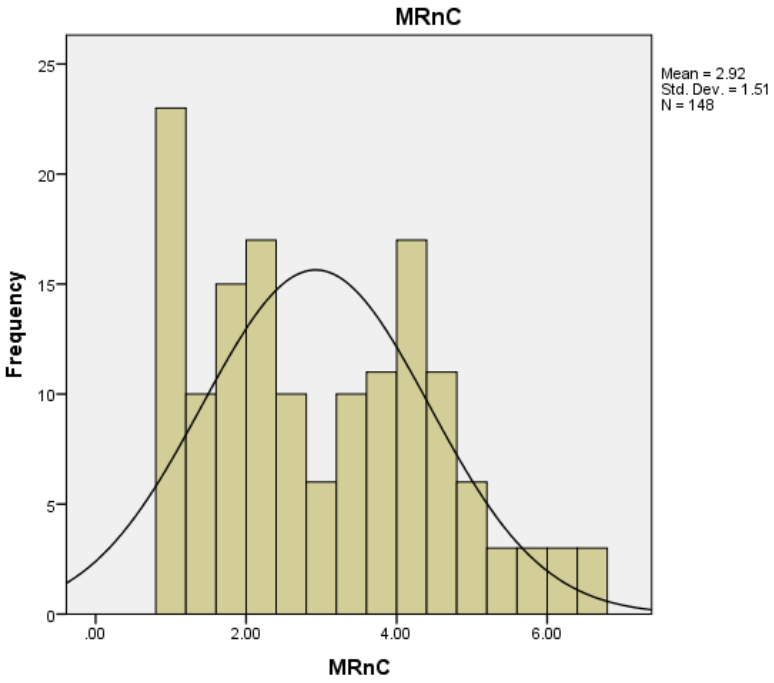
IRNC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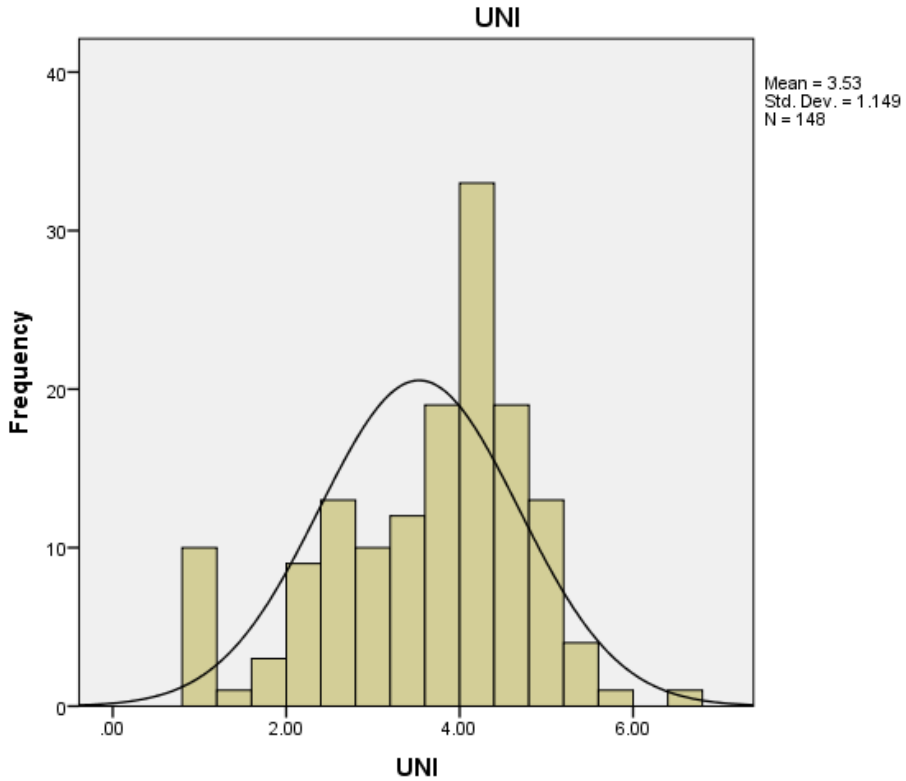
MRnC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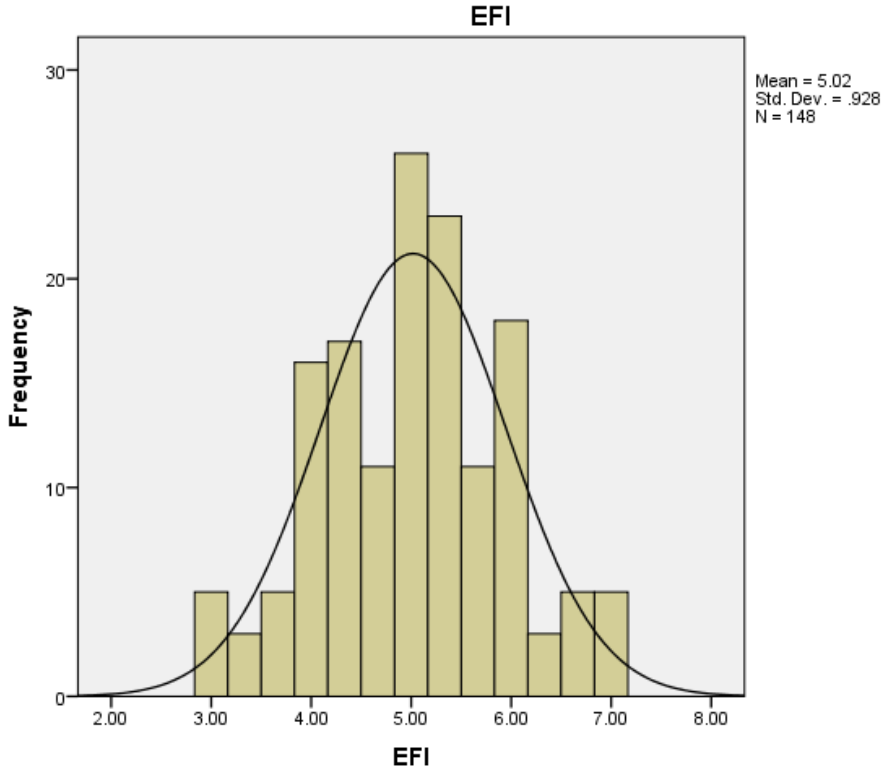
UNI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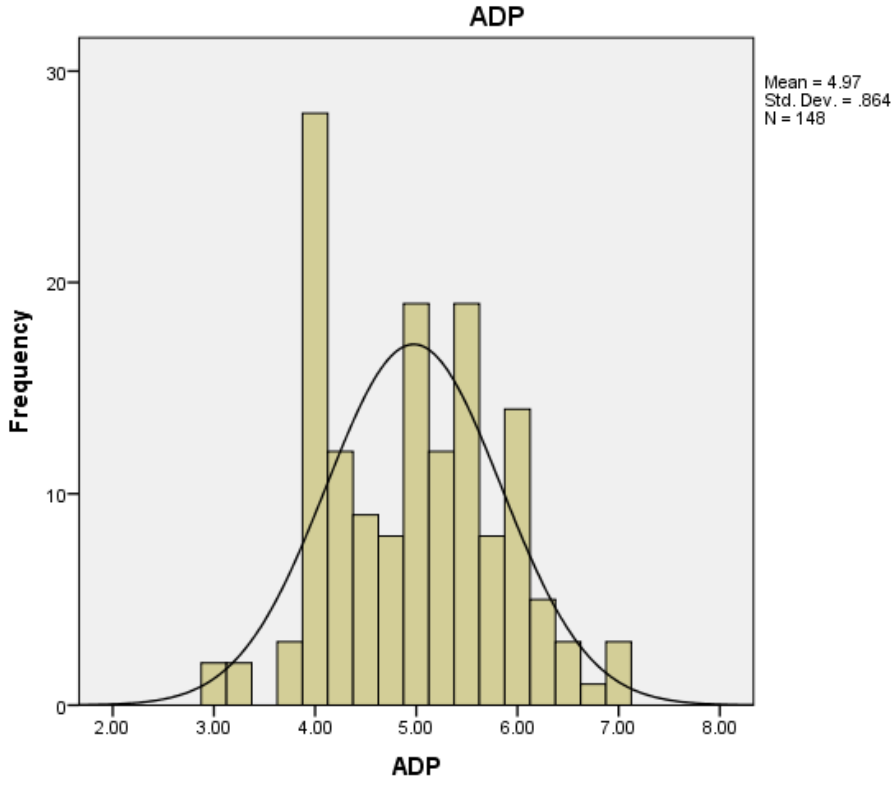
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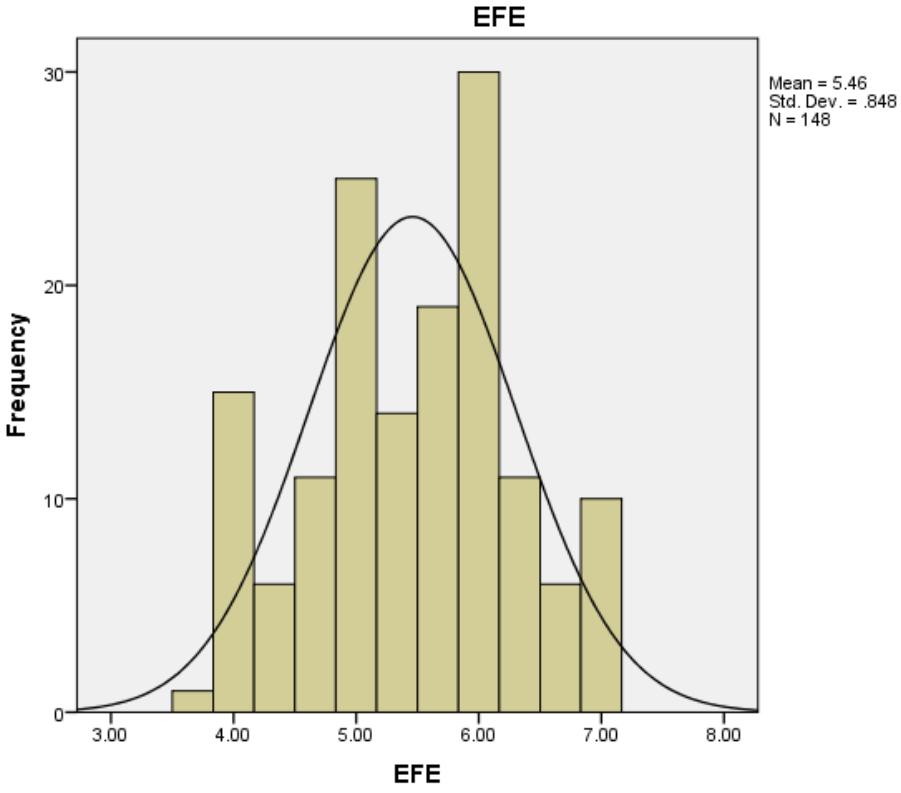
ADP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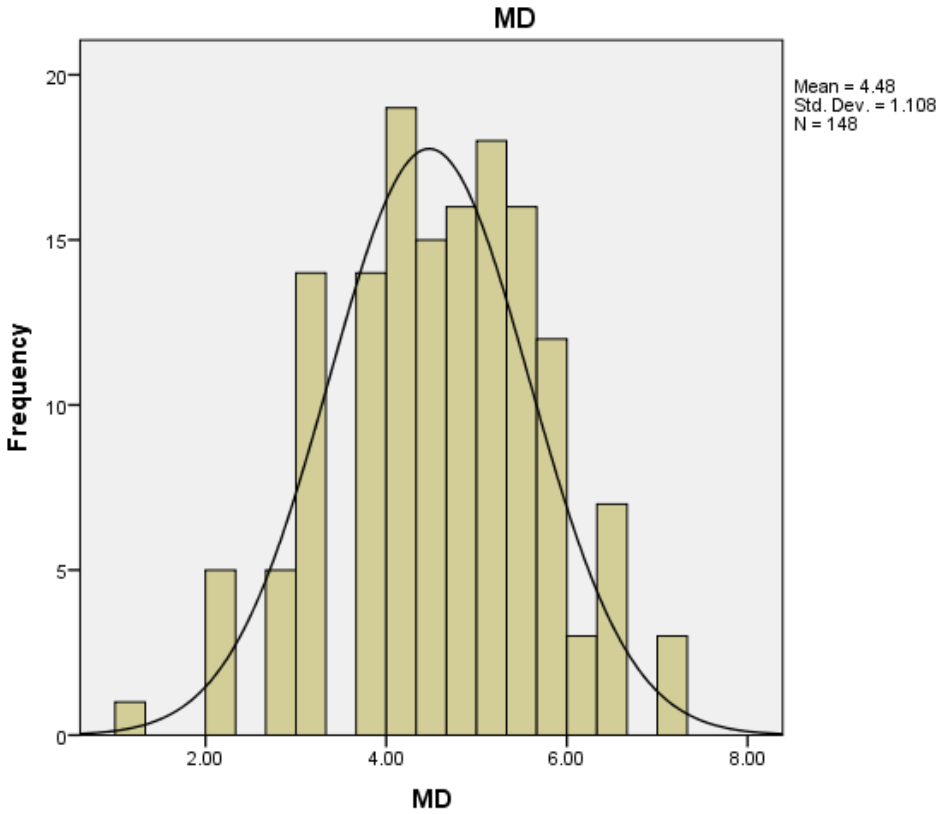
EFE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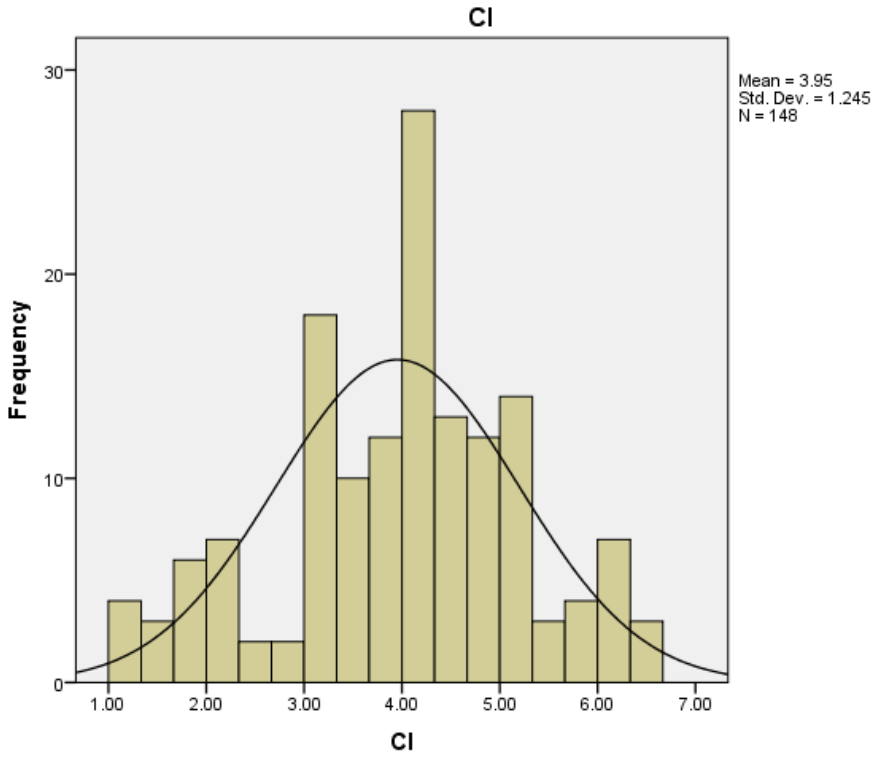
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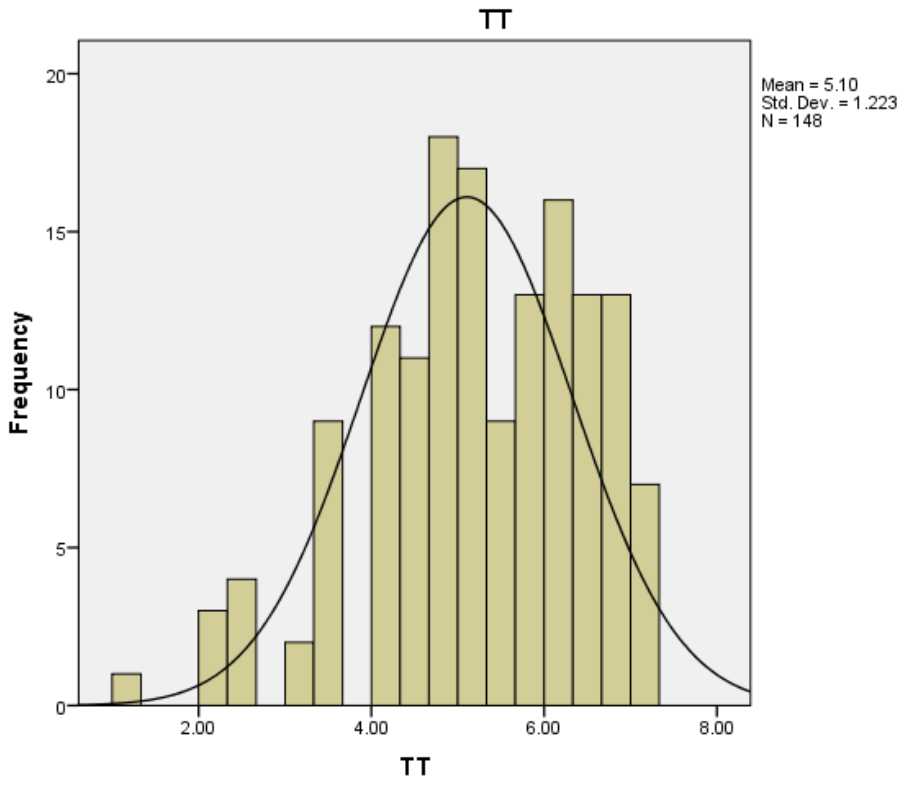
5.00
6.00
7.00
CI


TT
Mean = 5.10
Std. Dev. = 1.223
N = 148
Frequency
20
15
10
5
0
2.00
4.00
6.00
8.00
TT

Appendix 5.10 Correlation Matrix

	IFC	EFC	OPP	IRnC	MRnC	UNI	EFI	EFE	ADP
IFC	1								
EFC	.532**	1							
OPP	.168*	.257**	1						
IRnC	.552**	.352**	.315**	1					
MRnC	.344**	.511**	.280**	.727**	1				
UNI	.392**	.291**	.421**	.389**	.283**	1			
EFI	-.019	-.142	-.010	.053	-.004	-.061	1		
EFE	.051	.080	-.041	.067	.056	-.063	.534**	1	
ADP	-.023	.090	.027	.103	.141	-.028	.694**	.541**	1

** Correlation is significant at 0.01 level (2-tailed)

*Correlation is significant at 0.05 level (2-tailed)

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