



Title Developing dynamic capabilities for corporate sustainability: the role of knowledge transfer between supply chain partners

Name Qiang Wu

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**Developing Dynamic Capabilities for Corporate
Sustainability: The Role of Knowledge Transfer
between Supply Chain Partners**

Qiang Wu

PhD

March 2017

University of Bedfordshire

**Developing Dynamic Capabilities for Corporate
Sustainability: The Role of Knowledge Transfer
between Supply Chain Partners**

By

Qiang Wu

A thesis submitted to the University of Bedfordshire in partial fulfilment
of the requirements for the degree of Doctor of Philosophy

March 2017

AUTHOR'S DECLARATION

I, Qiang Wu, declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

Title of thesis: Developing Dynamic Capabilities for Corporate Sustainability: The Role of Knowledge Transfer between Supply Chain Partners

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ABSTRACT

Persistent differences in corporate commitments to sustainability have led to an increasing debate. However, reasons behind such differences still lack a generic theorization. To address this research gap, the purpose of this study is to: 1) explicate key organizational functions and process underpinning dynamic capabilities for corporate sustainability; 2) explore the relationship between supply chain knowledge transfer and the development of dynamic capabilities for corporate sustainability. For such a purpose a theoretical framework is established with proposed hypotheses deriving from existing literature. Then a two-stage, mixed method is designed to test the model.

In Stage One, a case study and a large-scale archival analysis are performed to elaborate the microfoundations, i.e. key organizational functions and process underpinning dynamic capabilities for corporate sustainability. In Stage Two, a large-scale survey is conducted among about 2,500 CILT members. The validity and reliability of the collected data are then verified through a series of tests. Finally the empirical data are fitted into a Structural Equation Model (SEM) to test proposed hypotheses.

The findings of the research are twofold. The result of Stage One study suggests that three types of dynamic capabilities for corporate sustainability, namely *scanning*, *sensing*, and *reconfiguration* capabilities, underpin a firm's competence to

successfully respond to the environmental and social concerns of various stakeholders and mobilize internal resources to make strategic change towards sustainability. Moreover, key organizational functions and process underpinning dynamic capabilities for corporate sustainability show commonalities among firms across various industrial sectors and geographic regions. In Stage Two study, the empirical finding is that supply chain knowledge transfer positively impacts the development of firm's scanning capability and sensing capability. However, the impact patterns vary significantly between focal firms' upstream and downstream supply chain partnerships.

The research contributes to knowledge from three perspectives. To theory, as an early attempt to extend Dynamic Capabilities View (DCV) to the area of corporate sustainability, the research not only introduces the concept of dynamic capabilities for corporate sustainability to the literature, but also examines how these capabilities can be developed through supply chain knowledge transfer. It thus contributes to the theories of both DCV and corporate sustainability. To research, the empirical findings of the research indicate that the effect of inter-firm knowledge transfer on capabilities development of supply chain customers tends to be underestimated by previous studies, thus providing a new potential research direction. To practice, professionals could possibly use the theoretical framework developed in the study to better understand what types of dynamic capabilities should be developed to more effectively overcome emerging sustainability challenges, and how to further develop these capabilities through supply chain knowledge transfer.

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The following list of references presents the outputs the author of this thesis has produced during the course of his doctoral research.

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Wu, Q., He, Q., and Duan, Y., 2013, “Explicating Dynamic Capabilities for Corporate Sustainability”, *Euromed Journal of Business*, 8(3), 255-272.

Wu, Q., He, Q., Duan, Y., and O'Regan, N., 2012, “Implementing Dynamic Capabilities for Corporate Strategic Change towards Sustainability”, *Strategic Change*, 21(5-6): 231-247.

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Wu, Q., He, Q., and Duan, Y. 2013, “Innovation Strategies, Dynamic Capabilities and Institutional Interactions: a Case of Huawei and ZTE”. In proceedings of British Academy of Management 2013 Conference, Liverpool, UK.

Wu, Q., He, Q., and Duan, Y. 2013, “CSR Standardization: a Dynamic Capabilities Perspective”. In proceedings of EURAM 2013 Annual Conference, Istanbul, Turkey.

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Book Chapter

Wu, Q., He, Q., and Duan, Y., 2017, *Corporate strategic change towards sustainability: a dynamic capabilities view*, the Handbook of strategic renewal: core concepts, antecedents, and micro-foundations.

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CHAPTER 1 - INTRODUCTION

1.1 Research Background

Over the last two decades, an increasing number of studies argue that, given the growing magnitude of ecological constraints and ethical problems, firms should integrate sustainability principles into their business models (Hart, 1995; Russo and Fouts, 1997; Shrivastava, 1995; Porter and Van de Linde 1999; Porter and Kramer, 2006). Drawing on Resource-Based View of the firm (Barney, 1991), these studies conclude that, the sustainable change of a firm' established strategies and operations will ultimately translate into its long-term economic viability and sustained competitive advantage (Hart, 1995; Russo and Fouts, 1997; Porter and Kramer, 2006; Hart and Dowell, 2011).

The above resource-based perspective clearly indicates that firms should implement organizational change towards sustainability, but it does not provide a compelling explanation on why many firms still hesitate to do so. Indeed, as observed by McWilliams and Siegel (2001; 2011), firms hold quite different views on sustainable investment. Although a growing number of firms have already proactively engaged into sustainable investment and realized fruitful returns for both public and private benefits, many firms still keep a quite cautious attitude because they believe that such efforts are inconsistent with their profit interests.

Despite the increasing concern on differential sustainable initiatives and performances of firms, the literature lacks a generic theorization of the reasons behind such differences. Drawing on extensive literature review, this study concludes that one source of these differences lies in the development and application of what refers to as firm's dynamic capabilities for corporate sustainability, which is a special kind of organizational capabilities that enable firms to systematically incorporate rapidly evolving stakeholders' expectations into their strategic change towards sustainability, so as to achieve both economic and sustainable benefits. Moreover, it has been recognized that firm's sustainable knowledge transfer with its supply chain partners is an important source for the development of its dynamic capabilities for sustainability. The research has been thus conducted to systematically understand the characteristics of dynamic capabilities for corporate sustainability, and also examine the potential impact of supply chain knowledge transfer on the development of these capabilities.

1.2 Research Gaps

A growing number of studies posit that Dynamic Capabilities View (DCV) should be extended to the research area of corporate sustainability (e.g. Garriga and Mele, 2004; Aragon-Correa and Rubio-López, 2007; Hart and Dowell, 2011; Barney *et al.*, 2011). The reason is twofold. First, as a theoretical extension of Resource-Based View (RBV) (Barney *et al.*, 2011), DCV focuses on the dynamic aspects of external

environment and aims to explain how firms evolve, create and recombine resources and capabilities into a new source of competitive advantage to address external changes (Teece *et al.*, 1997; Aragon-Correa and Sharma, 2003). Second, the constantly shifting sustainability challenges faced by contemporary firms form a moderate or even high-velocity environment in which organizations' existing competence and capabilities generated by past experience become quickly obsolete (Hart, 1995; Litz, 1996; Hart and Dowell, 2011). As such DCV could be a useful theoretical lens to explain how firms can mobilize their dynamic capabilities to cope with these emerging sustainability challenges (Aragon-Correa and Rubio-López, 2007; Barney *et al.*, 2011). Furthermore, it is suggested that firms' dynamic capabilities can be developed through deliberate learning and knowledge accumulation (Eisenhardt and Martin, 2000; Zollo and Winter, 2002). This DCV perspective can pave the way for a new theoretical direction of the research of corporate sustainability. However two major research gaps remain.

1.2.1 An Insufficient Focus of Existing DCV Literature on Corporate Sustainability

Since the seminal work of Teece *et al.* (1997), Dynamic Capabilities View (DCV) has been extensively discussed by a growing body of literature (Barreto, 2010). The fast growth of the research regarding dynamic capabilities has provided a rich body of distinctive views and constructs (Barreto, 2010). The agreed view of dynamic capabilities is that, as the exogenous factors such as technological innovation and

changes in regulatory and competitive conditions constantly erode the usefulness of existing resources and capabilities of the firm, long-term competitive advantage is more rooted in the development of dynamic capabilities that are defined as the abilities to purposely reconfigure resources and ordinary capabilities to address changing environments (Teece *et al.*, 1997; Winter, 2003; Helfat *et al.*, 2007).

Some recent studies suggest that dynamic capabilities should be applied to the process by which firms undertake corporate sustainability (e.g. Aragon-Correa and Sharma, 2003; Hart and Dowell, 2011). However, traditional DCV literature mainly concentrate on firm's economic bottom line, despite the fact that the external environment that drives corporate sustainability brings firms with new challenges from both environmental and social aspects. There is thus a paucity of research explicating the nature and microfoundations of the contingent dynamic capabilities in the context of corporate sustainability.

1.2.2 An Insufficient Understanding of the Impact of Inter-Firm Knowledge Transfer on the Development of Dynamic Capabilities

In dynamic capabilities building, firms are suggested to not only look inside, but also look outside of their organizational boundaries for external knowledge source (Handerson and Cockburn, 1994; Galunic and Rodan, 1998). The need of searching external knowledge becomes even salient when firms try to engage in corporate sustainability. The knowledge shared with its supply chain partners can inform the

firm emerging sustainability opportunities or threats. More importantly, the shared knowledge can also facilitate the firm to generate new dynamic capacities to catch the time window of these market opportunities or cope with the threats in time (Hart, 1995; 1997; Hart and Sharma, 2004; Hart and Dowell, 2011). The synergistic combination of firm's internal learning mechanism and its access to the external knowledge resource leads to its enhanced resource and capability building (Lorenzoni and Lipparini, 1999; Lee and Klassen, 2008). Inter-firm knowledge transfer is thus not only necessary, but also path-breaking routines for the firm to develop its dynamic capabilities for corporate sustainability.

However, the literature of DCV traditionally emphasize on the role of internal organizational learning in the creation and development of dynamic capabilities (Teece *et al.*, 1997; Zollo and Winter, 1999; Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Zott, 2003; Zahra *et al.*, 2006). Obviously a throughout investigation into the role of inter-firm knowledge transfer on the development of firm's dynamic capabilities is especially necessary in the context of corporate sustainability.

1.3 Research Objectives and Research Questions

This research attempts to fill the gaps in the existing literature discussed in Section 1.2. The objective of the research is twofold. First, linking back to the first research gap identified in Section 1.2, traditional DCV literature mainly concentrate on firm's

economic bottom line, despite the fact that the external environment that drives corporate sustainability brings firms with new challenges from both environmental and social aspects. Moreover, although in recent years an emerging research stream begins to examine the role of dynamic capabilities in corporate sustainable development, these studies assume the existence of contingent dynamic capabilities in corporate sustainable development, but fail to elaborate their distinctive nature, despite the argument that different dynamic capabilities are required in different contexts (Eisenhardt and Martin, 2000; Zollo and Winter, 2002). There is a paucity of research explicating the nature and microfoundations of the contingent dynamic capabilities in the context of corporate sustainability. The first objective of this research is thus to explore and explain the nature of the contingent dynamic capabilities in the context of corporate sustainability. this objective can be further elaborated into two research questions:

1) What are dynamic capabilities for corporate sustainability?

This question aims to define the concept of "dynamic capabilities for corporate sustainability", so as to specify their theoretical boundaries.

2) What are the key processes underpinning these capabilities?

This question aims to explore and explain the key organizational processes underpinning dynamic capabilities for corporate sustainability, so as to make explicit the theoretical constructs involved in this concept.

Second, linking back to the second research gap identified in Section 1.2, despite the argument that in the context of corporate sustainability, inter-firm knowledge transfer is a crucial factor in corporate change towards sustainability (Hart, 1995; 1997; Hart and Sharma, 2004; Hart and Dowell, 2011), traditional DCV literature mainly emphasize on the role of internal organizational learning in the creation and development of dynamic capabilities (Teece *et al.*, 1997; Zollo and Winter, 1999; Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Zott, 2003; Zahra *et al.*, 2006). Obviously a throughout investigation into the role of inter-firm knowledge transfer on the development of firm's dynamic capabilities is especially necessary in the context of corporate sustainability. To fill this gap, the second objective of this research is to explore and empirically test the potential impact of interfirm knowledge transfer between supply chain partners on the development of dynamic capabilities for sustainability. Again, this objective can also be further divided into two research questions:

3) What are the characteristics of inter-firm knowledge transfer in sustainable supply chain management?

As explained in Section 2.9, interfirm knowledge transfer in sustainable supply chain management can be divided into either monitor-based or support-based ones. These two types of knowledge transfer show different features and characteristics. Therefore, understanding and delineating these situation-specific characteristics can provide a

foundation for the following empirical study, in which both monitor-based and support-based knowledge transfers are two key theoretical constructs.

4) To what extent inter-firm knowledge transfer between supply chain partners positively impacts the development of firm's dynamic capabilities for corporate sustainability?

This question aims to use a SEM model to statistically test the correlations between inter-firm knowledge transfer and the development of dynamic capabilities for corporate sustainability.

1.4 Outline of Research Methodology

The research questions listed in Section 1.3 indicate that the research is of both exploratory and explanatory in nature. First, the study is going to explore the nature of and the key processes underpinning the dynamic capabilities for corporate sustainability. Second, the study also aims to empirically test the relationship between inter-firm knowledge transfer and the development of dynamic capabilities for corporate sustainability.

Therefore a two-stage, mixed method is adopted in the research which involves both qualitative and quantitative studies. Initially, an extensive literature review is carried out from which a theoretical framework is established outlining the relational

structure between inter-firm knowledge transfer and dynamic capabilities for corporate sustainability. Meanwhile, the characteristics of dynamic capabilities for corporate sustainability, as a multidimensional construct, are also examined. Then based on the findings of the literature review, the first-stage qualitative study involved in the mixed methods approach performs both a case study regarding a global telecommunications enterprise and an archival analysis of world-leading companies' CSR reports to identify and justify the key processes underpinning dynamic capabilities for corporate sustainability. The result of the qualitative study also contributes to the establishment of the measurement indicators that are going to be used in the quantitatively study.

In the second-stage quantitative study, a large-scale survey is carried out among about 2,500 members officially enrolled in UK Chartered Institute of Logistics and Transport (CILT). The questionnaire used in the survey considers sustainable knowledge transfer between focal firms and both their upstream and downstream supply chain partners. The reliability and validity of the collected data are statistically tested and established. Then the theoretical model is tested through a two-stage Structural Equation Modeling (SEM) analysis to reach the final results.

1.5 Structure of the Thesis

The structure of the thesis is as follows. Chapter 2 performs an extensive literature review based on which a theoretical framework is generated and the concept of dynamic capabilities for corporate sustainability is also explained in detail. Chapter 3 makes explicit the philosophical stance guiding the research and discusses the research methodology adopted in the study. Chapter 4 explores key practices, processes and functions underlying dynamic capabilities for corporate sustainability through a case study and an archival analysis. Chapter 5 explains the construction and implementation of the quantitative survey study. Chapter 6 details how the collected data are verified and analyzed. Chapter 7 further interprets the data analysis result by comparing it with previous literature findings. Finally Chapter 8 concludes the thesis by outlining the research outcomes, summarizing the research contributions and limitations, and pointing out possible directions for future research.

CHAPTER 2 – LITERATURE REVIEW

2.1 Introduction

The aim of this chapter is twofold: first, providing the theoretical base of the research presented in this thesis through a literature review; second, developing the research propositions and theoretical framework based on the gaps identified in the literature.

Because the research topic focuses on developing dynamic capabilities for corporate sustainability through knowledge transfer between supply chain partners, the review concentrates on the research regarding corporate sustainability, Dynamic Capabilities View (DCV) and the knowledge transfer in sustainable supply chain management. Moreover, the literature of the additional fields related with the research, namely Resource-Based View (RBV), Natural-Resource-Based View (NRBV), and Knowledge-Based View (KBV) are also covered.

Three key review questions are used when investigating the literature: (1) what definitions and constructs of dynamic capabilities have been elaborated in previous research; (2) how to define dynamic capabilities for corporate sustainability; and (3) whether and to what extent the knowledge transfer between supply chain partners can contribute to the development of dynamic capabilities for corporate sustainability.

The structure of the chapter is as follows. Section 2.2 reviews and summarizes the drivers to corporate sustainability through two theoretical perspectives. In Section 2.3, the theoretical views regarding how firms sustain competitive advantage through corporate sustainability are discussed. Section 2.4 closely examines the definitions and constructs of dynamic capabilities that have been elaborated in previous DCV research. Section 2.5 investigates emerging challenges for the use of dynamic capabilities in the context of corporate sustainability. Based on the findings of Section 2.4 and 2.5, the definition and constructs of dynamic capabilities for corporate sustainability are given and fully explained in Section 2.6. Section 2.7 and 2.8 explore the theoretical relationship between the development of dynamic capabilities and inter-firm knowledge transfer based on KBV perspective. Section 2.9 introduces an emerging research stream emphasizing both the importance and difficulties of the knowledge transfer through a multi-tier supply chain. Section 2.10 discusses the role of inter-firm knowledge transfer in the context of sustainable supply chain management. The research hypotheses and theoretical framework are developed in this Section. Section 2.11 presents the conclusions drawn from the literature review.

2.2 Drivers to Corporate Sustainability: Two Theoretical Perspectives

Corporate sustainability is an ongoing transitional progress in which firm simultaneously deliver economic, social and environmental values to both direct and indirect stakeholders (Shrivastava, 1995; Porter and Van de Linde 1995; Dyllick and

Hockerts, 2002; Hart and Milstein, 2003; Bansal, 2005). According to this definition, corporate sustainability needs firms to respond to emerging environmental and social issues and integrate them into their economic strategic visions to manage as a whole (Elkington, 1998; Flora, 2003). It also needs firms to consider the sustainability concerns not only from direct stakeholders (shareholders, customers and governments), but also from fringe or indirect stakeholders such as Non-Governmental Organizations (NGOs) and community groups (Hart and Milstein, 2003; Reinhard *et al.*, 2005). By doing so, proactive organizations, especially the quick movers towards sustainable management, can use the institutional sustainability pressure wisely to obtain their marketing competitive edge. For example, in a thematic analysis of the corporate social responsibility (CSR) reports of 100 global companies, Tate *et al.* (2010) find that the companies they investigate not only follow simple compliance with legal regulations but also proactively search for more responsible strategies to build their “healthier” social and environmental images in markets.

Why firms should commit to sustainable development is explained by two contrasting perspectives that are prevalent in the literature of corporate sustainability. The first is institution-focused and concentrates predominantly on the social context within which firms operate. This view aims to explain how social value and belief system affects firm’s legitimate status and drive them to pursue sustainability (Freeman, 1984; Cox *et al.*, 2004). The second perspective is more resource-based and turns the emphasis to

internal resources and capabilities of the firm. This approach explicitly focuses on identifying the specific capabilities and strategies that help firms to simultaneously pursue economic, environmental and social competence (Hart, 1995; Russo and Fouts, 1997; Porter and Kramer, 2006).

2.2.1 Institution-Based Perspective for Corporate Sustainability

The institution-based perspective argues that, as government, customers, public media, and the society as a whole have taken increasing interest in sustainability issues, failure to respond to this institutional pressure threatens firm's legitimacy and survival (Bansal and Roth, 2000). On the contrary, proactive stakeholder engagement as a means to identify and prevent negative social and environmental impacts not only reduces firms' ethical and ecologic risks, but also helps to gain access to scarce resources and enhance reputation among stakeholders (Hart, 1995; Bansal and Roth, 2000; Bansal, 2005). Nevertheless, the external pressure for sustainability faced by the firm is coming from a myriad of interest groups with conflicting preferences (Dixon and Fallon, 1989). This complex contextual situation seriously challenges the conventional management approach of the firm in three ways.

First, firms with limited resources cannot simultaneously meet all sustainability needs from a broad variety of stakeholders. They have to select and satisfy firstly those that are perceived as the most urgent and legitimate (Escobar and Vredenburg, 2011).

Firms used to put much attention on the social and environmental standards enforced

by official regulators (Hart and Sharma, 2004). But as NGOs and other civil society groups are becoming more and more active in sustainable concerns, in many cases their requests supersede governmental regulations to become a more serious challenge to the unsustainable operations of the firm (Reinhard *et al.*, 2005). Unfortunately, firms often find difficulties to quickly sense these emerging concerns and manage them properly because they lack immediate communication channels with these so-called indirect stakeholders (Hart and Sharma, 2004).

Second, the institutional pressure of sustainability cannot be understood as a collection of agreed schemas, norms and rules. Rather, it is a complex phenomenon full of conflicting views and interests (Dixon and Fallon, 1989; Gladwin *et al.*, 1995). Different stakeholders may interpret sustainability differently based on their own needs. So sustainability is not a predetermined goal but a negotiated outcome of various interest groups (Reinhard *et al.*, 2005). Any stakeholder involved, including regulators, customers, community members, and also firms themselves, plays a certain role in defining what sustainability means and how the navigation towards sustainability should be directed (Gladwin *et al.*, 1995). Following this viewpoint, firms cannot catch the trend of sustainability and minimize the related potential risks by simply listening and responding to the voice of stakeholders. They have to step into the sustainability debate so as to influence its transitional direction.

Third, firms embedded in different institutional contexts may face different sustainable development pressures (Escobar and Vredenburg, 2011). While the stakeholders in the north show increasing interest in eco-friendly production and social equality, those in the south still require firms to concentrate on more basic needs such as poverty, job opportunities and income (Hart, 1997; Escobar and Vredenburg, 2011). However, when international outsourcing activities link the firms in different geographic regions into a global supply chain, those involved in the same supply chain should not only consider the institutional contexts they are embedded, but also care about the different sustainable development pressures faced by their business partners. On the one side, the supply firms need to modify their unsustainable practices according to the guidance of the purchasing firms as well as the related regulations set by the destination market (Lee and Klassen, 2008). On the other side, it is an irresponsible behaviour if the customer firms in developed countries simply pass the sustainability burdens to their supply partners. Instead, they should work closely with their suppliers to find a viable way to reconcile the imbalance of the sustainability focuses between developed and less developed countries in social, environmental and economic spheres (Vachon and Klassen, 2006).

2.2.2 Resource-Based Perspective for Corporate Sustainability

Referring to the evolutionary theory (Nelson and Winter, 1982; Tushman and Anderson, 1986), Resource-based perspective views corporate sustainability as an ongoing, non-linear journey towards the intersection of environmental, social and

economic competence (Hart, 1995, Hart and Milstein, 2003). Initially, firms are easy to find inexpensive ways to reduce waste and achieve huge cost savings through internal process improvement and innovation. When these so-called “low-hanging fruits” are exhausted, further improvement becomes difficult to accomplish by simply increasing the efficiency of existing business practices and patterns. It requires huge investment and great shift in organizational strategies and technologies (Russo and Fouts, 1997; Hart, 1997). Alternatively stated, different capabilities are required at different sustainable development stages. Thus focusing on firms’ current capabilities and competence is necessary but not enough; it can only ensure a temporary success. Long term competitive advantage needs firms to quickly develop and apply new capabilities in responding to the increasingly frequent occurrence of the major and discrete shifts in social, environmental, technological and regulatory domains (Hart and Dowell, 2011).

However, firms with superior performance at present are more likely to stick to their existing capabilities (Hart, 1995; Markides, 1998). As indicated by resource-based view (RBV) (Barney, 1991), firm's specific capabilities represent a series of patterned, self-reinforced behaviours that are stabilized through the accumulation of relevant skills, expertise, and know-how (Helfat and Peteraf, 2003; Winter, 2003). They render organizations incapable of changing their familiar "way of doing" in volatile environments in which the rules of competitive game constantly change (Levinthal and March, 1993; Repenning and Sterman, 2002). This "capabilities trap"

becomes even salient when firms are not clear about the exact returns they can derive from the input into sustainability activities (Berchicci and King; 2007).

As a consequence, firms face a paradoxical situation: on the one hand, the superior capabilities that are valuable, rare, inimitable, and non-substitutable form the basis of strategic strength and competitive advantage of the firm; on the other hand, the very capabilities restrict organization's flexibility and responsiveness towards emerging sustainability challenges. Obviously, firms need to find new ways to unlock this dilemma.

In short, the resource-based perspective indicates that firms striving for sustainability should look inside to overcome the internal "capabilities trap" inhabited in strategic mind set and managerial routines. The institution-based perspective suggests that firm should look outside to continuously prioritize and cope with emerging sustainability needs. Based on the analysis of Section 2.2, Section 2.3 continues to discuss how firms can sustain their competitive advantage through corporate sustainability.

2.3 Gaining Competitive Advantage through Corporate Sustainability: Resource-Based Views of the Firm

Corporate sustainability must equally weight firm's economic development and its environmental and social impacts as three bottom lines. The advancement in one

bottom line should not compromise the performances of the other two (Elkington, 1998). This Triple Bottom Line (TBL) paradigm overturns the traditionally rooted assertion that firm should only emphasize its economic contribution and the further consideration regarding its environmental and social impacts will impede its economic competitive advantage (Bansal, 2005). The TBL philosophy has gained wider acceptance in both academic and practitioner communities in last two decades mainly because of the increasing awareness that without explicit sustainability consideration, the accumulated environmental and social burdens created by extensive human economic activities cannot be absorbed by, and will eventually jeopardise the social and ecosystem of the earth (Hart, 1995; Carter and Rogers, 2008). The theoretical justification of TBL paradigm has been slowly built up in extant literature. The concept of resource productivity introduced by Porter and Van de Linde (1995) suggests that firms can meet the seemingly controversial economic and environmental goals through innovation. Moreover, the deployment of environmental technologies enables companies to better manage environmental constraints so as to gain their competitive advantage (Shrivastava, 1995). From a dynamic social-business impact perspective, Porter and Kramer (2006) argue that social-friendly value chain transformation leads to both economic and social values. The common thread of these arguments is that the environmental and social considerations of a business can be compatibly integrated into its economic strategic visions and managed as a whole (Carter and Rogers, 2008).

In recent years, researchers have paid increasing attention to how firms capture sustained competitive advantage through the pursuit of sustainability. Studies conclude that, because the unnecessary environmental and social burdens are largely caused by business inefficiencies, external sustainability pressure from stakeholders can be viewed as stimuli for firms to proactively innovate their processes and technologies (Hart 1995; Shrivastava, 1995; Porter and Van de Linde 1995). Through innovation, firms outperform competitors by implementing sustainable strategies to achieve the equal balance of economic, environmental, and social outcomes (Russo and Fouts, 1997; Sharma and Vredenburg, 1998; Porter and Kramer, 2006). Furthermore, given the growing magnitude of ecological constraints and ethical problems, sustained competitive advantage hinges on the development of valuable and sustainability-oriented resources and capabilities (Garriga and Mele, 2004; Aragon-Correa and Rubio-López, 2007).

Two interrelated theoretical views are mainly used to explain how organizational resources and capabilities enable firms to achieve or sustain competitive advantage through corporate sustainability change, namely Resource-Based View (RBV) and Natural Resource-Based View (NRBV).

2.3.1 Resource-Based View (RBV) of the Firm

Resource-Based View (RBV) maintains that a firm's sustained competitive advantage is built on the unique interplay of its internal idiosyncratic resources and capabilities

(Wernerfelt, 1984; Barney, 1991). These resources and capabilities can be separated as either tangible (equipment and assets), or intangible (knowledge and intellectual property) ones (Barney, 1991). More importantly, they should be valuable to customers, rare, difficult to imitate, and non-substitutable ("VRIN" attributes), and effectively organized and deployed by the firm. Drawing on this Resource-Based View of the firm, studies conclude that the sustainability challenge faced by the firm also means new competitive opportunities (Hart, 1997; Hart and Dowell, 2011). Through sustainability innovation and technology upgrading, firms could create and accumulate idiosyncratic resources and capabilities. These resources and capabilities enable firms to achieve competitive advantage by implementing new sustainability strategies which are difficult to be imitated by competitors (Hart, 1995; Shrivastava, 1995; Porter and Van de Linde, 1995; Porter and Kramer, 2006).

Despite the theoretical significance of RBV, its explanatory power for firm's competitive advantage in the context of corporate sustainability has not gone without critiques. First, in corporate sustainability, the environmental and social concerns lead to a much more complex environmental uncertainty featured by harsher governmental regulations, closer monitoring by official agencies and public media, constantly changing customer and market preferences, and unexpected competitive threats by rival companies (Markley and Davis, 2007; Carter and Rogers, 2008; Seuring and Muller, 2008). In such a high dynamic and unpredictable environment, the existing resources and capacities possessed by a firm cannot ensure its persistent competitive

advantage. For example, Teece *et al.* (1997) argue that in a shifting competitive landscape, sustained competitive advantage is rooted in the rapid generation of new sets of resources and competencies through dynamic capacity management because the present resources are easily to be eroded and become obsolete in rapidly changing environments. However, according to RBV, the bundle of a firm's VRIN resources and capabilities are historically grown and evolved slowly over time (Eisenhardt, 2000). Alternatively stated, these resources and capabilities cannot be created in a short period of time. Therefore, new theoretical viewpoint is needed to explain how firm's competitive advantage can be sustained when facing the rapidly emerging sustainability challenges.

Second, RBV mainly focuses on firms' internal resources, capacities and competence. When the competition focus has shifted gradually from organization-oriented sustainability to supply chain sustainability, the importance of the collective competitive advantage arising from supply chain partners' strategic collaboration has been increasingly recognized by researchers (Dyer and Singh, 1998; Carter, 2005; Krause *et al.*, 2009). In this regard RBV is inadequate to explicate the driving forces and the nature of this inter-firm based competitive advantage such as: (1) what resources and capacities can be regarded as the source of this inter-firm based competitive advantage; (2) are these resources and capacities rooted within intra-organizational boundary or generated from the interactions between supply chain partners; and (3) what is the difference between inter-firm based competitive

advantage and the traditional intra-firm based competitive advantage (Dyer and Singh, 1998).

More recently, by concluding the theoretical evolution of RBV since Barney's (1991) seminal work, Barney *et al.* (2011) suggest that, as a theoretical extension of RBV, Natural Resource-Based View (NRBV) can be applied to examining how firms develop and mobilize their resources and capabilities to capture competitive advantage through interacting with external environment.

2.3.2 Natural Resource-Based View (NRBV) of the Firm

The Natural Resource-Based View (NRBV) of the firm developed by Hart (1995) extends RBV by considering constraints and challenges posed by external biophysical environment. NRBV states that these constraints and challenges will drive firms to evolve or generate different levels of resources and capabilities as the new source of competitive advantage. Within the framework of NRBV, three-stage competitive advantages can be achieved through developing new resources and capabilities. At the first stage, the pollution prevention capability generated through continuous improvement leads to low-cost advantage. At the second stage, by integrating various stakeholders' needs, firms can develop product stewardship capability to preempt their competitors. At the third or final stage, shared vision and long-term sustainable development capability enable firms to carry out substantial technological change, so as to secure their future leading position (Hart, 1995; Hart and Dowell, 2011).

Proactive sustainability strategies force firms to generate valuable organizational capabilities that may contribute to competitive advantage (Hart, 1995; Litz, 1996). However, the paucity in NRBV literature is how firms can effectively develop contingent capabilities and resources to cope with the fast-changing sustainability requirements from various external stakeholders. It fails to provide the means to determine *ex ante* what resources and capabilities are valuable and deserve deliberate investment (McWilliams and Siegel, 2011). This long-standing theoretical omission leads to two negative consequences. First, firms may miss the opportunities to invest in valuable resources and capabilities for both the public and themselves (Porter and Van de Linde 1995; and Porter and Kramer, 2006). Second, firms may invest too much in those that cannot satisfy the most emergent sustainability needs or meet the desired ends (McWilliams and Siegel, 2001). This situation seriously deters firms' willingness to invest for sustainability. Indeed, as suggested by Hart and Dowell (2011), fifteen years after the introduction of Natural-Resource-Based view (NRBV), most applications of this theory still focus on the practices that are concluded by pollution prevention strategy and easily to be recognized and implemented. The other two more advanced strategies for product stewardship and sustainable development are much less to be considered because they require significant changes of the preoccupied thinking and behavioural patterns of firms.

Since NRBV is constructed in light of dynamic capabilities (Barney *et al.*, 2011), an increasing number of studies posit that DVC may fill this void (e.g. Garriga and Mele, 2004; Aragon-Correa and Rubio-López, 2007; Hart and Dowell, 2011; Barney *et al.*, 2011).

The reasoning is twofold. First, the constantly shifting sustainability challenges faced by contemporary firms form a moderate or even high-velocity environment in which organizations' existing competence and capabilities generated by past experience become quickly obsolete (Hart, 1995; Litz, 1996; Hart and Dowell, 2011). Second, focusing on the dynamic aspect of external environment, DCV aims to explain how firms evolve, create and recombine resources and capabilities into the new source of competitive advantage to address external change (Teece *et al.*, 1997; Aragon-Correa and Sharma, 2003). It is further suggested that firms' dynamic capabilities can be developed through deliberate learning and knowledge accumulation (Eisenhardt and Martin, 2000; Zollo and Winter, 2002). As such DCV could be a useful theoretical lens to link between NRBV and organization's dynamic capabilities so as to integrate the demands of both the firm and external environment (Aragon-Correa and Rubio-López, 2007; Barney *et al.*, 2011).

2.4 Dynamic Capabilities View (DCV) of the Firm

The question of how firms sustain competitive advantage in a changing environment is a central focus in the field of strategic management. Researchers have long understood that technological discontinuities and environmental shifts require the alignment of internal resource and capabilities configuration of the firm with external environmental variations (Nelson and Winter, 1982; Tushman and Anderson, 1986). But only since the seminal work of Teece *et al.* (1997), the concept of dynamic capabilities has begun to be extensively discussed by a growing body of literature (Barreto, 2010). The agreed view of dynamic capabilities is that, as the exogenous factors such as technological innovation and changes in regulatory and competitive conditions constantly erode the usefulness of existing resources and capabilities of the firm, long-term competitive advantage is more rooted in the development of dynamic capabilities that are defined as the abilities to purposely reconfigure resources and ordinary capabilities to address changing environments (Teece *et al.*, 1997; Winter, 2003; Helfat *et al.*, 2007).

The fast growth of the research regarding dynamic capabilities has provided a rich body of distinctive views and constructs (Barreto, 2010). Under the banner of dynamic capabilities view (DCV), a number of studies give various definitions of dynamic capabilities. Table 2.1 summarizes some typical definitions of dynamic capabilities.

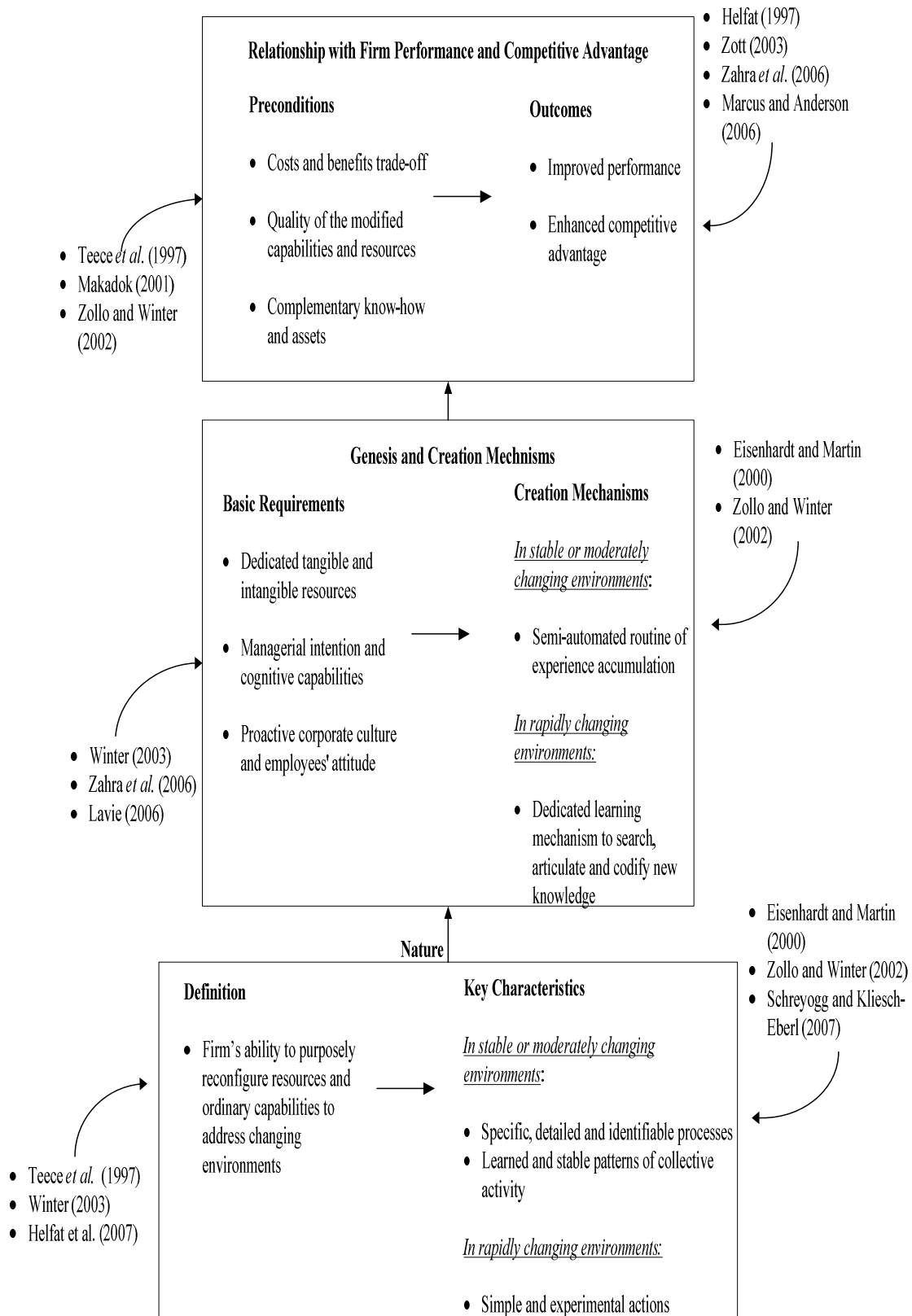
Table 2. 1 - Definitions of Dynamic Capability

Reference	Definitions
Teece <i>et al.</i> (1997)	The firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments
Zollo and Winter (2002)	A dynamic capability is a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness
Zahra <i>et al.</i> (2006)	The abilities to reconfigure a firm's resources and routines in the manner envisioned and deemed appropriate by its principal decision maker(s)
Helfat <i>et al.</i> (2007)	The capacity of an organization to purposefully create, extend, or modify its resource base
Teece (2007)	Dynamic capabilities can be disaggregated into the capacity (a) to sense and shape opportunities and threats, (b) to seize opportunities, and (c) to maintain competitiveness through enhancing, combining, protecting, and, when necessary, reconfiguring the business enterprise's intangible and tangible assets

However, the fast growing literature of DCV is full of diverse assumptions and constructs that vary significantly in terms of the nature of dynamic capabilities, their specific characteristics and creation mechanisms in relevant contexts, and their relationship with firm's performance and competitive advantage. Figure 2.1 graphically summarizes these disparate views and the associated key authors.

Figure 2. 1 - Theoretical Constructs of Dynamic Capabilities

The Dynamic Capabilities View of the Firm



2.4.1 Nature of Dynamic Capabilities

In DCV literature, dynamic capabilities are explained as a special kind of organizational capabilities that should be differentiated from ordinary organizational capabilities (Zollo and Winter, 2002; Winter, 2003; Zahra *et al.*, 2006). More specifically, dynamic capabilities enable firms to change their ordinary capabilities in order to address external turbulence (Teece *et al.*, 1997; Winter, 2003). This argument does not mean that ordinary capabilities are totally immobile and fail for any change or adjustment. However, the evolution of ordinary capabilities has to follow their own life-cycle trajectories (Helfat and Peteraf, 2003) and bears an inherent tendency towards self-enforcement (Schreyögg and Kliesch-Eberl, 2007).

Indeed, the self-enhancement adaptation of ordinary capabilities is a double-blade sword. On the one hand, it ensures organizations to operate in a reliable and efficient manner (Hannan and Freeman, 1984). On the other hand, it leads to the “capabilities trap” that narrows the scope of firm’s alternative strategic choices in major, discrete environmental shifts (Levinthal and March, 1993). To overcome this long-standing theoretical paradox, the concept of dynamic capabilities is introduced. Different from the conception of ordinary capabilities as the abilities to solve complex problems (Amit and Schoemaker, 1993), dynamic capabilities are described as the abilities to change the way the firm solves its problems (Zahra *et al.*, 2006). For example, product development process is an ordinary capability. But the ability to change the way the firm develops new products is dynamic capability (Zahra *et al.*, 2006). Firms

can utilize both of these two capabilities to meet present and future competitions. Ordinary capabilities are deployed as “zero-order” capabilities in operational activities and allow a firm to “make a living” in a short term (Winter, 2003). Dynamic capabilities are the “higher-order” ones that operate in turbulent environments and deliberately change the adaptation routines of the ordinary capabilities in order to break the “capabilities trap” for future challenges (Zollo and Winter, 2002).

However, no matter how *dynamic* they are, dynamic capabilities are still conceptualized as organizational capabilities. Organizational capabilities are defined by Amit and Schoemaker (1993) as habitualized and reliable processes that are developed through interactions among firm’s resources for complex problems solving. In a similar vein, the literature of DCV also stresses the repeatability and reliability of dynamic capabilities by presenting them as specific and identifiable processes (Eisenhardt and Martin, 2000), learned and stable patterns of collective activities (Zollo and Winter, 2002), or capabilities to perform given tasks in an acceptable and repetitive manner (Teece *et al.*, 1997; Helfat *et al.*, 2007). But if dynamic capabilities are treated as reliable processes and replicable routines, they still need to follow stabilized action patterns and cannot become fully flexible for all kinds of external changes (Schreyögg and Kliesch-Eberl, 2007). The studies of DCV are quite aware of this problem and suggest that different changing scenarios require different dynamic capabilities.

2.4.2 Specific Characteristics of Dynamic Capabilities in Different Environmental Contexts

The literature of DCV mainly relates dynamic capabilities with two changing scenarios: high-velocity environments vs. moderately changing or stable environments (Eisenhardt and Martin, 2000; Barreto, 2010). In high velocity environments, disruptive technological change destroys the usefulness of existing competence and capabilities generated by past experience (Handerson and Clark 1990; Teece, 2007). The sudden shift of marketing preference makes future business models unclear (Eisenhardt and Martin, 2000), and established firms are thus forced to follow a different set of technology and marketing principles introduced by radical innovation (Bourgeois and Eisenhardt, 1988; Handerson and Clark, 1990). In contrast, in moderately changing or stable environments in which market change can be predicted (Eisenhardt and Martin, 2000), incremental innovation requires minor changes to established product design (Handerson and Clark, 1990), and competence of the firm is reinforced by the exploitation of existing knowledge and skills base (Gatignon *et al.*, 2002). It is suggested that the effective patterns and roles of dynamic capabilities vary greatly between these two contrasting environments (Eisenhardt and Martin, 2000, Schreyögg and Kliesch-Eberl, 2007).

In moderately dynamic or stable environments, dynamic capabilities are conceived as specific, detailed and identifiable processes (Eisenhardt and Martin, 2000). These stable processes or routines can be used to systematically modify resource

configurations in responding to the predictable market change (Eisenhardt and Martin, 2000; Zollo and Winter, 2002). But in high-velocity environments, dynamic capabilities are more recognized as a series of simple, experimental, and reactive actions based on real-time information and situation-specific knowledge (Eisenhardt and Martin, 2000). Open and non-routine search for extraordinary, unforeseen marketing signals allows firms to break preset cognitive framing (Teece, 2000; Teece, 2007; Schreyögg and Kliesch-Eberl, 2007). Extensive cross-functional communication enables managers to quickly understand the changing situation and adapt to it (Zollo and Winter, 2002). Experimental actions following flexible and simple rules allow firms to make more improvisational and non-linear strategic decisions in fast-shifting and ambiguous markets (Eisenhardt and Martin, 2000; Okhuysen and Eisenhardt, 2002).

2.4.3 Genesis and Creation Mechanism of Dynamic Capabilities

The development of dynamic capabilities is costly and complex (Winter, 2003). Dedicated resources such as financial and manpower input are prerequisite but not sufficient conditions (Winter, 2003; Zahra *et al.*, 2006). What equally important is managers' intention and cognitive capabilities, as well as proactive corporate culture and employees' attitudes towards change (Winter, 2003; Zahra *et al.*, 2006). In addition, the evolution of dynamic capabilities is also influenced by existing knowledge base and resource endowment of the firm (Winter 2003; Lavie, 2006).

In moderately dynamic or stable environments, the genesis of dynamic capabilities relies heavily on previously built expertise (Eisenhardt and Martin, 2000). The semi-automated routine of experience accumulation within existing knowledge domain is adequate to ensure the repetitive upgrading of dynamic capabilities for frequent and incremental changes (Zollo and Winter, 2002). However, in high-velocity environments where market conditions and rules of competition are subject to rapid change, dynamic capabilities should not bind to established rules and historical experience (Zollo and Winter, 2002). Rather, they are more based on new, situation-specific knowledge (Eisenhardt and Martin, 2000). What firms need is a dedicated learning mechanism composed of a set of cognitive processes and activities to deliberately search, articulate and codify knowledge that is more relevant to the changing situation (Eisenhardt and Martin, 2000; Zollo and Winter, 2002).

2.4.4 Relationship between Dynamic Capabilities and Firm's Performance and Competitive Advantage

Earlier research in DCV theoretically links the application of dynamic capabilities with enhanced competitive position of the firm by arguing that firms with idiosyncratic dynamic capabilities can generate above-the-average economic rents, especially in changing environments (Teece *et al.*, 1997; Makadok, 2001). In addition, through articulation and codification of the tacit knowledge embedded in operating routines, firms can understand and realize the causal linkage between the dynamic

capabilities they operate and the performance outcomes obtained (Zollo and Winter, 2002).

More recent research complements the above assumptions by stating that, although the assertion is theoretically sound that dynamic capabilities can enhance firm's performance and competitiveness, this effect is indirect. First, as "higher-order" capabilities, dynamic capabilities have no direct impact on firm's performance. Instead, they can influence performance only through reconfiguring the ordinary capabilities in which the quality of the modified capabilities plays a mediating role (Zott, 2003; Zahra *et al.*, 2006). Second, the development of dynamic capabilities is a huge investment involving both economic and cognitive costs (Winter, 2003, Lavie, 2006). Whether dynamic capabilities should be used for firm's performance improvement depends on the relevant cost and benefit analysis (Winter, 2003). If dynamic capabilities are used based on wrong calculations, they may damage rather than improve a firm's performance (Zahra *et al.*, 2006). Third, the possession of dynamic capabilities is a necessary, but not sufficient condition for firm's competitiveness (Eisenhardt and Martin, 2000). Firms with identical dynamic capabilities but different complementary know-how and assets may actually build differential resource positions and consequently have differentiated performance and competence levels (Helfat, 1997; Zott, 2003; Marcus and Anderson, 2006).

The discussion of dynamic capabilities provides three salient conclusions. First, the common feature of dynamic capabilities is that they are a special kind of capabilities aiming to modify firm's existing resources and capabilities for the need of environmental changes. Second, like other organizational capabilities, dynamic capabilities are still patterned processes and replicable routines and oriented towards specific tasks (Eisenhardt and Martin, 2000; Zollo and Winer, 2002). It is impossible to develop a general-purpose dynamic capability that is fully flexible for all kinds of external changes (Winter, 2003). Different competition contexts require different dynamic capabilities. Third, the development mechanisms of dynamic capabilities based on diverse external environments vary greatly from experience accumulation to new knowledge creation (Zollo and Winer, 2002). Firms should consider the marketing conditions they are facing when designing the development routines of dynamic capabilities.

More recently, some studies suggest that dynamic capabilities should be applied to the process by which firms undertake corporate sustainability (e.g. Aragon-Correa and Sharma, 2003; Hart and Dowell, 2011). The argument is, given that corporate sustainability is an ongoing development progress in which the firm has to continuously evolve its capabilities and strategies to address emerging sustainability challenges (Hart, 1995; Shrivastava, 1995; Porter and Van de Linde 1995; Hart and Milstein, 2003; Porter and Kramer, 2006; Shevchenko *et al.*, 2016), the perspective of

dynamic capabilities holds the promise for a better understanding of how firms adjust their capabilities for sustainable change (Hart and Dowell, 2011).

Traditional DCV literature links dynamic capabilities mainly with the environments that concentrate on firm's economic bottom line, despite the fact that the external environment that drives corporate sustainability brings firms with new challenges that are not encountered before.

More recently, a growing number of studies examine the role of dynamic capabilities in corporate sustainable development either at intra-organizational level or inter-organizational level. At the intra-organizational level, the linkage has been established between dynamic capabilities and the various aspects of corporate sustainability including corporate sustainable commitment and strategies (Aragon-Correa and Sharma, 2003; Hart and Dowell, 2011; Arend, 2014; Bhupendra and Sangle, 2015; Borland *et al.*, 2016), environmental management (Marcus and Anderson, 2006); CSR and stakeholder engagement (Cantrell *et al.*, 2015; Dentoni *et al.*, 2016), green leadership (Chen and Chang, 2013), and R&D and innovations for sustainability (Castiaux, 2012; Chakrabarty and Wang, 2012; Hofmann *et al.*, 2012; Chen and Chang, 2013; Dangelico *et al.*, 2017; Ko and Liu, 2017; Inigo *et al.*, 2017). The findings can be condensed as follows. First, to incorporate DCV into the research area of corporate sustainability, studies should consider new challenges in corporate sustainability which firms have not encountered before. Second, the traditional

sensing, seizing and maintaining framework of DCV should be extended to accommodate the above-mentioned sustainability challenges. Third, contingent dynamic capabilities should be developed to address various challenging aspects of corporate sustainability.

At the inter-organizational level, the relevant studies turn the focus to the relationship between firm's dynamic capabilities with sustainable supply chain management (SSCM) and collaboration. The finding is that the common practices of SSCM and supplier management can be regarded as the basic routines of specific dynamic capabilities (Beske, 2012; Reuter *et al.*, 2010; Beske *et al.*, 2014; Rauer and Kaufmann, 2015) to facilitate green logistics and purchasing management (Defee and Fugate; 2010; Reuter *et al.*, 2010), supply chain collaboration (Vanpoucke *et al.*, 2014; Glavas and Mish, 2015), and information integration and knowledge transfer for new green market opportunities (Wong, 2013; Dangelico *et al.*, 2013; Beske *et al.*, 2014).

This research stream provides profound insights into how to apply dynamic capabilities to corporate sustainable development, but one issue still remains. Most of the studies assume the existence of contingent dynamic capabilities in corporate sustainable development, but fail to elaborate their distinctive nature, despite the argument that different dynamic capabilities are required in different contexts (Eisenhardt and Martin, 2000; Zollo and Winter, 2002). There is thus a paucity of

research explicating the nature and microfoundations of these contingent dynamic capabilities.

The above conclusion indicates that the research intending to applying DCV to the field of corporate sustainable development cannot simply treats the external condition that drives corporate sustainability as a general changing environment. The research should delineate the key differences between the dynamic capabilities used to pursue firm's sustainability competence and the traditional dynamic capabilities only affecting economic competence (Marcus and Anderson, 2006). The following questions thus arise: (1) how does the external context that drives corporate sustainable development look like; (2) what are the distinctive characteristics of the dynamic capabilities used for corporate sustainable development; (3) And how to develop these dynamic capabilities.

To address these three questions, section 2.5 firstly carries out the analysis of the distinctive challenges involved in corporate sustainability.

2.5 Corporate Sustainability: A New Changing Environment for the Use of Dynamic Capabilities

Based on the analysis of Section 2.2, it can be concluded that the external environment that drives corporate sustainability brings firms with two types of new challenges along with institutional and value dimensions.

2.5.1 Challenges along with the Institutional Dimension

At before, the external institutional environment of the firm is determined by direct stakeholders such as customers, governments and shareholders (Freeman, 1984; Gladwin *et al.*, 1995). But corporate sustainability also needs to consider the interests of indirect stakeholders, such as NGOs and other civil society groups (Jennings and Zandbergen, 1995; Gladwin *et al.*, 1995). When these indirect stakeholders are becoming increasingly active in sustainability issues, the concerns raised by them may seriously challenge firms' conventional management approach (Bansal and Roth, 2000; Hart and Sharma, 2004). As a result, more and more companies realize that if their sustainability commitments fail to meet these newly emerging requirements, their legitimacy and even survival will be seriously jeopardized (Porter and Van de Linde, 1995; Bansal, 2005).

First, because indirect stakeholders stay at the periphery, or even outside of firm's established communication or relationship networks, their sustainability interests are

difficult to be immediately sensed or predicted (Hart and Sharma, 2004). These remote concerns, if overlooked, become a major source of firm's potential sustainability risks (Reinhard *et al.*, 2005). Second, different indirect stakeholder groups hold different sustainability interests (Dixon and Fallon, 1989; Gladwin *et al.*, 1995). They compete with each other to attract firm's attention (Hoffman, 1999; McWilliams and Siegel, 2001). Obviously, firms cannot simultaneously meet all sustainability needs from such a broad range of stakeholders. They have to allocate their limited resources to those that are perceived as the most urgent and legitimate (Escobar and Vredenburg, 2011).

2.5.2 Challenges along with the Value Dimension

External pressure for corporate sustainability requires firm to deliver not only economic, but also sustainable (environmental and social) values (Waddock and Graves, 1997; Elkington, 1998). However, no external market exists by which firm can generate revenues directly from the environmental and social values they create for the public (Berchicci and King; 2007). Stated alternatively, the simultaneous pursuit of both economic and sustainable values is not straightforward; firms have to find new ways to transform their sustainability efforts into their private interests.

These two kinds of challenges make the application of dynamic capabilities for corporate sustainability a far more complex process. On the one hand, sensing the emerging sustainability needs from direct stakeholders is no longer enough, firms also

need to give sufficient consideration to those “weak” and “remote” concerns from indirect stakeholders (Hart and Sharma, 2004). Furthermore, firms should be able to always capture the most urgent and legitimate needs from conflicting sustainable views and interests of various stakeholders (Hoffman, 1999; Escobar and Vredenburg, 2011). On the other hand, the reconfiguration of the internal resources and capabilities becomes even more challenging because a new task involved that requires firms to identify profitable opportunities from the seemingly unrelated social and environmental-friendly activities (McWilliams and Siegel, 2001; 2011). Therefore, a theoretical extension of the concept of dynamic capabilities seems necessary to accommodate the distinctive challenges involved in the context of corporate sustainability.

Two questions thus arise: (1) *what are dynamic capabilities for corporate sustainability?* And (2) *how could dynamic capabilities for corporate sustainability enable firms to pursue both economic and sustainable benefits?* These questions are addressed in the next section.

2.6 Towards a Definition of Dynamic Capabilities for Corporate Sustainability

In this thesis, dynamic capabilities for corporate sustainability is defined as *"firms' abilities to address rapidly evolving sustainability expectations of stakeholders by*

purposefully modifying functional capabilities for the simultaneous pursuit of economic, environmental and social competences" (Wu et al., 2012; 2013; 2014).

This definition is underpinned by DCV literature, but also incorporates the insights gained from research on corporate sustainability. The word *purposefully* indicates that the application of dynamic capabilities for corporate sustainability should be linked directly with a firm's strategic objective and managerial intent, so as to systematically derive *sustainable development opportunities* from internal and external stakeholders' demand (Porter and Kramer, 2006; McWilliams and Siegel, 2011). Here, *sustainable development opportunities* are those that firms can use to pursue both environmental and social values for the public and economic values for themselves (McWilliams and Siegel, 2001). The definition is also in line with the conception of dynamic capabilities as the higher-order capabilities to change the functional, or "ordinary" capabilities to match the market change (Zollo and Winter, 2002; Winter, 2003; Zahra et al., 2006).

In DCV literature, dynamic capabilities are treated as a multidimensional construct (Wang and Ahmed, 2007; Barreto, 2010). First, dynamic capabilities are firm's ability to monitor the constantly shifting environment (Schreyögg and Kliesch-Eberl, 2007), and sense and seize new business opportunities (Teece, 2007). Second, dynamic capabilities also represent the antecedent organizational routines by which managers alter their resource deployment to generate new value-creation strategies (Eisenhardt

and Martin, 2000). Following this theoretical viewpoint, in the thesis dynamic capabilities for corporate sustainability are disaggregated into three distinctive, but related capabilities to: (1) *scan* emerging sustainability needs of various stakeholders; (2) *sense* opportunities or threats from the rapidly changing sustainability expectations; and (3) *reconfigure* existing functional capabilities for corporate sustainability.

2.6.1 Scanning Capability

Teece (2007) suggests that the monitoring function of dynamic capabilities involves an analytical system to scan, learn, and interpret the signals reflecting emerging market and technological developments. Such a system represents a set of processes in which external innovation ideas are received, integrated and used to define future business model and investment priorities (Teece, 2007; Schreyögg and Kliesch-Eberl, 2007). Following this suggestion, the dynamic capability to scan emerging sustainability needs is considered as an information processing mechanism composed of two different searching processes, one for direct stakeholders and the other for indirect stakeholders.

In corporate sustainability, the pressure from direct stakeholders, such as customer requirements and governmental regulations, is always treated as the most relevant factor that affects firm's legitimate status (Carrol, 1979; Porter and Van de Linde, 1995). Thus formal searching processes should be in place to communicate with these

direct stakeholders, in order to recognize new sustainable trends, and analyze their impact on firms' current operations.

In addition, the sustainable concerns from indirect stakeholders cannot be neglected also (Bansal and Roth, 2000; Reinhard *et al.*, 2005). Because indirect stakeholders normally reside outside of firm's established communication or relationship networks, firms need to find new ways to systematically identify their "remote voices" (Hart and Sharma, 2004). On the one hand, in the case of the indirect stakeholders whose concerns are perceived as the most urgent and legitimate, firms should build direct communication channels with them (Hart and Sharma, 2004; Escobar and Vredenburg, 2011). On the other hand, in the case of the stakeholders that cannot be directly accessed at the moment, their concerns can also be sensed via firm existing communication network. For example, a firm can rely on its supply chain partners to gain information and insights about the stakeholders staying outside of its networking boundaries (Hart and Sharma, 2004; Ansett, 2007). In either case, the broad search of distant and unfamiliar sustainable signals requires deliberate managerial attention to delineate explicit search routines and processes in organization's existing communication structure (Berchicci and King; 2007; Hart and Dowell, 2011).

It should be noted that the scanning capability is by no means a one way mechanism for firms to receive information from various stakeholders. Instead, it is firm's ability to establish a trust-based collaboration relationship with a wide variety of

stakeholders (Buysse and Verbeke, 2003; Sharma and Henriques, 2005). The firm with effective scanning capability is more likely to manage context-specific stakeholder pressures along its value chain (Sharma *et al.*, 2007), and reduce negative social and environmental impacts in its pursuit of competitive advantage (Buysse and Verbeke 2003).

2.6.2 Sensing Capability

A firm's capability to sense external environmental changes and its capability to identify relevant business opportunities and threats are often regarded as a unified theoretical construct (Gilbert, 2006; Teece, 2007). However, these two kinds of capabilities need to be delineated separately in the context of corporate sustainability, because understanding new sustainable expectations from external stakeholders does not mean firms can automatically generate profitable opportunities from them (McWilliams and Siegel, 2001). These sustainable requirements often focus on improving firm's environmental and social performances. In many cases they do not tell firms how to obtain their own financial benefits at the same time (McWilliams and Siegel, 2001). In this sense the sensing capability should be applied to not only recognizing potential sustainability risks, but also finding the intersection between the firm's environmental and social goals and its economic interest. Alternately stated, firm's sensing dynamic capability is the ability to sense and capitalize on, rather than merely react to, emerging external sustainability challenges and opportunities in its business environment (Aragon-Correa 1998; Dunphy 2003; Sharma *et al.* 2007).

The development of sensing capability needs a shared vision within the firm to unify objectives and aspirations of its members (Oswald *et al.*, 1994; Tsai and Ghoshal, 1998). A shared vision enables a firm to generate internal pressure and mobilize employees' enthusiasm necessary for innovation and change (Hart 1995; Graafland *et al.*, 2003; Worthington *et al.*, 2006). The shared vision facilitates organizational learning and employee creativity, initiates competitive actions to challenge the *status quo* (Hitt *et al.*, 1991; Storey, 1994; Chen and Hambrick, 1995), and enables firms to accumulate and harness the resources and skills necessary for developing and adopting proactive sustainability innovations (Hart, 1995; Graafland *et al.*, 2003).

In the context of corporate sustainability, sensing capability should be performed to analyze new sustainable knowledge and information, and systematically link them with related organizational functions in various innovation activities. For example, to simultaneously reduce negative sustainable impacts and operational cost through process reengineering, firms must combine strong process redesign capability with deep sustainable know-how (Russo and Fouts, 1997). Similarly, to obtain the differentiation advantage in “green” product market, the knowledge about customers' sustainable preference should be used to guide the related R&D activities (Hart 1995; 1997). Specifically, the sensing capability plays two dedicated roles: one for cross-functional knowledge sharing, and the other for knowledge articulation and codification.

First, before the sustainable information and knowledge collected from diverse stakeholders are applied to subsequent actions, they must be well understood and meaningfully integrated into organization's existing knowledge structure. For this purpose, cross-functional knowledge exchange is necessary because novel sustainable knowledge should be forwarded to and interpreted by the individuals or planning units who are capable of making sense of them (Teece, 2007). For example, when new demands in organic product market are received by sales department, through knowledge sharing, they can be sent to product design teams for further analysis. Moreover, in more comprehensive sustainable innovations, profitable opportunities are often generated from the coordination of multiple functional departments. As an illustration, the study of Wells and Seitz (2006) shows that, when an engine remanufacturing program is triggered by a new sustainable idea, its implementation involves the knowledge integration of at least 10 different departments to realize the anticipated environmental and cost benefits.

Second, once new sustainable knowledge has been successfully applied to organizational operations and repetitively justified, the resulting sustainable know-how sometimes need to be articulated and codified into explicit management approaches (Winter, 2003). In the literature of DCV and strategic management, these approaches are described as "best practices" (Christmann, 2000), combinative capabilities (Kogut and Zander, 1992), or proactive corporate approach (Sharma and

Vredenburg, 1998; Aragon-Correa, 1998; Aragon-Correa and Sharma, 2003). In the research of corporate sustainable management, they are operationalized as environment management system (Florida and Davison, 2001), or responsive corporate social approaches (Wood, 1991; Porter and Kramer, 2006). These explicit approaches are the formalization of the past experience accumulated in recurrent sustainable innovation activities. They offer stable action templates and simplify future task execution in similar situations.

2.6.3 Reconfiguration Capability

Reconfiguring organization's functional capabilities has been recognized as one of the fundamental roles of dynamic capabilities (Teece *et al.*, 1997; Winter, 2003; Zahra *et al.*, 2006). Organization's functional capabilities are complex, rigid operational routines guided by accumulated tacit skills (Helfat and Peteraf, 2003; Winter, 2003). Firms tend to stick to their established functional capabilities to ensure reliable and efficient organizational operations (Hannan and Freeman, 1984; Leonard-Barton, 1992; Levinthal and March, 1993), even when the changing business environment has begun to undermine its fundamental capabilities base (Repenning and Sterman; 2002; Schreyögg and Kliesch-Eberl, 2007). For example, to avoid possible operational disturbance, many firms prefer the so-called end-of-pipe approach to solve imposed sustainable problems, despite the fact that this approach may entail huge, non-productive cost (Hart, 1995; Russo and Fout, 1997). Therefore, in corporate sustainable change, the reconfiguration capability refers to the firm's capability to

discard, modify, or rebuild the well-entrenched organizational routines and practices that are unsustainable.

This reconfiguration capability aims to overcome the potential "capabilities trap" involved in corporate sustainable development. This so-called "capabilities trap" is more salient in corporate sustainable management (Berchicci and King; 2007), because the link between sustainable actions and firm's economic performance is not straightforward (McWilliams and Siegel, 2001; 2011). Sometimes even firms tend to take more proactive actions to realize both sustainable and financial benefits, without a reliable estimation about the resulting impact on their existing operational routines, firms may still fail to make right decisions (McWilliams and Siegel, 2001; Berchicci and King; 2007).

Therefore, effective reconfiguration of firm's existing routines requires a clear understanding of their ambiguous nature (Schreyögg and Kliesch-Eberl, 2007). Firms should conduct a series of collective discussion and evaluation sessions to articulate how these routines are generated and organized (Winter, 2003), and what the results will be when these routines are changed.

Furthermore, the capabilities reconfiguration process should also consider the strong effect of functional interdependence that has been repetitively identified in corporate sustainable development (Hart, 1995; 1997). Functional interdependence means that

operational functions within an organization are interrelated. If one function is changed, its interactive patterns with other functions may be changed as well (Teece, 2007). Put differently, in corporate sustainability, what should be reconfigured includes not only organizational capabilities, but also their interactive patterns (Handerson and Cockburn, 1994; Hart, 1995). To rearrange these combinative patterns, firms should break the tacit routines embedded in the established communication channels and information filters between operational functional units (Galunic and Rodan, 1998; Galunic and Eisenhardt, 2001).

Drawing on RBV of the firm (Barney, 1991; Barney *et al.*, 2011), these three particular dynamic (scanning, sensing, and reconfiguration) capabilities are not only valuable, socially complex, causally ambiguous and deeply embedded within a firm, but also likely to be firm-specific and costly to imitate (Galunic and Eisenhardt, 2001; Hillman and Keim 2001). As such, these three distinctive capabilities provide a foundation for successful corporate strategic change towards sustainability.

2.7 DCV and Inter-Organizational Learning

When dynamic capabilities for corporate sustainability has been clearly defined and illustrated, an important question arises: how to develop them? The literature of DCV traditionally emphasizes on the role of internal organizational learning in the creation and development of dynamic capabilities (Teece *et al.*, 1997; Zollo and Winter, 1999;

Eisenhardt and Martin, 2000; Zollo and Winter, 2002; Zott, 2003; Zahra *et al.*, 2006).

This internal organizational learning includes both experience accumulation from repeated practices and past mistakes (Eisenhardt and Martin, 2000), and a more dedicated mechanism to search, articulate and codify new knowledge that is relevant to changing situations (Zollo and Winter, 2002).

Quite obviously, internal organizational learning is one key source for the development of dynamic capabilities. However, despite the argument that developing dynamic capabilities should follow the second-order learning process as described by Argyris (1976), in which managers and employees should break their existing cognitive framings in decision-making or problem-solving (Winter 2003; Zahra *et al.*, 2006), some studies point out that the internal organizational learning involved in dynamic capabilities creation is still path-dependant, and shaped by firm's established mental model (Teece *et al.*, 1997; Schreyögg and Kliesch-Eberl, 2007). Firms thus need to jump out of their path-dependent routines to gain new knowledge resource in a quick, simple, and experimental fashion (Eisenhardt and Martin, 2000). Therefore, for dynamic capabilities building, firms are suggested to not only look inside, but also look outside of their organizational boundaries for external knowledge source (Handerson and Cockburn, 1994; Galunic and Rodan, 1998).

The need of searching external knowledge source becomes even salient when firms try to engage in corporate sustainability. On the one hand, it is suggested that new

sustainability imaginations and ideas are often coming from external sources (Hart, 1995; 1997; Hart and Sharma, 2004; Hart and Dowell, 2011). On the other hand, stakeholders are increasingly demanding firms, especially those focal companies, to work with their supply chain partners to ensure sustainable operations across entire product value chain (Roberts, 2003; Amaeshi *et al.*, 2008). Under such a circumstance, supply chain partners are forced to share their sustainable understandings for the mutual development of capabilities for sustainability (Lee and Klassen, 2008, Gold, *et al.*, 2010). Furthermore, firms' supply chain partners have been recognized as one of the most immediate and reliable knowledge sources for new capabilities creation (Clark and Fujimoto, 1991; Kotabe *et al.*, 2003), and the causal linkage between supply chain sustainable knowledge sharing and the improvement of firms' financial and sustainability performances has been repetitively proved (Rao and Holt, 2005; Carter, 2005; Vachon and Klassen, 2007).

The knowledge shared by its supply chain partners can inform the firm emerging opportunities or threats in the sustainable market. More importantly, the shared knowledge can also facilitate the firm to generate new dynamic capacities to catch the time window of these market opportunities or cope with the threats in time. The synergistic combination of firm's internal learning mechanism and its access to the external knowledge resource leads to its enhanced resource and capability building (Lorenzoni and Lipparini, 1999; Lee and Klassen, 2008). Inter-firm knowledge

transfer is thus not only necessary, but also a path-breaking routine for the firm to gain its dynamic capabilities for corporate sustainability.

In conclusion, since firms need to keep extensive communication with diverse stakeholders for corporate sustainable development, a large proportion of new information and knowledge source appears to be acquired from outside of organizational boundaries (Hart and Sharma, 2004; Simanis and Hart, 2009). Drawing on the Knowledge-Based View of the firm (KBV) (Kogut and Zander, 1992; Grant and Baden-Fuller, 1995; Grant, 1996), Aragon-Correa and Sharma (2003) argues that, by working together with their supply chain partners, firms are able to develop a set of resources and capabilities leading to better sustainability results.

2.8 Knowledge Transfer between Supply Chain Partners: A Knowledge-Based View (KBV) Perspective

Knowledge-Based View (KBV) regards knowledge as one of the most important resources for a firm's competitive advantage and superior performance (Grant, 1995). Following this logic, the inter-firm knowledge transfer between supply chain partners is an effective way to share, access, and obtain valuable resources across organizational boundaries. The argument of KBV is that if the production-related knowledge can be perfectly embodied into a product, the transaction between buyers and suppliers can be solely based on arm-length contracts to realize market efficiency.

If not, collaborative relationship has to be established for inter-firm knowledge exchange (Grant and Baden-Fuller, 1996). This observation has been proved by researchers in various supply chain settings (Lorenzoni and Lipparini, 1999; Dyer and Nobeoka, 2000; Lee and Klassen, 2008). Because the environmental and social-related knowledge of a product cannot be embodied into its production, the transfer of this knowledge between supply chain partners is the prerequisite for both corporate and supply chain sustainability. For example, Ansett (2007) observes that the sustainability initiatives of Gap Inc. enables this company to know every detail of the social and environmental impacts involved in its suppliers' production.

Inter-firm knowledge transfer contributes to not only intra-firm but also inter-firm competitive advantages. Because sustained competitiveness of individual firms is often rooted in the capacities of its supply chain partners (Dyer and Singh, 1998; Krause *et al.*, 2009), the ongoing and rich exchange of knowledge between supply chain partners in their sustainable collaboration enhances the development of their specialized dynamic capabilities. These specialized dynamic capabilities are complementary *per se*. They co-evolve together to transform inter-connected supply chain entities into a complex adaptive system to collectively address external challenges, and obtain more socially complex and causally ambiguous competitive advantage which is particularly difficult to be imitated (Lorenzoni and Lipparini, 1999; Lee and Klassen, 2008). More specifically, the source of the inter-firm competitive advantage is coming from the following capacities and resources, namely

relation-specific assets, knowledge-sharing routines, complementary resources and capabilities, and effective governance (Dyer and Singh, 1998).

2.9 Knowledge Transfer in A Multi-Tier Supply Chain Structure

More recently, in the field of sustainable supply chain management, an emerging research stream begins to emphasize both the importance and difficulties of the knowledge transfer through a multi-tier supply chain. Because focal firms are assumed to be responsible for the sustainability liabilities of not only themselves, but also their supply chain partners, any unsustainable behaviour identified across the entire supply chain could be a potential risk of focal firms (Hartmann and Moeller, 2014). However, since focal firms lack direct communication routines with their distant suppliers, the effective sustainable management and knowledge transfer with these so-called multi-tier suppliers is a huge challenge of firms (Hartmann and Moeller, 2014). To this regard, despite the literature review finding that multi-tier sustainable supply chain management and collaboration still lacks enough attention (Chen *et al.*, 2017), some recent studies already propose a set of potential processing mechanisms as well as the relevant drivers.

First, the "green bullwhip effect" has been identified in multi-tier sustainable supply chain management and knowledge transfer. Under such an effect, the sustainability-related information and knowledge sent from downstream supply chain may be

greatly distorted when they are passed to upstream supply chain through successive tiers (Lee *et al.*, 2014). Second, facing this green bullwhip effect, first-tier supplier, acting as the linkage between upstream buyer firm and the successive tiers partners, should integrate its marketing and procurement functions (Foerstl *et al.*, 2015). Such an integration makes sure that true sustainability requirements and guidance can be passed to upstream sub-suppliers without variation (Foerstl *et al.*, 2015). Moreover, in this information and knowledge transfer process, the sustainability management capabilities of the first-tier suppliers, supply chain complexity, and different sustainability focuses are the three key factors determining whether and how focal firms extend their sustainability strategies to their sub-suppliers (Wilhelm *et al.*, 2016). Third, the power issue has been recognized as a key element affecting the management of multi-tier sustainable supply chain relationships. It is suggested that dominant firms in a supply chain should properly use their power to share sustainability-related risks and value with their supply chain partners, and deal with these partners' responses to the implementation of new sustainability initiatives (Touboulic *et al.*, 2014). Fourth, the development of sustainable innovations at both firm and supply chain levels has been recognized as an emergent phenomenon (Hofmann *et al.*, 2012; Nair *et al.*, 2016). To address the question of how sustainability-oriented innovations emerge and proliferate in supply networks across multiple supply chain linkages, a complex adaptive systems perspective has been introduced. This perspective observes that sustainable innovations originated from dominating buying firms, once being diffused in its supply network realm, tend to

follow a self-organizational fashion (Nair *et al.*, 2016). Alternatively stated, the creation and spreading of environmental innovations in supply networks cannot be fully controlled by focal firms. Instead, decentralized coordination should be in place to foster the dissemination of such innovations in a supply chain network over time (Nair *et al.*, 2016).

2.10 Developing Dynamic Capabilities through Inter-Firm Knowledge Transfer: A Theoretical Framework

Emerging environmental and social pressures have propelled sustainable supply chain management to the forefront of researchers' agenda (Carter and Jennings, 2002; Carter, 2005; Vachon and Klassen, 2007). Sustainable supply chain management (SSCM) is defined as *“the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements”*. (Seuring and Muller, 2008: 1700). Extent literature suggests that the cooperation between supply chain partners engaging in sustainable management not only positively affects natural environment and society, but also creates economic benefits and competitive advantage of the supply chain (for example: Markley and Davis, 2007; Vachon and Klassen, 2007; Carter and Rogers, 2008).

In the framework of SSCM, inter-organizational collaboration between supply chain partners in forms of information sharing and knowledge transfer is one key element (Koplin *et al.*, 2007; Hartmann and Moeller, 2014). In the research of sustainable supply chain management, the knowledge transfer between supply chain partners is recognized as either being monitor-based or support-based (Vachon and Klassen; 2006; 2007; Lee and Klassen, 2008; Gualandris and Kalchschmidt, 2014). Monitor-based knowledge transfer is regarded as the management approach of buying firms to control the levels of particular sustainability performances of their suppliers (Min and Galle, 2001; Handfield *et al.*, 2005; Lee, 2008). Compared with monitor-based knowledge transfer, support-based knowledge transfer involves more direct interactions of supply chain partners to collectively develop new solutions to complex sustainable problems (Geffen and Rothenberg, 2000; Vachon and Klassen; 2006; Lee and Klassen, 2008). These two forms of knowledge transfer contribute to the development of organizational capabilities of both supply chain buyers and suppliers (Vachon and Klassen; 2006; 2007; Lee and Klassen, 2008; Klassen and Vereecke, 2012).

2.10.1 Monitor-Based Knowledge Transfer

Monitor-based sustainable knowledge transfer is manifested in the application of a series of compliance rules enforced by supply chain buying firms to regulate the sustainable behaviour of their suppliers. These rules include both the so-called ethical codes of conduct established by leading companies, such as fair trade labelling

(Roberts, 2003; Maloni and Brown, 2006; Amaeshi *et al.*, 2008), and international standards, such as ISO 9000 and ISO 14001 (Beamon, 1999; Daily and Huang, 2001). Moreover, in recent years, a growing number of companies, especially MNEs, began to adopt ISO 26000 for their sustainable supply chain development (Castka and Balzarova; 2008). The findings show that implementing ISO 26000 standard is positively related to managing sustainable supply chains (Castka and Balzarova; 2008; Chiarini and Vagnoni, 2017), and enable firms to more effectively gain process efficiency, dynamic capabilities, and innovation (Castka and Balzarova; 2008; Hahn and Weidtmann, 2012; Chiarini and Vagnoni, 2017).

Following these compliance rules, focal company imposes new sustainability requirements on its suppliers to comply with (Green *et al.*, 2000), and then monitors their sustainable performance against particular criteria (Lee and Klassen, 2008).

Monitor-based knowledge transfer in sustainable supply chain management covers both environmental and social aspects. From the environmental aspect, knowledge transfer between supply chain partners often leads to a great upgrading of their ability to understand emerging environment protection needs of various stakeholders (Lee and Klassen, 2008). These newly generated capacities can be regarded as dynamic because they are innovative practices, processes and routines that drive the synergistic improvement of both supply chain environmental and economic performances.

From the social aspect, supply chain inter-firm knowledge transfer facilitates firms' capacity to sense and manage both internal and external social issues. Internal social issues focus on labour equality and welfare, such as employee diversity, working safety, human rights, etc. External social issues deal with the concerns of and the relationship with the external stakeholders, such as community building and philanthropic issues (Lee and Klassen, 2008). Because these social responsible practices and activities are largely based on firms' self discretion, the sharing of social responsibility-related knowledge better informs supply chain partners the social responsibilities and benefits which they have a stake, and enables them to make more sensible decision makings (Koplin *et al.*, 2007). Furthermore, inter-firm knowledge transfer and collaboration between supply chain partners regarding social issues concentrate more on long-term and broader considerations rather than immediate financial benefits. For example, an increasing number of leading companies realize that the social responsibility image of their supply chains largely determines their brand reputation, and the legitimacy and opportunities of their long-term development (Tate *et al.*, 2010). Empirical evidence also shows that certain social responsible practices, such as ethical purchasing, improve the trust building between supply chain partners (Carter and Jennings, 2002; Carter, 2005). Deep trust between supply chain partners is the most relation-specific asset for the establishment of knowledge-sharing routines and the governance mechanism of supply chain relationships (Dyer and Singh, 1998). These observations lead to the following proposition:

Hypothesis 1a. Monitor-based knowledge transfer between supply chain partners positively impacts the development of their scanning capability to understand emerging sustainability (both environmental and social) needs from various stakeholders, so as to recognize new sustainability trends, and analyze their impact on firms' current operations.

External sustainability pressure requires focal firms to pay closer attention to their supply chain partners' social and environmental performances, and also enables these companies to develop their own social and environmental awareness and management capacities (Koplin *et al.*, 2007). Through inter-firm knowledge transfer, the increased social and environmental management capacities of their supply chain partners can contribute to the capacity building of the leading companies as well (Hartmann and Moeller, 2014). The co-evolution of these complementary capacities can lead to their collective competitive advantage at the supply chain level.

Moreover, the standard policies and procedures introduced by the monitor-based knowledge transfer often drive deliberate changes in firm's current operations. For example, the environmental purchasing programme initiated by UK Company B&Q helps its suppliers to adopt new practices to reduce the negative environmental impacts involved in their manufacturing (Ytterhus *et al.*, 1999). Daily and Huang (2001) also observe that, to achieve the ISO 14001 standard required by their downstream buyers, firms have to build a cross-functional work group, and take one

or two years to systematically check and correct their internal functions against 20 specific, process-based guidelines. Consistent with these arguments, Lee and Klasson (2008) find that, the sustainable knowledge transferred at a monitor-basis provides explicit guidance for the recipient companies to systematically identify new sustainability development needs. Therefore,

Hypothesis 1b. Monitor-based knowledge transfer between supply chain partners positively impacts the development of their sensing capability to identify new sustainable development opportunities.

2.10.2 Support-Based Knowledge Transfer

Different from monitor-based knowledge transfer that focuses on compliance to standard regulations (Vachon and Klassen 2006), support-based sustainable knowledge transfer aims to develop new sustainability-sound processes and products through close interactions between supply chain partners (Vachon and Klassen 2006; Lee and Klassen, 2008). This kind of knowledge transfer encompasses a broad range of activities, including not only formal cross-organizational communications, such as joint planning sessions, periodical team meetings, employee training and education programs, but also loose social interactions of the boundary spanners in different firms to share their information and experience in daily operations (Vachon and Klassen 2006; Lee and Klassen, 2008; Pagell and Wu, 2010).

Supply chain partners can use support-based knowledge transfer to search and share emerging external sustainability concerns. These constantly evolving concerns are coming from various stakeholders (Reinhard *et al.*, 2005). They are quite diversified, deeply rooted in specific social contexts (Dixon and Fallon, 1989; Gladwin *et al.*, 1995), and thus become potential sustainability risks that cannot be monitored and managed by standard policies and procedures (Carter and Rogers, 2008). Therefore, it is suggested that supply chain partners should use their social interaction routines to support free sharing of their understandings about external sustainability issues (Hart and Sharma, 2004). Hart and Sharma (2004) describe this social interaction process as a core-to-periphery networking approach, by which firms use their supply chain partners as the bridge to obtain the information about the stakeholders that cannot be directly accessed. This approach is successfully implemented by Italian Company Gap Inc. to reduce its potential sustainability risks (Ansett, 2007). In addition to risk management, support-based knowledge transfer also helps firms to explore sustainable opportunities through stakeholder management. The studies of Lee and Klassen (2008) and Alvarez *et al.* (2010) prove that support-based knowledge transfer often brings about new sustainability perspectives, and thus allows firms to find new ways to cooperate with external stakeholders for mutual benefits. In short, through support-based knowledge transfer, supply chain partners learn to establish more transparent communication channels with external stakeholders. Therefore,

Hypothesis 2a. Support-based knowledge transfer between supply chain partners positively impacts the development of their scanning capability to recognize and manage new sustainability demands through stakeholder engagement.

Through experience and practices sharing between supply chain partners, support-based knowledge transfer can generate novel solutions to complex sustainable problems (Geffen and Rothenberg, 2000; Lee and Klassen, 2008). The empirical research of Walton *et al.* (1998) compares the implementations of a “Design for the Environment” (DfE) initiative in six different furniture manufacturers, and concludes that, if a company wants to reap greatest benefits from its environmental management processes, it must firstly establish a dialogue platform with its supply chain partners for extensive, on-going information and knowledge exchange. Similarly, Geffen and Rothenberg (2000) find that successful development of “green” products partly depends on the engagement of raw material suppliers. These empirical findings confirm the theoretical argument that, due to the imperfect congruence between product and knowledge domains of the firm, the potential business opportunities often can be explored through inter-firm knowledge integration (Grant and Baden-Fuller, 1995; Grant, 1996).

Furthermore, support-based knowledge transfer helps firms to break their inertial mental models and information processing routines. For example, joint worker and management training is suggested as an effective means to reduce employees’

potential cognitive bias towards sustainable activities (Krause *et al.*, 2009; Andersen and Skjoett-Larsen, 2009). In addition, Mason and Leek (2008) note that, because the tacit knowledge received through support-based knowledge transfer should be passed to appropriate actors and collectively understood, firms' existing communication routines are forced to be re-organized, so as to support flexible information flows across functional boundaries. These arguments suggest that support-based sustainable knowledge transfer drives firms to re-examine their practices and routines that are taken for granted before, and thus stimulate the second-order learning required in the development of dynamic capabilities. Therefore,

Hypothesis 2b. Support-based knowledge transfer between supply chain partners positively impacts the development of their sensing capability to seize new sustainability development opportunities.

2.10.3 Interconnectedness of the Three Types of Dynamic Capabilities for Corporate Sustainability

It should be noted that the three dynamic capabilities for corporate sustainability are interconnected. Interconnectedness, as suggested by Hart (1995), consists of two dimensions that complement each other: path-dependence and embeddedness. Path dependence suggests that there is a sequential logic to the development of the three dynamic capabilities. For instance, the capability to sense new opportunities and threats is relevant only if the scanning capability has been in place to recognize future

sustainable trend. Similarly, the reconfiguration capability is relevant only when the sensing capability has already indicated what capabilities might be seriously challenged in further sustainable actions (Teece *et al.*, 1997; Wang and Ahmed, 2007).

The logic of path dependence is reinforced by the effect of embeddedness. Embeddedness means that these three capabilities are overlapped. For example, it can be argued that, because the sustainable information collected from different stakeholders often contradicts with each other (Dixon and Fallon, 1989; Gladwin *et al.*, 1995), the scanning capability can improve the sensing capability by identifying and prioritizing the most relevant sustainable needs. Likewise, the sensing capability cannot be separated from the reconfiguration capabilities because seizing sustainable opportunities require firms to apply new knowledge to their existing operations to realize both private and public benefits (McWilliams and Siegel, 2011). In this process, without a comprehensive understanding about how its internal operations are organized and how they can be reconfigured, an organization cannot capture real sustainable opportunities and transform them into profitable outputs. Furthermore, because the sensing capability requires deliberate managerial attention to establish new information sharing mechanism with various external stakeholders (Berchicci and King; 2007; Hart and Dowell, 2011), the reconfiguration capability is thus needed to modify existing communication practices and routines. In short, there are clear synergies across these three capabilities. Therefore:

Hypothesis 3. The development of scanning capability positively impacts the development of sensing capability, and

Hypothesis 4. The development of sensing capability positively impacts the development of reconfiguration capability.

2.10.4 The Theoretical Framework

The hypotheses raised in Section 2.10.3 discuss the development of dynamic capabilities of supply chain partners (both supply chain buyer and supplier) through knowledge transfer. However, empirical studies prove that the impacts of knowledge transfer on the capabilities development between supplier and buyer firms may vary greatly (Daily and Huang, 2001; Lee and Klassen, 2008). A special research setting is thus created to consider such a variance in a uniform arrangement. This setting covers the knowledge transfer between focal firms and both their upstream suppliers and downstream buyers (see Figure2.2).

Figure 2. 2 - The Research Setting



On the one hand, in the relationship between focal firm and its downstream buyer, the focal firm acts as the supplier and the focus is how knowledge transfer with its supply chain buyer impacts the development of focal firm's dynamic capabilities. Based on the hypotheses listed above, CA model (between focal firm and its supply chain customer) is established (see Figure 2.3) and the related hypotheses are given in Table 2.2.

Figure 2. 3 - CA Model (between Focal Firm and Its Supply Chain Customer)

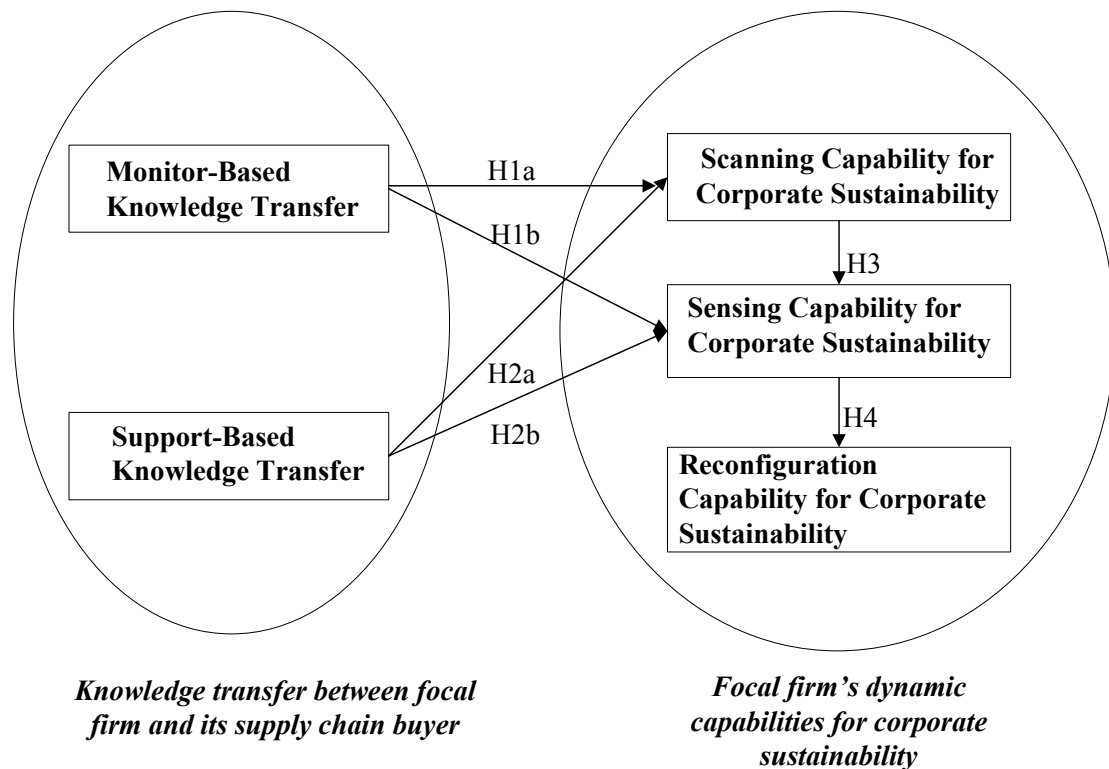


Table 2. 2 - Research Hypotheses in CA Model (between Focal Firm and Its Supply Chain Customer)

Research Hypotheses in CA Model	
H1a	Monitor-based knowledge transfer between focal firm and its supply

	chain buyer positively impacts the development of its scanning capability for corporate sustainability.
H1b	Monitor-based knowledge transfer between focal firm and its supply chain buyer positively impacts the development of its sensing capability for corporate sustainability.
H2a	Support-based knowledge transfer between focal firm and its supply chain buyer positively impacts the development of its scanning capability for corporate sustainability.
H2b	Support-based knowledge transfer between focal firm and its supply chain buyer positively impacts the development of its sensing capability for corporate sustainability.
H3	The development of scanning capability positively impacts the development of sensing capability for corporate sustainability.
H4	The development of sensing capability positively impacts the development of reconfiguration capability for corporate sustainability.

On the other hand, in the relationship between focal firm and its upstream supplier, the focal firm acts as the buyer and the focus is how knowledge transfer with its supply chain supplier impacts the development of focal firm's dynamic capabilities. Based on the hypotheses listed above, SA model (between focal firm and its supply chain supplier) is established (see Figure 2.4) and the related hypotheses are given in Table 2.3.

Figure 2. 4 - SA Model (between Focal Firm and Its Supply Chain Supplier)

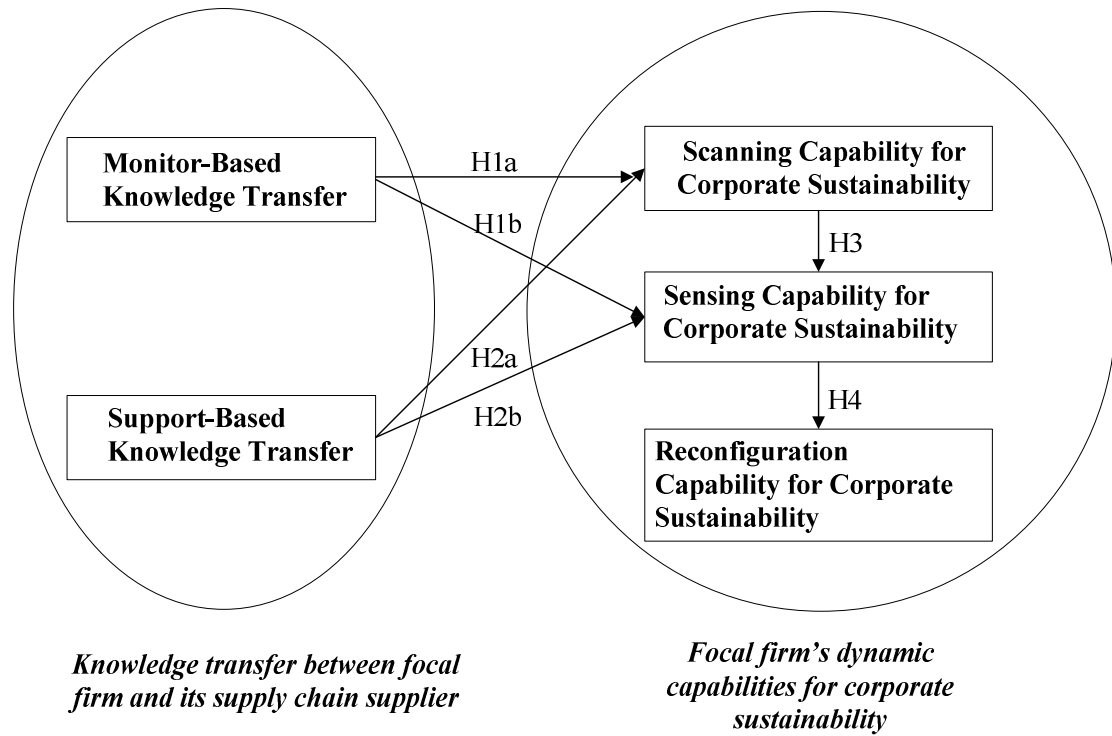


Table 2. 3 - Research Hypotheses in SA Model (between Focal Firm and Its Supply Chain Supplier)

Research Hypotheses in SA Model	
H1a	Monitor-based knowledge transfer between focal firm and its supply chain supplier positively impacts the development of its scanning capability for corporate sustainability.
H1b	Monitor-based knowledge transfer between focal firm and its supply chain supplier positively impacts the development of its sensing capability for corporate sustainability.
H2a	Support-based knowledge transfer between focal firm and its supply chain supplier positively impacts the development of its scanning capability for corporate sustainability.
H2b	Support-based knowledge transfer between focal firm and its supply

	chain supplier positively impacts the development of its sensing capability for corporate sustainability.
H3	The development of scanning capability positively impacts the development of sensing capability for corporate sustainability.
H4	The development of sensing capability positively impacts the development of reconfiguration capability for corporate sustainability.

Based on previous theoretical findings, the above models and hypotheses create two separate but related research settings to illustrate the research hypotheses which propose the relationship between the inter-firm knowledge transfer among supply chain partners and the development of dynamic capabilities for corporate sustainability. These two models will be further tested through both qualitative and quantitative explorations.

2.11 Chapter Summary

This chapter introduces dynamic capabilities for corporate sustainability and elaborates them as three interrelated capabilities for firms to systematically identify and capture potential opportunities from emerging sustainable expectations of stakeholders. The key role of sustainable knowledge transfer between supply chain partners in the development of dynamic capabilities for corporate sustainability is also examined. The findings contribute to the research of both corporate sustainability and dynamic capability.

First, the resource-based perspective in corporate sustainability research focuses dominantly on the identification of the functional capabilities that directly link with firms' current economic and sustainable performance (Hart, 1995; Russo and Fouts, 1997; Porter and Kramer, 2006). This perspective is extended by suggesting that the development of dynamic capabilities for corporate sustainability is equally important. Firms can use these two levels of capabilities to achieve both present and future competences. On the one hand, firms can rely on their functional capabilities to ensure reliable and efficient business operations. On the other hand, firms can use dynamic capabilities to change these functional capabilities when they are envisaged to be inadequate in addressing future sustainability challenges.

Second, DCV literature is also extended by turning the focus to the role of external knowledge sources for the creation of dynamic capabilities. A set of research hypotheses are proposed regarding how two types of sustainable knowledge transfer (monitor-based and support-based) between supply chain partners can synergistically contribute to the development of dynamic capabilities for corporate sustainability. These research hypotheses and the resulting theoretical framework will be used for the following empirical test.

CHAPTER 3 - RESEARCH METHODOLOGY AND DESIGN

3.1 Introduction

The purpose of this chapter is to identify appropriate research philosophical paradigm and methods, and establish suitable research designs for the field work. Three main aspects are considered in the chapter: (1) the philosophical position determining the appropriate logic of reasoning to guide the research; (2) the specific research methods in line with the logic of reasoning; and (3) the research design to operationalise the methods.

The structure of the chapter is as follows. Section 3.2 makes explicit the philosophical stance guiding the research. Section 3.3 explains why both qualitative study and quantitative study should be applied as a mixed methods approach for the current research setting. Section 3.4 justifies the use of the fieldwork research methods in the study. Section explains the linkage between the three research methods used in this study, namely case study, archival analysis and survey study. Section 3.6 and Section 3.7 respectively consider the main aspects involved in the qualitative study stage and quantitative study stage. The relevant ethical issues in the research are discussed in Section 3.8. Section 3.9 outlines the research process which is followed by a chapter summary in Section 3.10.

3.2 Research Philosophy

All research is based on some underlying assumptions about what constitutes a valid research and which research methods are appropriate (Morgan and Smircich, 1980). Making explicit the hidden assumptions and philosophical perspective of the researcher is thus important because they shape the logic of reasoning by which the researcher conducts or evaluates the research.

3.2.1 The Philosophies of Management Research

There are multiple philosophical perspectives in management study in which positivism and social constructionism present two extreme epistemological positions: objectivism and subjectivism (Saunders *et al.*, 2009). The view of positivism holds an assumption that an objective truth exists in the world and its properties can be measured by scientific methods which lead to findings reflecting underlying cause-effect relationship (Cassell and Symon, 1994; Easterby-Smith *et al.*, 2008). Social constructionism, on the other hand, argues that the reality is socially constructed by joint understandings of people (Easterby-Smith *et al.*, 2008).

Critical realism and post-positivism are two additional major research perspectives in between the above totally contrasting philosophical views. Compared with post-positivism, critical realism is more inclined to social constructionism. Although critical realism admits that the reality exists independent of the observer (Chia, 2002),

it rejects positivism by adopting an interpretive viewpoint. Critical realism claims that a fundamental difference exists between natural and social phenomena. While natural phenomena requires scientists to develop concepts and theories to justify and test real existence; social phenomena is manifested as a collective understanding through various interpretations (Bhaskar, 1979,1986,1989; Blaikie, 1993). Alternatively stated, social world is already constructed before the critical realism-based research (Collier, 1994).

On the contrary, following the philosophical view of positivism, post-positivism insists that social phenomena can still be treated as external objective by which all scientific propositions are founded on facts, and hypotheses are tested against facts (Robson, 2002). However, as a modified positivism, post-positivism considers social science as a unique research background in which the experience, assumptions and values of the researcher can influence what is observed (Robson, 2002). Stated alternatively, the researcher cannot distance him or herself from the object of study.

3.2.2 The Choice of Philosophical Stance: Post-Positivism

In the research, Post-Positivism is the chosen philosophical position. The Post-Positivism approach is selected because it offers a perspective for viewing the phenomena, which is valid for both the explanatory and exploratory nature of the research. It also reflects a way of thinking that is clearly consistent with that of the researcher.

The aim of the research is twofold: (1) to explore the nature and specific characteristics of the dynamic capabilities for corporate sustainability; and (2) to empirically test and explain the impact of inter-firm knowledge transfer on the development of dynamic capabilities. Post-Positivism is found appropriate in such a research context. Compared with other philosophical perspectives in management study, post-positivism can be justified as suitable for the research based on the following characteristics.

First, the research will be carried out in a typical social phenomenal setting in which what to be observed, such as organizational capabilities, corporate sustainability and inter-firm knowledge transfer are socially constructed and influenced by people's perceptions and interests (Robson, 2002). In such a setting, the collected data are deeply embedded in the social context and perfectly objective interpretation of the data will be impossible (Trochim, 2000). Post-Positivism is thus a logical choice which allows for a more complex and interdependent set of considerations of organizational, historical, ethical, and personal factors relevant to an investigation (Buchanan and Bryman, 2007).

Second, the socially constructed context that will be investigated in the research means that researchers' value and perceptions cannot be excluded in the research process so as to make detachable observations in a value-free manner (Sarantakos,

2005; Fraser, 2014). To this regard, Post-Positivism enables the researcher to triangulate the multiple measures and observations, so as to reach a better understanding of the observed reality (Trochim, 2000).

Third, Post-Positivism indicates that observations are theory-laden in that existing theories may influence the observation process (Trochim, 2000). In this thesis the research hypotheses and theoretical framework are established largely based on exiting theoretical views and findings. Post-Positivism is therefore an appropriate choice.

Fourth, given that the research has both explanatory and exploratory purposes, Post-Positivism is a suitable research philosophical stance in that it allows the use of multiple measures and observations (Robson, 2002).

3.3 Research Design Rationale

This research design adopts a mixed methods approach which combines both qualitative and quantitative approaches in the various stages of research (for example: research questions, research methods, and data collection and analysis) as a single study (Tashakkori & Teddlie, 1998). Mixed methods approach, underpinned by pragmatism philosophy, is growing in popularity in social science (Creswell and Plano Clark, 2007). The central argument of mixed methods research is that the

combination of both qualitative and quantitative approaches contributes to a better understanding of a special phenomenon of interest which either approach cannot undertake along (Tashakkori and Teddlie, 2003; Elliott, 2005; Creswell and Plano Clark, 2007).

Mixed methods approach is appropriate to address the research attempts raised in this study. First, quantitative method is needed to test the relationship between inter-firm knowledge transfer and the development of dynamic capabilities for corporate sustainability. The structural equation model (SEM) tested in the research will provide strength in determining the relative correlations of measured variables. Second, although the concept of dynamic capabilities for corporate sustainability developed in the research is based on extant literature in the areas of both DCV and corporate sustainability, limited evidence exists which can directly inform the underlying constructs and micro-foundations of the concept of dynamic capabilities for corporate sustainability. The nature of dynamic capabilities for corporate sustainability, as an insufficiently articulated phenomenon, thus needs the application of qualitative approach to explore. Alternatively stated, while the focus is on testing the significant relationship between inter-firm knowledge transfer and development of dynamic capabilities for corporate sustainability, the testing model used at the quantitative study stage, to a large extent, is based on the conceptualization of dynamic capabilities for corporate sustainability enriched in the qualitative stage study.

The mixed methods used in the research follows a sequential order design. This sequential design means that the data collection and analysis at the first stage occur before the next (Creswell and Plano Clark, 2007). The research starts with collecting and analyzing qualitative data and follows with a quantitative study that develops from and connects to the result of the qualitative stage. To be specific, the constructs and micro-foundations of dynamic capabilities for corporate sustainability explored and established in the qualitative stage study will be used to further justify the measurement indicators that are going to be used in quantitative study stage. These measurement items are then tested by a SEM model. Such a sequential arrangement enables the researcher to (1) generate new findings through the qualitative stage study (Morgan, 1998); (2) use the qualitative findings to develop new instruments in the situation that existing instruments are inadequate or not available; and (3) administer the instruments to a sample of population (Creswell and Plano Clark, 2007).

3.4 Choice of the Research Methods for the Field Work

Because the mixed methods setting outlined in the research includes both qualitative and quantitative approaches, how to choose suitable research methods for the field work becomes a key consideration. Yin (2003) suggests that there are three dimensional considerations involved in choosing a suitable research method (see Table 3.1). First, the type of research questions. Second, the degree of investigator

control over actual behavioural events. Third, the degree of focus on contemporary, rather than historical events.

Table 3. 1 - Relevant Situation for Different Research Strategies

Strategy	Form of Research Questions	Requires Control of Behavioural Events?	Focuses on Contemporary Events?
Experiment	how, why	Yes	Yes
Survey	who, what, where, how many, how much	No	Yes
Archival Analysis	who, what, where, how many, how much	No	Yes/No
History	how, why	No	No
Case Study	how, why	No	Yes

Source: COSMOS Corporation cited in Yin (2003: 5).

As stated above, the aim of the research is to explore the nature and specific characteristics of the dynamic capabilities for corporate sustainability, and to empirically test the impact of inter-firm knowledge transfer on the development of dynamic capabilities. For such a purpose the research process is divided into two

phases. First, at the qualitative study phase, the nature and specific characteristics of the dynamic capabilities for corporate sustainability are explored which focus on “what”, “how” and “why” questions. Following Yin’s (2003) suggestion, both case study and archival analysis will be mainly used. Second, at the quantitative study phase, because the focus is on investigating the impact of inter-firm knowledge transfer on the development of dynamic capabilities for corporate sustainability, survey method will be applied to answer the so-called “how many” or “how much” questions (Yin, 2003).

3.5 The Linkage between the Three Adopted Research Methods: Case Study, Archival Analysis and Quantitative Survey Study

As indicated in Section 1.3, the objectives and questions proposed by this study decide that the research is of both exploratory and explanatory in nature (see Section 1.3 for the questions detail). To this regard a mixed method approach is adopted in which both qualitative and quantitative studies are included. The case study and the archival analysis included in the qualitative study stage aim to answer the exploratory questions, and the survey study in the quantitative research stage aims to answer the explanatory questions. The linkage between these three specific research methods is explained as follows.

First, to answer the question of "what are the key processes underpinning dynamic capabilities for corporate sustainability", a case study is carried out with the aim to provide an illustration and a more in-depth understanding of the underlying functions and processes of the contingent dynamic capabilities which drive firms to make more effective strategic changes toward sustainability. The case study answers the above research questions by giving a typical example. However, the inclusion of only one sample case means that the research outcome is limited in generalizability.

Second, to overcome this limitation, an archival analysis is performed to further substantiate the findings of the case study. This archival analysis draws on the theoretical argument that dynamic capabilities exhibit commonalities across firms, which can be referred to as "best operational practices" (Eisenhardt and Martin, 2000; Barreto, 2010). To identify the commonalities exhibited in dynamic capabilities for corporate sustainability, the archival analysis investigates the CSR reports of 64 world-leading companies in the last five years. The relevant finding supports the conclusion of the case study by proving that the common organizational processes, routines and functions underlying dynamic capabilities for corporate sustainability really exist across various industrial sectors and geographic regions. More importantly, these identified common processes are going to be adopted as a reference to empirically justify the robustness of the measurement items that are going to be tested in the SEM model in the following quantitative study.

Third, to answer the explanatory question of "to what extent inter-firm knowledge transfer between supply chain partners positively impacts the development of firm's dynamic capabilities for corporate sustainability", a SEM analysis based on a large-scale survey is carried out to test the hypotheses proposed by the theoretical framework introduced in Section 2.10.4. In this analysis, the common organizational functions and processes underlying dynamic capabilities for corporate sustainability, which are concluded in the above case study and archival analysis, are used to verify the empirical soundness of both the measurement items and the theoretical constructs of the SEM model.

In short, the lineage of the above three research methods, namely case study, archival analysis and quantitative survey study, follows a sequential logic. Initially, the case study paves the way to explore the internal operational mechanism of dynamic capabilities deployed by the firm to achieve corporate sustainability. Then the archival analysis generalizes the case study's finding by identifying the common organizational processes supporting dynamic capabilities for corporate sustainability. Finally, the measurement items and the theoretical constructs, which are verified against the findings of both the case study and the archival analysis, are estimated in the SEM analysis in the quantitative study.

3.6 Research Design for the Qualitative Study Stage

Research design is a detailed action plan before the actual field work. It should delineate clearly how a researcher intends to collect the data, and why certain methods or tools are proposed to collect the data. Research design should be consistent with the research philosophy and research methods adopted by the researcher (Saunders *et al.*, 2009).

At the qualitative study stage, to answer the “what” question, i.e. what are the constructs and micro-foundations underpinning the dynamic capabilities for corporate sustainability, both a case study and an archival analysis are performed. The case study of a world-leading telecommunications company is firstly carried out with the aim to provide an illustration and more in-depth understanding of the way dynamic capabilities can help firms to make more effective strategic change toward sustainability. However, the inclusion of only one sample case means that the research outcome is limited in generalizability.

To overcome this limitation, the following archival analysis of the CSR reports of world-leading companies aims to identify the common sustainable best practices exercised in these companies. As observed by Eisenhardt and Martin (2000), dynamic capabilities exhibit commonalities across firms. These commonalities are referred to as “best practices” (Eisenhardt and Martin, 2000). Drawing on this view, it is reasonable to argue that companies will also have commonalities in their dynamic

capabilities for corporate sustainability. These commonalities exist because firms follow multiple, but similarly effective ways in dynamic capabilities execution (Barreto, 2010). Alternatively stated, although the dynamic capabilities possessed by different firms are idiosyncratic in detail, overlapped key features can always be identified in terms of organizational processes or routines (Eisenhardt and Martin, 2000). Even though these similarities may be limited, they do exist because of the similar external requirements or the mobilization of similar organizational resources.

To identify what are the commonalities, the CSR reports of world-leading enterprises are analyzed to find out the common best practices adopted to change their existing operations for corporate sustainability. These commonalities also form the basis to develop a framework to explicate the key elements underpinning the dynamic capabilities for corporate sustainability.

In the following, Section 3.6.1 and Section 3.6.2 discuss the role of case study in the research, and how the case company is chosen and the relevant data are collected and analyzed. Then Section 3.6.3 and Section 3.6.4 explain how the CSR reports of world-leading companies are selected and investigated in the archival analysis.

3.6.1 Case Study - Case Selection

Guided by the research questions showed in Section 1.3, an in-depth, qualitative case study approach is proposed because the theoretical underpinning of the dynamic

capabilities focusing on corporate sustainability is still at its early stage (Eisenhardt, 1989). The use of a qualitative case study is suitable because it is consistent with the argument that dynamic capabilities are embedded in a firm's tacit routines and processes (Eisenhardt and Martin, 2000; Zollo and Winter, 2002), and thus difficult to be identified through quantitative research. The case study is not meant to empirically test the conceptual framework and make generalizable conclusions, but rather to provide an illustration and more in-depth understanding of the way dynamic capabilities can help firms to make more effective strategic change toward sustainability.

In the case study, the world-leading telecommunications company, Huawei Technologies Co., Ltd. is selected for three main reasons. First, the telecommunications sector, in which Huawei operates, is a typical technology-intensive industry. Huawei's high-tech background makes it a suitable example for investigating how firms develop new technology solutions to emerging sustainability requirements. Second, Huawei is a fast-growing company, having developed from a small, domestic Chinese company to one of the world-leading operators in telecommunications industry. The environmental shift experienced during the company's rapid development indicates that Huawei is more likely to develop dynamic capabilities to cope with external changes (Zollo and Winter, 2002; Winter, 2003). Third, the business environment of telecommunications sector is changing rapidly. To achieve business success, Huawei is more likely to have superior abilities

to identify potential business opportunities and quickly respond to the external market changes. Therefore, the study of Huawei will provide more insights into the possible role of a firm's capability to identify business opportunities from the growing external pressure for sustainable development.

3.6.2 Case Study - Data Collection and Analysis

The case study collects data from documentary research (analysis of third-party analysis and Huawei's annual reports, sustainability reports, and sustainability newsletters), and seven short telephone interviews with relevant managers from Huawei. The purpose of the documentary research is to investigate Huawei's strategic objectives, missions, and main approaches to sustainable development. The purpose of the interviews is to obtain in-depth information to verify the social and environmental initiatives and practices documented by the company. These interviews also aim to investigate how the managers and employees understand and react to the organization's strategic change for sustainable development.

3.6.3 Archival Analysis - Data Collection

For the archival analysis, the CSR reports of world-leading companies are used as the main source to identify the common best practices in corporate sustainability. The reason is twofold. First, the published CSR reports normally contain latest sustainability initiatives and practices that companies wish to report to the public

(Gary and Milne, 2002; Porter and Kramer, 2006). Although it could be argued that CSR reports may include more of good practices rather than failures (Porter and Kramer, 2006), CSR reports can still reflect up-to-date sustainability focuses of modern companies. Second, CSR reporting is increasingly adopted by leading companies around the world, and thus becomes an appropriate proxy to examine the potential commonalities in the corporate sustainable practices applied across various industrial sectors and nations.

To ensure that CSR reports are extracted from representative companies in industries, the candidate companies for the analysis are chosen from the top ones that are listed in FTSE4Good Index and Dow Jones Sustainability Index (DJSI). FTSE4Good and DJSI are two major socially responsible investing indices that receive prominent public acceptance (Chatterji and Levine, 2006). These two indices are considered as the most comprehensive and up-to-date ones which cover various CSR performances of contemporary companies.

Initially, 114 companies, 46 from FTSE4Good and 68 from DJSI, are short listed based on their reputations and influence in the sector. 43 companies are listed in both of these two indices, so when the lists are combined totally 71 companies are included in the short list. These sample companies are then organized based on industrial sectors and geographic regions. It is worth noting that FTSE4Good and DJSI use quite different ranking criteria (Porter and Kramer, 2006). This allows the researcher to

examine a wide array of CSR strategic focuses and activity patterns of the listed companies in these two renowned indices.

Once the candidate companies are identified, the availability of their CSR reports is checked at both the companies' official websites and corporateregister.com (CorporateRegister, 2012). The CSR reports of these companies are then evaluated for completeness and relevancy. 64 companies are finally selected for the analysis because the complete current CSR reports can be obtained from these companies. The selected companies are based in three major geographic regions: America, Europe and Asia. These companies come from eight industrial sectors: Industrial Goods, Consumer Goods, Materials, Technology, Telecommunications, Oil and Gas, Healthcare and Finance. The wide spread of regions and industrial sectors of companies ensures the representativeness of the sample and enhances generalisability of the analysis.

3.6.4 Archival Analysis - Data Analysis

Archival analysis is used to examine the common best practices identified from these CSR reports. Archival analysis is particularly useful to systematically evaluate the themes of recorded communication (Kolbe and Burnett, 1991). It allows researchers to synthesize texts with a large number of words into several key themes (Stemler, 2001). In the archival analysis, three researchers with substantial knowledge of corporate sustainability and CSR are involved. First, one researcher reads through the

CSR reports of the selected companies to identify the common practices that can be related with the dynamic capabilities for corporate sustainability, and condenses these practices into several key organizational processes. Second, the second researcher verifies the practices and processes concluded by the first researcher, and categorizes them under the three dynamic capabilities for corporate sustainability, namely scanning, sensing and reconfiguration capabilities. Third, the categorization structure proposed by the second researcher is reviewed independently by the first researcher and the third researcher. These two researchers are asked to evaluate the consistency and relevancy of the key categories. They are also asked to propose alternative ways of categorization. Fourth, the evaluation results are then reported to the second researcher, who then identifies and compares the major areas of the inconsistencies, and makes changes to the categorization accordingly. Fifth, this revised categorization structure is reviewed again by the first and the third researcher to identify any further inconsistencies. In the end, after three rounds of reviewing and correction more than 90 percent of consistency is achieved among the three researchers. Thus the interrater reliability is established (Carol *et al.*, 1979).

3.7 Research Design for the Quantitative Study Stage

At the second stage, the test of the theoretical framework developed in the research needs a quantitative research approach. Such a strategy enables the researcher to empirically justify the research hypotheses which are generated mainly from existing

literature in the areas of DCV, corporate sustainability and inter-firm knowledge transfer in sustainable supply chain management. Focusing on a deductive approach, quantitative research method uses numerical analysis to test the relationships amongst various theoretical constructs (Bryman and Bell, 2007; Creswell, 2009). This strategy is typically useful in hypotheses testing (Patton, 1990; Creswell, 2009).

In the following, three key elements involved in quantitative study, namely unit of analysis, target population and sampling frame are firstly discussed in Section 3.7.1, Section 3.7.2 and Section 3.7.3. Then based on the above analysis, Section 3.7.4 and Section 3.7.5 respectively introduces the sampling strategy and survey method that are going to be used in the research. The validity and reliability of the survey are considered in Section 3.7.6.

3.7.1 Unit of Analysis

The unit of analysis is the major entity to be analyzed in a study (Creswell, 2009). Defining a unit of analysis in the research not only can clarify an investigation phenomenon for data collection and analysis (Barratt *et al.*, 2011), but also make explicit the linkage between the research objective and the generalization of a broad body of knowledge (Barratt *et al.*, 2011). In social science studies, typical units of analysis include individual employees, business units, organizations and dyadic relationship between buyers and suppliers (Forza, 2002). Choosing an appropriate unit

of analysis from these options depends on the presetting research objective and questions (Creswell, 2009).

The research focus of the study is on the organizational dynamic capabilities in the context of corporate sustainability, it is thus evident that the unit of analysis should be at the firm level. However, given that inter-firm knowledge transfer between supply chain partners is also considered in the study, the dyadic relationship between buyers and suppliers seems necessary to be included as well. To balance these two different requirements, the survey questionnaire for the research establishes a unique section setting which can be divided into two parts (as indicated in Chapter 2). In Part One, the respondents are asked to answer the questions regarding the knowledge transfer with their biggest *customer*; In Part Two, the respondents are asked to answer the questions regarding the knowledge transfer with their biggest *supplier*. Such a setting enables the researcher to observe the knowledge transfer between suppliers and customers from the perspective of focal firms.

When choosing the firm as the unit of analysis, an additional consideration is whether the opinions of the respondents can truly reflect the situation of the whole organization. Especially if only one informant represents the respondent company, his own perception may not fully indicate the real proposition of the company (Tornatzky and Klein, 1982). The questionnaire takes two steps to address such a limitation. First, it follows the key informant method to target only at middle and

senior-level managers as respondents (Chau and Tarn, 1997). Second, to reduce the informant's bias, the questionnaire clearly indicates that the respondents, when answering questions, should consider his or her company's situation, rather than their own perspective.

3.7.2 Target Population

Population represents the entire pool of units of interest from which a sample is statistically selected (Bryman and Bell, 2007). Typical population in social science include group of companies, communities, individuals, associations, colleges, etc. (Zikmund, 2003). The target population of the research is mainly manufacturing and logistics firms in the U.K. which are represented by their senior managers. Because the topic of the research is related with organizational capabilities, supply chain and inter-firm knowledge transfer, ideally the respondent managers should be decision makers across various functions such as corporate strategy and development, operations/project management, and purchasing/logistics/supply chain management. The demographic information of the respondents, such as job title, working experience, company type/size and industrial sectors are very relevant for the research purposes.

3.7.3 CILT UK's Environment & Sustainability Forum as the Sampling Frame

A sampling frame is needed when considering entire population in this research is impractical or too costly and time-consuming (Zikmund, 2003). A proper sampling frame which correctly reflects the characteristics of the target population is an important factor to the success of any research (Baker, 2002). In this research the registered professional members in Chartered Institute of Logistics and Transport (CILT UK) Environment & Sustainability Forum is selected as the sampling frame. The reason is fourfold. First, founded in 1919, CILT now becomes a recognized world-leading professional body representing the professionals working mainly in the fields of supply chain, logistics and transport. Its professional membership background in supply chain field is especially suitable for the research setting. Second, the professional members of CILT are not restricted in logistics or transport industries, but in all major industrial sectors, such as manufacturing, high-tech, power, aviation, energy and oil/gas. Such a diversified distribution across various industrial sectors greatly improve the generalizability of the research findings. Third, compared with some general online business databases such as FAME, the membership database of CILT is not an open source and the access requires official authority. However, this also means that relevant data are more likely to be generated from verified members. In fact, during a joint research event organized by one of my PhD supervisor, 15 senior CILT members were involved in the pilot study (in the form of focus group) of the research and provided valuable suggestions to measurement items development and questionnaire design. Also under their support the researcher gained access to

CILT's database. Fourth, there are 16 forums included in CILT UK which offer members the opportunity to connect and network with like-minded professionals facing similar issues and challenges, such as outsourcing and procurement, lean business process and manufacturing leadership. From them the Environment & Sustainability Forum is decided to be the selected sampling framework. Because sustainability has been recognized as a critical issue for businesses worldwide, this forum is an increasing growing one and until to 2013 its registered number is about 2500. The purpose of the forum is to support awareness of the critical importance of sustainability through promoting new thinking and research, sharing best practices, highlighting regulatory issues, and linking subject matter experts in business, government, academic and NGO organisations. The topics of the forum concentrate on various contemporary sustainability issues such as resource availability risks and ecosystem degradation, and new sustainable business and supply chain models. The background and focus of CILT UK's Environment & Sustainability Forum ensure that its members possess sufficient knowledge regarding corporate sustainability and sustainable supply chain management and thus become suitable survey respondents.

3.7.4 Sampling Strategy

A large variety of sampling techniques are available for social research which can be divided into two main categories: probability based and non-probability based sampling (Bryman and Bell, 2007). Major probability sampling techniques include simple random sampling, stratified random sampling, and multi-stage sampling

(Sekaran, 2000). Typical non-probability sampling methods are quota sampling, convenience sampling, purposive sampling, and snowball sampling (Sekaran, 2000; Bryman and Bell, 2007). The choice of an appropriate sampling method from various available options is crucial for the survey research design (Schindler and Cooper, 2003; Bryman and Bell, 2007). A proper sampling method should consider the realistic research setting in terms of time, financial resources and limited access to all potential participants, and also ensure that the pattern of the sampling data correctly represents the general attributes of the targeted population, so as to justify the validity of the statistical results (Schindler and Cooper, 2003; Bryman and Bell, 2007; Saunders *et al.*, 2009).

Among the above sampling techniques, simple random sampling is selected as the most suitable one for the current research setting. This selection considers both the advantages and disadvantages of simple random sampling technique. On the one hand, the main advantage of simple random sampling is that the individual sample case from target population has an equal probability of being chosen (Saunders *et al.*, 2009). The samples chosen through such an approach are free from classification errors and researcher's bias, and thus bear the greatest potential in highly representing the population for external validity (Saunders *et al.*, 2009). On the other hand, the critique of simple random sampling is that, although this technique is much more reliable than other sampling methods in approximating the general population, it should consider the extra cost and time involved, and whether the sampling list of the

whole population is available or not (Bryman and Bell, 2007). However, as explained above, the chosen CILT's database is an appropriate sampling frame in terms of both suitability and diversity. In addition, the official permission of the access to this database enables the researcher to complete the research process in designed time frame.

3.7.5 Questionnaire Survey as Data Collection Method

For a quantitative study, multiple fieldwork research methods exist such as laboratory experimental research, field experiments research and questionnaire survey (Crotty, 1998; Creswell, 2009). Among them questionnaire survey method gains increasing popularity in management studies (De Horatius, 2011). Through various approaches, such as telephone interviews, mailed questionnaire or online questionnaire, this survey method can efficiently collect data from a large size of samples in a cost effective way (Saunders *et al.*, 2012). Then the data can be analyzed through various statistical tools (Creswell, 2009). Questionnaire survey method is found to be appropriate for the data gathering at the quantitative study stage due to the following two reasons.

First, questionnaire survey method follows a set of structured research questions to collect data, and use them to analyze the correlated occurrences of proposed hypotheses in a natural setting with a large population (Gill and Johnson, 2010). Since one of the main objectives of the research is to test the relationship hypotheses

between knowledge transfer and the development of dynamic capabilities for corporate sustainability, questionnaire survey method is an appropriate method for collecting the data through a well-defined, organised tool (Pinsonneault and Kraemer, 1993).

Second, according to Zikmund (2003), questionnaire survey method is a fast, simple, and economical approach to evaluate the information related to the population targeted. It also gives considerable control over cost and time, and the findings could be generalised to the larger population through appropriate sampling techniques and standard information examination (Gill and Johnson, 2010).

3.7.6 Validity and Reliability of the Survey Study

Validity and reliability are two key dimensions that a researcher should follow to estimate the trustworthiness of the research (Creswell, 2009). While validity is about the extent to which the measurement process of concepts can reflect real situation, reliability refers to the consistency and suitability of this measure process (Gill and Johnson, 2010; Bryman, 2012).

In terms of validity, three aspects should be considered: construct validity, internal validity and external validity (Robson, 2002). Construct validity emphasizes the fit between conceptual constructs and the matched measurement items (Robson, 2002).

To justify the construct validity of the research, certain steps are performed according

to Bryman (2012). First, a detailed literature review is undertaken with rigor to make sure that the conceptual constructs involved in the theoretical framework are sufficiently supported by relevant theories. Second, both a case study and an archival analysis are performed in the qualitative study stage to verify the underlying micro-foundations of dynamic capabilities for corporate sustainability. Third, most of the measurement indicators used in the questionnaire survey are constructed based on the validated variables already applied in previous empirical studies. Fourth, in the research nine academic researchers in the area of management study participate into evaluating and comparing the measurement items under different conceptual constructs, and approximately 80% similarity rate is reached through a small-scale delphi method test. Fifth, various statistical tests at the data analysis stage are performed to justify the measurement power of external observable indicators on latent variables.

Internal validity is concerned with how well certain explanation, compared with other options, can best illustrate the causal relationship between conceptual constructs (Robson, 2002). The study setting of the research improves its internal validity in three ways. First, the causal relationship between conceptual constructs hypothesized in the theoretical framework are strongly theory driven. The importance of inter-firm knowledge transfer in the development of organizational dynamic capabilities are not only recognized by various theoretical views such as RBV, NRBV, KBV and DCV, but also supported by empirical studies (e.g. Min and Galle, 2001; Aragon-Correa and

Sharma, 2003; Modi and Mabert, 2007). Second, before the main survey, a triangulation method is performed in which both academic researchers and professional practitioners are involved to justify the consistent relationship of the conceptual constructs as well as the appropriateness of related measurement indicators, by ruling out other options. Third, appropriate statistical control and trimming methods are used in the data analysis stage to rule out unrelated measurement indicators and research hypotheses.

External validity refers to how well the research findings and explanations can be applied to other contexts (Bryman, 2012). To improve the external validity of the research, a large-scale survey is carried out in the professional members of CILT UK across various industrial sectors. The outcome of the research is thus not restricted in one organization or a single industrial sector, but has the potential to be applied to a much more generalized setting.

Reliability refers to the consistency of the measurements to test concepts (Bryman, 2012). Two main aspects should be considered in terms of reliability, namely internal reliability and external reliability (Bryman 2012). On the one hand, internal reliability emphasizes whether the measurement items under the same construct are consistent with each other (Bryman 2012). To ensure internal reliability Cronbach test is performed in data analysis. On the other hand, external reliability concerns about the extent to which different observers provide consistent estimates of the same

phenomenon (Bryman 2012). In the research, before the main survey a triangulation method is performed by which the measures are further revised according to the suggestions of both academic researchers and professional practitioners.

3.8 Ethical Considerations

The researcher should comply with the relevant ethical regulations throughout the research process (Saunders *et al.*, 2009). Sufficient ethical consideration before, during and after the data collection process will increase the consent and cooperative attitudes of the respondents (Zikmund, 2003). Based on Zikmund's (2003) suggestions, five prevention measures are carried out at both the qualitative and quantitative study stages during the research.

- 1) A formal statement is given in the invitation email to the respondents in advance, which outlines the purpose of the study, and the process of the data collection, analysis and storage. The aim of the statement is to clarify to respondents that all the data obtained are only used for research purpose and will be safely stored under the research and confidentiality regulations of the University of Bedfordshire.

- 2) Before the interviews and the questionnaire survey, all respondents are informed that the data collection is completely based on respondents' voluntary willingness.

And the respondents have the right to withdraw from the study at any time during and after the data collection. In this case his or her data will be deleted accordingly.

- 3) Before the interviews and the questionnaire survey, all respondents are informed that their private information will be protected and will not be disclosed to third parties without prior consent.
- 4) Before the interviews and the questionnaire survey, all respondents are informed that the collected data related with sensitive business information will be protected and will not be disclosed to third parties without prior consent.
- 5) Before the interviews and the questionnaire survey, all respondents are informed that their views will not be distorted, misinterpreted, misquoted or misused in any time during the research.

3.9 Outline of the Research Process

Figure 3.1 gives the summary of the main research approaches and process involved in the study. Guided by the initial research ideas, the researcher carries out an extensive literature review in all major relevant fields, especially the areas of DCV, corporate sustainability and inter-firm knowledge transfer in sustainable supply chain

management. The outcome of the literature review is twofold. First, the conception of dynamic capabilities for corporate sustainability is proposed and disaggregated into three sub-capabilities, namely scanning, sensing and reconfiguration capabilities. The functions of these three sub-capabilities are discussed as well. Second, an initial theoretical framework is proposed with related hypotheses regarding the relationship between inter-firm knowledge and the development of dynamic capabilities for corporate sustainability.

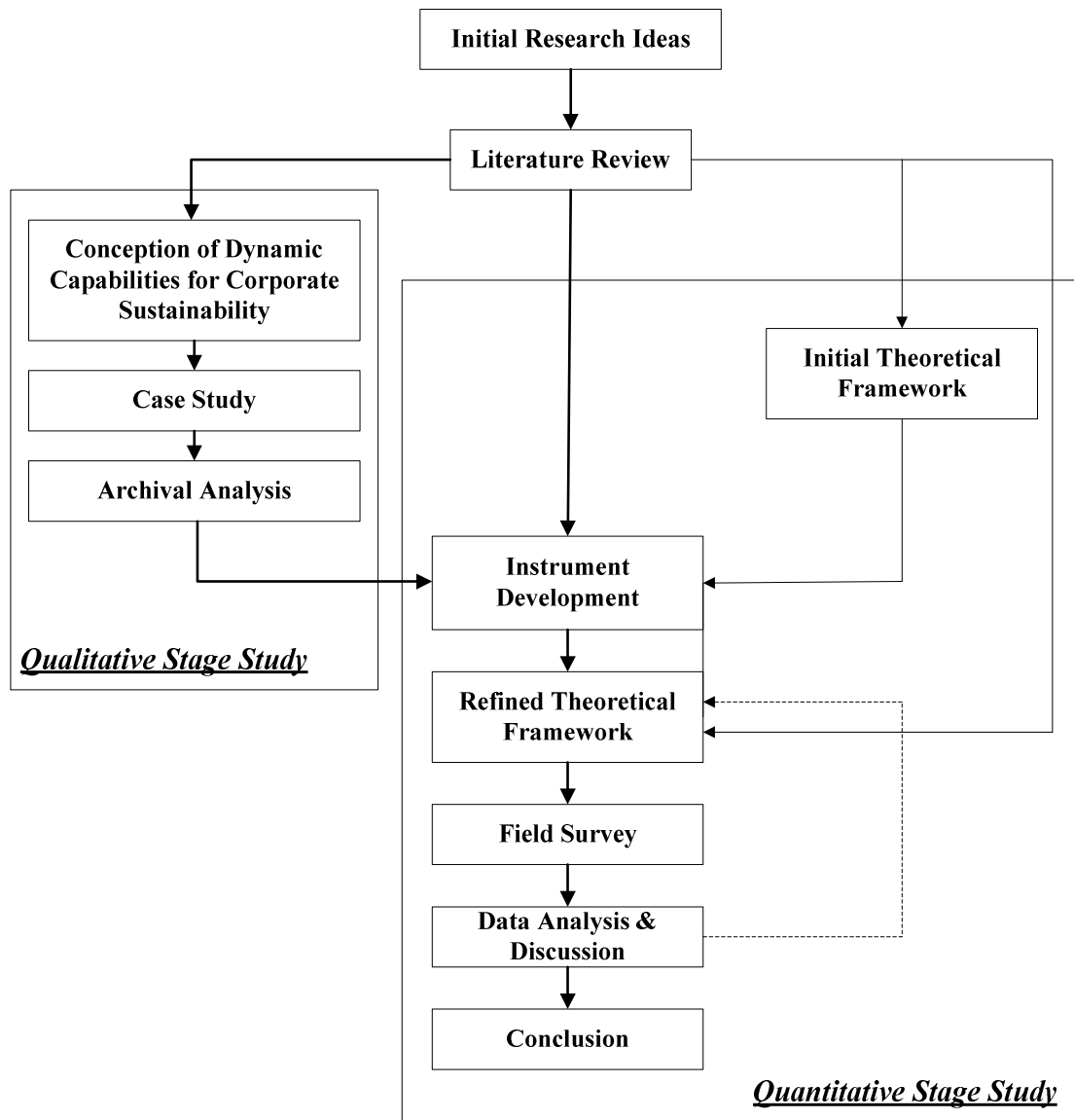
Then the researcher performs a case study and an archival analysis, to empirically substantiate the constructs and micro-foundations of dynamic capabilities for corporate sustainability. The second purpose of the qualitative study is to use the empirical findings to develop or justify the refined theoretical framework and instruments that are going to be used in survey questionnaire.

Before the field survey, a triangulation method involving both academic researcher and professional practitioners, is applied to pre-test the measurement items. Then the survey questionnaire is developed accordingly. The detailed work in triangulation and survey questionnaire development is explained in Chapter 5.

In the field quantitative study, data are collected from the professional members of CILT's Environment and Sustainability Forum. Based on the collected data, the proposed research hypotheses and theoretical framework are tested using a Structural

Equation Model (SEM). Finally, conclusions are provided based on a complete data analysis and discussion.

Figure 3. 1 - Summary of the Research Approaches and Process



3.10 Chapter Summary

Based on a Post-Positivism philosophical stance, this chapter justifies why both qualitative and quantitative studies, as a mixed methods approach, should be applied to the research. The detailed research methods that are going to be used are concluded as well. In the end, the research design rationales at both qualitative and quantitative study, and the outline of the two-stage research process are explained.

Chapter 4 will discuss the findings of the qualitative study, which is followed by the explanation of the survey construction and implementation in Chapter 5.

CHAPTER 4 - UNDERSTANDING DYNAMIC CAPABILITIES FOR CORPORATE SUSTAINABILITY: A QUALITATIVE STUDY

4.1 Introduction

The aim of this chapter is to explore the underlying key practices, process, and functions of dynamic capabilities for corporate sustainability through qualitative studies. The chapter is mainly composed of two sections. Section 4.2 discusses the findings of the case study, and Section 4.3 discusses the findings of the large-scale archival analysis.

4.2 A Case Study of Huawei and Key Findings

This section begins with the introduction to the background of the case company, Huawei Technologies. Then the main aspects of Huawei's sustainability strategy and the related dynamic capabilities are analyzed. Based on this analysis the six major functions involved in Huawei's dynamic capabilities for corporate sustainability are discussed.

4.2.1 Background of the Case Company

Huawei is a telecommunications equipment manufacturer and ICT service provider headquartered in Shenzhen, Guangdong Province of China. It was established in 1988 as a small distributor of private branch exchange (PBX) switches. Through drastic international expansion since the late 1990s, the company has already become the world's largest telecommunications equipment provider with products and services provided in over 170 countries and to more than one-third of the world's population (Huawei, 2006, 2015).

Huawei's fast development is rooted in its unique competitive strategy that focuses on customers' market challenges by providing low-cost, high-value-added telecom solutions and service. Huawei does not pursue a strategy of technology leadership. Based on its matured R&D platform, Huawei's customer-centered innovation strategy concentrates only on the technologies that can quickly be transformed into customer value. This unique competitive strategic position compared with its major competitors, such as Ericsson and Lucent-Alcatel, is supported by the company's specific core competences. First, the long-term marketing orientation enables Huawei to quickly sense and satisfy customers' requirements. Second, as a technology follower, Huawei focuses on the application of technologies, rather than their originality and advancement. Such a strategy provides Huawei with more chances to drive its innovations into real business opportunities. Third, as a fast-growing company,

Huawei has accumulated valuable experience and capabilities in change management, which leads the company to a better position to cope with external challenges.

4.2.2 Main Aspects of Huawei's Strategic Change towards Sustainability

Huawei's sustainable change is in correspondence with its rapid international expansion. When the company was still a small company, sustainable issues was not a strategic concern. However, after 2001, the various sustainable challenges encountered by Huawei in different regional markets led the company to put sustainable development as one of its strategic priorities. Huawei focuses its corporate strategic change towards sustainability on six main areas to identify and seize the opportunities of simultaneously conferring environmental, social and economic benefits to the society: (1) bridging the digital divide; (2) environmental protection; (3) enhancing supply chain management; (4) community support; (5) caring for employees; and (6) fair operation.

4.2.2.1 Bridging the Digital Divide

Despite the rapid evolution of ICT technologies, there are still major gaps in receiving ICT services between people in developed countries and those living in low-income and remote regions. The perceived communication and information-access gap between different geographic regions is known as the digital divide (Compaine, 2001).

Satisfying the basic human needs of communication in less-developed countries / regions has become a prominent sustainable issue.

Huawei viewed this sustainable challenge as its new development opportunity. The company established its sustainable strategic vision as bridging the digital divide to promote the sustainable development of the economy, society, and environment of target countries. As remarked by a vice president of Huawei:

“Bridging the digital divide is our company’s sustainable strategic focus because we always believe that Huawei’s success can only be built on the success of our customers and the society.”

Due to the poor telecommunications infrastructure and low average-revenue-per-user (ARPU) rates in less-developed countries, providing ICT services in those areas is normally considered as not economically viable. However, recognizing its cost advantage and the long-term market potential in developing countries, Huawei provided various customized solutions to ensure commercial success for the local telecommunications operators in developing countries (see Table 4.1).

Table 4. 1 - Selected Cases of Huawei’s Sustainable Telecommunications Solutions

Year	Region	Solution	Sustainable Benefit
2008	Pakistan	Village Connection Solution	Reduced operating costs and improved network coverage

2008	Mali	ADSL technology-base Internet access services	Bringing over 6,000 previously un- served families into internet network
2008	Guinea	CDMA WLL wireless access solution	Extended telecommunications services to almost two million users in rural areas,
2009	South Africa	EasyGSM BTS technology	Reduced electricity use
2010	Bangladesh	SingleRAN solution	Low-cost mobile broadband service
2010	Peru	ATCA-based CDMA Mobile Softswitch Solution	Simplified telecommunications network architecture and reduced operating expenditure

Source: Huawei (2010b)

As a result, Huawei quickly increased its international market penetration in developing regions, such as Africa, South America, Middle East and Russia. By 2005 Huawei's overseas sales reached 4.76 billion U.S. dollars and already surpassed its domestic sales (Huawei, 2006). Furthermore, Huawei's experience in providing sustainable telecommunications solutions also facilitates the company's entry into European telecommunications markets such as Germany, Spain, France, Italy and UK. By 2011, Huawei's overseas sales revenue is about 22 billion U.S. dollars and doubles its domestic income (Huawei, 2011). Obviously, Huawei's dedication to bridging the digital divide reinforces its competitive position in international markets.

4.2.2.2 Environmental Protection

When Huawei was a local company based on Chinese telecommunications market, environment protection is not the strategic consideration of the company. But when Huawei rapidly became a global enterprise, the increasing external pressure required the company to monitor and manage emerging environmental issues. Huawei thus established a comprehensive environment management system and adopted the life cycle analysis (LCA) approach to systematically analyze the environmental impact caused by its business operations in the entire value chain. The analysis suggested that Huawei needed to focus on two environmental issues to drastically reduce energy consumption and emission release: green product and green logistics.

For green product issue, Huawei actively communicates with customers about energy saving and environmental protection measures, and closely collaborates with the business partners across the value chain to build an energy-efficient telecom network. The company regards environmental performance as one of the most important measurement criteria for evaluating product quality during product design and manufacturing. For this purpose, Huawei has incorporated certification standards for green products into its integrated product development (IPD) process, which covers all aspects of energy efficiency, weight, packaging, harmful substance, recycling, noise and electromagnetic performance of products (Huawei, 2010b). Today all

products of Huawei have achieved more than 30% energy savings compared to traditional solutions in the industry (Huawei, 2008).

For green logistics, Huawei has already optimized its end-to-end logistics model in 129 countries across five continents. Through this approach, it is expected that 2,090,000 tons of CO₂ emissions will be reduced and the cost of 4.3 million U.S. dollars can be saved each year (Huawei, 2008). In addition, Huawei also initiated a 6Rs1D packaging strategy, namely, right design, reduce, returnable, reuse, recycle, recovery and degradable, resulting in a reduction of annual timber usage by 6,100 cubic meters and carbon emissions by 12,000 tons (Huawei, 2008).

4.2.2.3 Enhancing Supply Chain Management

Along with its international expansion, Huawei gradually realized that its supply chain partners, if poorly managed, might become a source of potential sustainable risks. Huawei thus established a supply chain Corporate Social Responsibility (CSR) management system to define organizational responsibilities, improve supply chain processes and policies, develop supplier CSR agreements, and manage the capability of suppliers for sustainable development. Huawei also built a dedicated supplier CSR department for supplier CSR risk management, designing and reinforcing supplier CSR certification and audit, and providing CSR training and skill enhancement.

Through supplier CSR risk assessment, Huawei periodically reviews and classifies the CSR risk levels of its 670 key suppliers worldwide and mitigates the potential risks by ensuring that the suppliers meet the pre-defined CSR requirements (Huawei, 2010b). Once high-risk CSR problems are identified, Huawei will assist the relevant suppliers to correct their unsustainable actions under the supplier corrective action request tracking and management system. Moreover, Huawei's supplier CSR department has introduced a Green Partner Program to certify its suppliers. The objective of this green certification is to ensure that all parts and materials purchased by Huawei meet environmental protection laws, regulations, and customer requirements. By 2010, 31 suppliers passed the certification and became Huawei's green partners (Huawei, 2010b). In addition, the company also concentrates on the development of CSR knowledge and skills of its procurement buyers and team leaders. By 2010, 140 procurement engineers have obtained CSR internal auditor qualification, and over 100 engineers have received the SA8000 internal auditor certificates (Huawei, 2010b).

4.2.2.4 Community Support

Huawei believes that support for local communities is not just philanthropic, but also a chance to strengthen the company's future competitiveness. For example, Huawei is keen to support the telecommunications education in local communities. Huawei has already established 36 training centres and over 20 R&D centres worldwide to develop local telecom engineers and scientists (Huawei, 2010b). These activities not

only benefit many communities, but also help Huawei to recruit more telecom talents worldwide.

Huawei's support to local communities is also represented by the company's commitment to the restoration of telecommunications networks during crisis. When communications are disrupted in disasters, for example in 2008 Sichuan earthquake in China, Huawei's service team is always one of the first to arrive at the scene for repairing and recovering communications services. Huawei's quick response to the crisis not only helps the local people to receive reliable telecommunications service in the critical time, but also enhances the company's image of being a responsible corporate citizen.

4.2.2.5 Caring for the Employees

Huawei always regards its human resource as the company's foundation of sustainable development. As remarked by Huawei's CEO, Mr. Ren Zhengfei:

“Our employees are the most valuable treasure. Even a fire can burn all tangible assets of the company, with these employees, I can rebuild a new Huawei soon.”

Huawei used to only focus on ensuring a competitive salary level of its employees. But this narrow mindset has been revised during the company's strategic change towards sustainability. Now Huawei has introduced more comprehensive measures

for employee's well-being in terms of diversity, compensation and benefits, safety and healthcare, communication, and career path and growth. By the end of 2010, Huawei has over 110,000 employees in 150 countries. The localization rate of employees in Huawei's overseas subsidiaries is about 69 percent (Huawei, 2010a). In daily operations, the employees can exchange ideas with their direct supervisors or the managers at higher levels through various open communication channels including president mailbox, bulletin board system (BBS), and formal complaint procedure. Moreover, Huawei also provides a dual career path for its staff with the intention to maximize growth opportunities for every individual. An employee can choose his/her career objective as a manager or technology expert. These measures significantly improve the employees' morale, satisfaction, productivity, and creativity.

4.2.2.6 Fair Operation

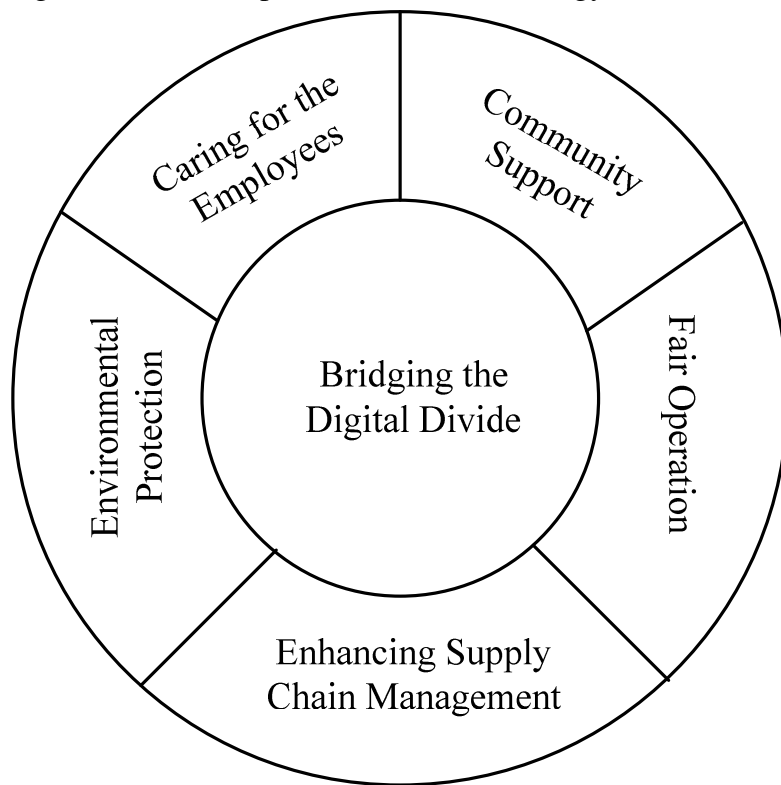
During its fast international expansion, Huawei encountered various unexpected cultural and ethical belief conflicts. This issue became more serious when Huawei entered the telecommunications markets in developed countries. According to a manager of Huawei:

“When we firstly contacted with British Telecom, we knew nothing about the way people are doing business in the U.K. We found that our familiar way of doing business were useless or even against the business practices here. We had to learn from zero.”

The ethical concerns become a new challenge of Huawei's sustainable development. Therefore, the company incorporates the principle of fair operation into its core sustainable strategy. Huawei's fair operation principle aims to keep a fair and honest business environment through developing guidelines for the employees to maintain professional conducts according to the regulations and ethical standards in the local markets.

Overall, it is important to note that the six strategic aspects of Huawei's sustainable development are closely linked as a whole. The strategic focus, bridging the digital divide, is the central mission of the company's sustainable change, because this focus represents the company's core strategy to provide tailored, high value-added solutions to customers' needs. Other five aspects support this central focus and address the related sustainable issues from various dimensions (see Figure 4.1).

Figure 4. 1 - Six Aspects of Huawei's Strategy towards Sustainability



4.2.3 The Dynamic Capabilities for Huawei's Sustainable Change

Although Huawei's distinctive strategy and competences were primarily used to drive its economic success, the company quickly updated them to support its sustainable development. Huawei's sustainable development is a profound change covering almost all major organizational functions, such as R&D, marketing, manufacturing, logistics, human resource, and supply chain management. This effective move towards sustainability is rooted in the company's deployment of dynamic capabilities to drive this strategic change.

4.2.3.1 Huawei's Scanning Capability

One of the superior capabilities of Huawei exhibited during its strategic change towards sustainability is to quickly sense and respond to emerging external needs. This capability is one of the key driving forces behind the company's business success. Huawei also applies this capability during its development of sustainable business strategy, while the scope of concern has been extended to include the views and concerns of various stakeholders.

Based on AA1000 Stakeholder Engagement Standard¹, Huawei systematically categorizes its various stakeholders into eight major interest groups: business customers, end consumers, governments, industry and standards associations, industry peers, suppliers, non-government organizations (NGOs), and employees. The company has established different long-term communication channels with these interest groups, and used various approaches to ensure accurate understanding of their environmental and social concerns.

After scanning and categorizing the sustainable concerns of different interest groups, Huawei uses a matrix approach to evaluate and compare the impact of these concerns on the company's strategy and operations according to six principles: responsibility, influence, proximity, dependency, representation, and policy and strategic intent

¹The AA1000 Stakeholder Engagement Standard is an open-source framework designed by AccountAbility Organization to provide a basis for designing, implementing, evaluating and assuring the quality of stakeholder engagement.

(Huawei, 2010b). The purpose is to identify the most significant concerns and define the level of priority of those external requirements.

4.2.3.2 Huawei's Sensing Capability

Huawei is outstanding in its capability to identify potential opportunities and risks from emerging environmental and social concerns, and develop the most feasible solutions to meet the intersection between environmental, social, and its business interests.

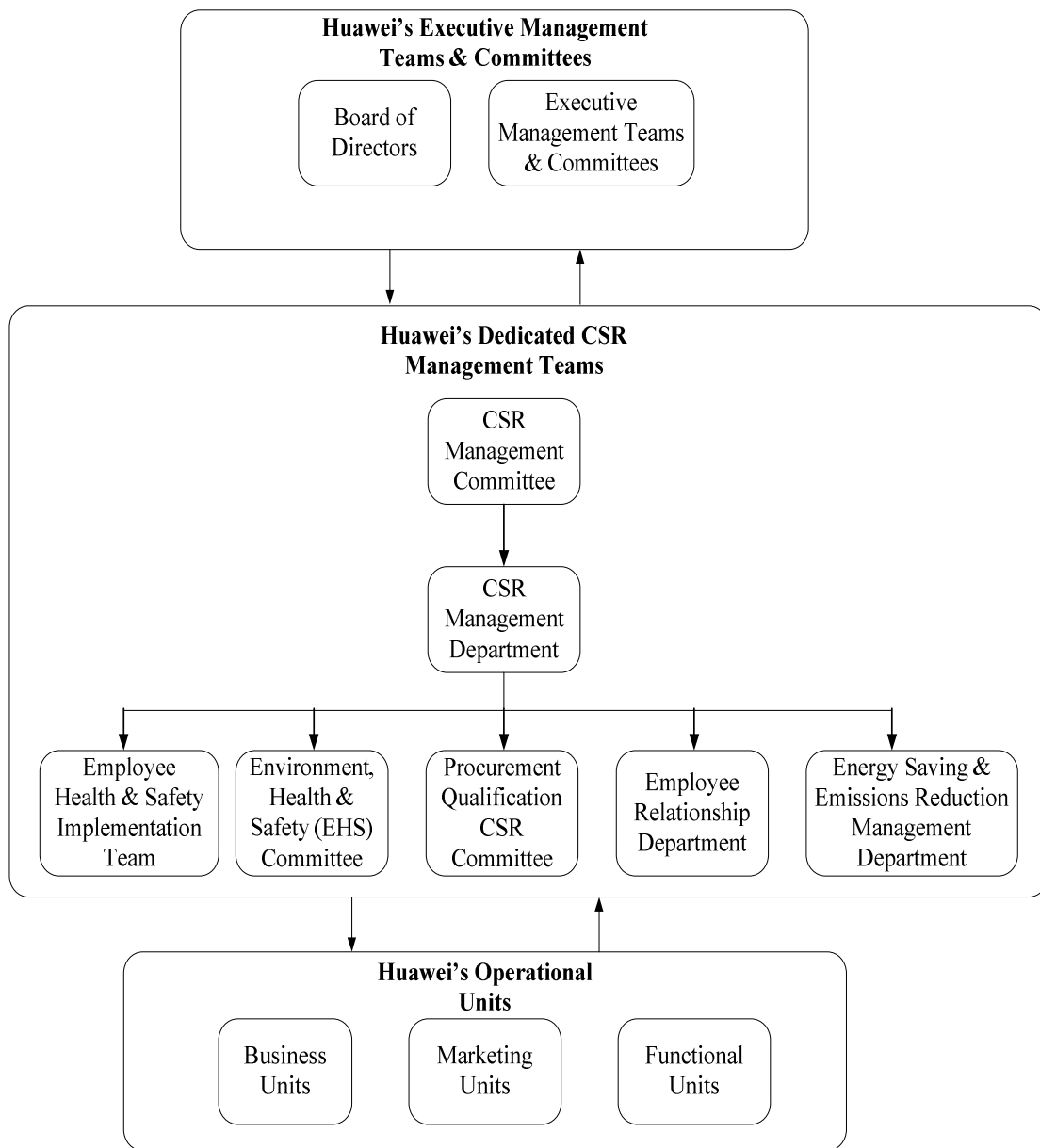
Huawei regularly reviews and updates its sustainable strategies and policies to address new sustainable concerns. For example, the company's initial sustainable strategy only includes two aspects: bridging the digital divide and community support. When Huawei has rapidly developed into a large multinational enterprise, there were increasing requirements from external stakeholders for the company also to be responsible for the environmental and social performances of its business partners. Environmental protection and supply chain management thus became another strategic focus of the company to account for the sustainable issues beyond the organizational boundary. More recently, the ethical concerns raised in European market led Huawei to include ethical operation and employee welfare standard into its strategic consideration. Despite the short term cost incurred, these strategic moves significantly reduced the company's sustainable risks.

Furthermore, Huawei does not simply regard its response to external sustainable pressure as a risk mitigation process. It always tries to link external sustainable interests with its own business interests. Sometimes this linkage is obvious. For example, by optimizing its global logistics network, Huawei greatly reduced both CO2 emissions and operational cost (Huawei, 2009). But in many other circumstances the sustainable initiatives cannot generate immediate paybacks. Being aware that those initiatives are more about the company's long-term economic viability and sustained competitive advantage, Huawei's strategic sustainable decision makings involves not only CSR management team, but also other executive committees at the board level, such as finance committee, human resources committee, and strategy and customer standing committee. This managerial arrangement helped Huawei to establish its sustainable orientation surrounding "bridging the digital divide" strategy, and thus reinforce its competitive position in international markets.

4.2.3.3 Huawei's Reconfiguration Capability

Corporate strategic change towards sustainability requires the firm to discard, modify, or rebuild its unsustainable functions and processes. Huawei has been successful in overcoming the organizational inertia and obstacles in executing the company's sustainable strategies and action plans. The reconfiguration capability of Huawei is manifested in the interactive patterns between the company's dedicated CSR management teams and other organizational departments and business units (see Figure 4.2).

Figure 4. 2 - Huawei's Governance Structure for CSR Management



At the strategic level, under the guidance and support of the investment audit committee, the CSR management committee is responsible for coordinating and leveraging the company's strategic resources and capabilities. According to Huawei's policy, the corporate executives should hold regular review meetings with the CSR management committee to discuss and make decisions on topics related to corporate

sustainable development. Once new sustainable action plans are approved and pass the project investment audit, enough authority is given to the project manager to mobilize and coordinate the necessary resources from all related functional departments.

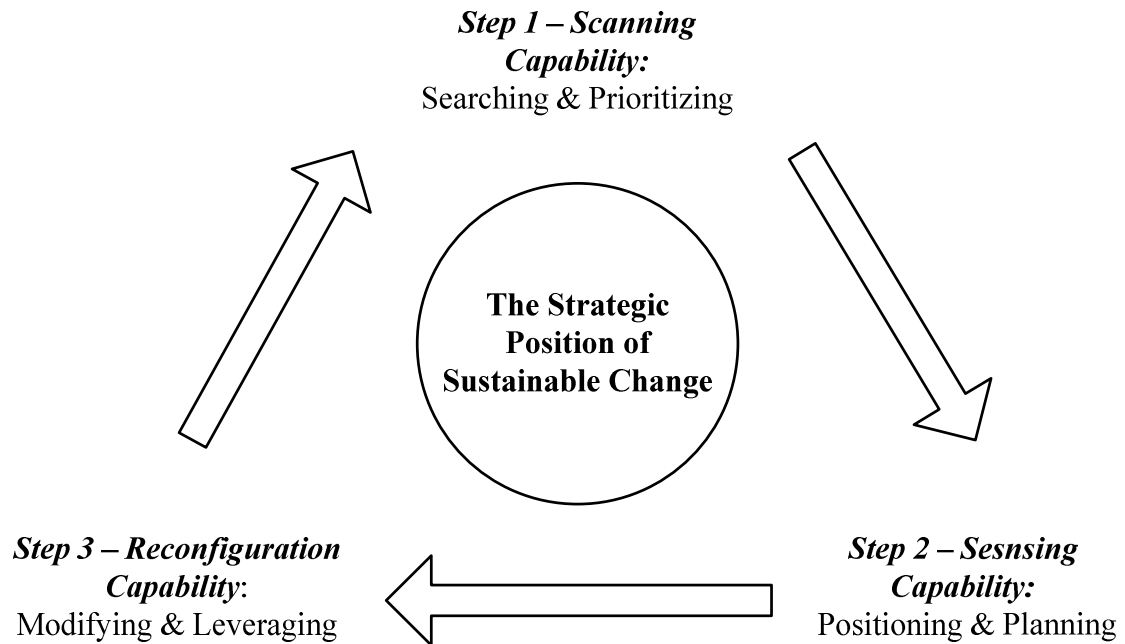
At the operational level, under the direction of the CSR management committee, a dedicated CSR management department with five different subordinate functional teams is responsible for organizing daily sustainable activities with other operational units. The CSR management teams adopt a PDCA (Plan-Do-Check-Act) model to regulate and measure the implementation processes of new CSR initiatives. Moreover, to break potential departmental silo, a specific “departmental interface” policy has been introduced. Under this policy, all functional departments should ensure the proper staffing in key management positions to work with CSR management teams in daily operations.

4.2.4 Main Functions involved in Huawei’s Dynamic Capabilities for Corporate Sustainability

According to DCV literature, dynamic capabilities can help firms to rebuild their competitive competence and strategic position in fast changing environment (Teece *et al.*, 1997; Eisenhardt and Martin, 2000; Helfat *et al.*, 2007). In the case of Huawei, these capabilities can be described as a dynamic mechanism performing six major

functions for firm's strategic sustainable change: searching, prioritizing, positioning, planning, modifying, and leveraging (see Figure 4.3).

Figure 4. 3 - The Action Cycle of Dynamic Capabilities for Corporate Sustainability



4.2.4.1 Searching Function and Prioritizing Function

The scanning capability performs the searching and prioritizing functions. The searching function enables firms to monitor external sustainable pressure from both direct and indirect stakeholders. In corporate sustainable change, the sustainable issues raised by indirect stakeholders are becoming increasingly important (Bansal and Roth, 2000; Hart and Sharma, 2004; Steurer *et al.*, 2005). However, because indirect stakeholders stay at the periphery, or even outside of firm's established communication or relationship networks, their sustainable interests are difficult to be immediately sensed or predicted (Hart and Sharma, 2004). These remote concerns, if

overlooked, become a major source of firm's potential sustainable risks (Steurer *et al.*, 2005). Therefore, the searching function helps Huawei to systematically categorize these stakeholders and establish effective communication channels with them.

Because different stakeholders of corporate sustainability often hold conflicting views and interests (Dixon and Fallon, 1989; Gladwin *et al.*, 1995), the prioritizing function involves comparing and prioritizing various sustainable interests based on the level of significance of those issues to Huawei's strategies and operations. This function helps the company to recognize the most relevant and urgent sustainable issues to deal with, and thus become the guiding principle for developing new sustainable strategy.

4.2.4.2 Positioning Function and Planning Function

Based on the accurate understanding of external sustainable concerns, the sensing capability enables the firm to identify potential sustainable opportunities and threats, choose unique strategic position, and develop long-term sustainable development plans. Without implementing such a capability the firm may devote to a series of defragmented, short-term defensive reactions, and lose the opportunities to support both the society and its own business goals (Porter and Kramer, 2006).

The sensing capability performs the positioning function to establish firm-specific, competitive, and value-adding strategy for sustainable change. This function is firm-specific because it links external sustainable opportunities and threats with Huawei's

internal conditions – its capabilities and resource base, competitive positioning, weakness and strength. This function is also competitive because it helps Huawei to balance its trade-offs and set its unique value proposition by which the greatest competitive benefit can be gained from corporate change towards sustainability.

Guided by the company's unique strategic position of sustainable change, the planning function helps Huawei to define the roadmap and milestones for its long and mid-term sustainable development. This function involves both development planning, and also clear governance and authorization mechanism to ensure sufficient resource input for plan execution and monitoring. For example, in Huawei, although the sustainable plans are designed by the CSR management team, the plan execution is governed by the company's investment audit committee to ensure necessary resource allocation and cross-departmental coordination.

4.2.4.3 Modifying Function and Leveraging Function

While strategic positioning and planning establishes the goals for corporate sustainable development, to put sustainable plans into practice, the company also needs the modifying and leveraging functions under the reconfiguration capability. Huawei performs the modifying function to discard, revise, or rebuild the deeply entrenched organizational routines and practices that become unsustainable. This function is related with introducing a series of sustainable policies and guidance into daily operations and the corresponding compliance rules and standards. For example,

Huawei adopts a company-wide CSR management system to systematically regulate and monitor the sustainable performance in the areas of product design, manufacturing and operation, logistics and supply chain management, fair operation, and human resource management.

However, the independent sustainable efforts of individual organizational functions are far from enough. The optimized effect of corporate change towards sustainability can only be achieved by assembling and orchestrating company-wide complementary assets (Hart, 1995; 1997). Therefore, the leveraging function can help the company to coordinate and leverage the interrelated sustainable efforts in different business departments and units. Huawei's CSR management department and its five subordinate functional teams (as shown in Figure 4.2) hold the main responsibility for this function. The CSR management department works as the communication hub for information and knowledge sharing between different business and functional units. By this way, novel sustainable knowledge can be forwarded to and interpreted by the individuals or planning units who are capable of making sense of them. Moreover, if new sustainable initiatives need cross-functional collaboration, the CSR management department will step in as the project leader and the coordinator to streamline the work flows among different business units.

In short, these six major functions of dynamic capabilities represent a recurrent action cycle to drive continuous corporate strategic change towards sustainability. They can

generally be viewed in a sequential order: once new sustainable challenges are sensed, they are prioritized and used as the reference for the firm to revise its strategic direction and update its sustainable development plans. These new strategic initiatives are then implemented through reconfiguring the firm's internal resource and capabilities base. However, in practice there could be much overlaps between each function and sometimes skip between functions.

4.2.5 Summary of the Case Study's Findings

First, the findings of the case study justify the theoretical viewpoint of the resource-based view towards corporate sustainability (Hart, 1995; Russo and Fouts, 1997; Porter and Van de Linde, 1999; Porter and Kramer, 2006). Given that natural resources are becoming increasingly scarce, and the environmental constraints are getting tighter and tighter, sustainable development is already a common consensus of the market. The question is not whether companies should make strategic changes towards sustainability, but how quickly and how well companies can make these changes and find new opportunities from the market environment. Top level management needs to have a clear and dedicated vision towards these strategic changes.

Second, the findings of the case study suggests that firms should realize the importance of the development and implementation of dynamic capabilities for corporate sustainability. Moreover, the deployment of dynamic capabilities is not

fixed and one-off. Instead they are recurrent in the management process. Companies should establish systematic management routines and even renovate the management structures to allow more effective development and deployment of those capabilities. High level of commitment from top management is, therefore, needed in allocating adequate resources to stimulate the strategic changes.

Third, the findings of the case study advocates that, during the change process, conventional thinking and cliché practices should be largely avoided. Enough flexibility should be given to the management team to allow new ideas to arise. Knowledge sharing within organization, between departments, and with external stakeholders should be encouraged. Companies should be aware that new opportunities are equally likely to be identified from external knowledge sources as from internal ones.

Fourth, the findings of the case study of Huawei generally support the conceptual framework of dynamic capability for corporate sustainability developed in the research. The three dimensions of the dynamic capabilities – scanning, sensing, and reconfiguration – form the basis of firms’ competence to successfully respond to the environmental and social concerns of various stakeholders and mobilize firms’ internal resources to make strategic changes towards sustainability. How well a firm can develop and manage these capabilities can determine whether the firm will be passively reactive to the various stakeholders’ concerns or proactively seek new

opportunities from the environmental changes. This can also be a reason why companies have different speed and performance in the move towards sustainability.

The case study makes an early attempt to extend the DCV into the understanding of corporate strategic change towards sustainability. It identifies the six typical functions performed by the dynamic capabilities for corporate sustainability (see Table 4.2 below). However, given that the case study is based on a single company in telecom industry, the findings can be context specific. A large-scale archival data analysis across various industrial sectors is thus needed to examine the validity of the case study' findings so as to achieve a more generalizable conclusion.

Table 4. 2 - Main Functions involved in Dynamic Capabilities for Corporate Sustainability

Dynamic Capabilities for Corporate Sustainability	Main Functions Involved
1. Scanning Capability	<ul style="list-style-type: none"> • Searching • Prioritizing
2. Sensing Capability	<ul style="list-style-type: none"> • Positioning • Planning
3. Reconfiguration Capabilities	<ul style="list-style-type: none"> • Modifying • Leveraging

4.3 Findings of the Archival Analysis

The aim of the archival analysis is to justify and generalize the conclusions of the case study, so as to identify the common processes and micro-foundations of the dynamic capabilities for corporate sustainability. The findings of the archival analysis also facilitate the development of the measurement instruments involved in the quantitative study. As explained in the previous chapter, the CSR reports of world-leading companies are used as the data source for the archival analysis, and totally 64 companies are finally selected. The selected companies are based in three major geographic regions: America (20), Europe (26) and Asia (18). These companies come from eight industrial sectors: Industrial Goods (10), Consumer Goods (16), Materials (8), Technology (7), Telecommunications (5), Oil and Gas (5), Healthcare (9) and Finance (4) (see Table 4.3). The wide spread of regions and industrial sectors of the selected companies ensures the representativeness of the sample and enhances generalisability of the analysis.

Table 4. 3 - Sample Companies included in the Archival Analysis

	Industrial Sectors							
Regions	Industrial Goods	Consumer Goods	Materials	Technology	Telecommunications	Oil & Gas	Healthcare	Finance
American (20)	General Electric Co	Coca-Cola	Dow Chemical	IBM	AT&T	Chevron Corp	Baxter Intl Inc	Wells Fargo & Company
	3M Co	Colgate-Palmolive Co	Praxair Inc	Intel Corp		Exxon Mobil Corp	Johnson & Johnson	
		Ford Motor Co		Microsoft Corp			Merck & Co	
		PepsiCo Inc		Unitedhealth Group Inc				
		Procter & Gamble						

European (26)	Atlas Copco AB	Adidas	BASF SE	Nokia	Ericsson	BG Group	AstraZeneca	Allianz
	Sandvik AB	Bayer Motoren Werke AG (BMW)	Bayer AG		Telefonica SA	Royal Dutch Shell	GlaxoSmithKline	HSBC
	Siemens AG	Diageo PLC		Vodafone Group	TOTAL SA	Novartis AG Reg		
	Volvo AB	Nestle					Roche Hldgs AG	
		Royal Philips Electronics					Sanofi	
Unilever								
Asian (18)	Asahi Glass Co	Hyundai Mobis	BHP Billiton	Samsung Electronics Co	NTT Docomo			Mizuho Financial Group

	Mitsui & Co	Kia Motors Corp	LG Chem Ltd	SK Hynix Inc				
	Marubeni Corp	KT&G Corp	POSCO	Taiwan Semiconductor Manufacturing Co				
	Toshiba Corp	Nissan Motor	Rio Tinto					
		Toyota Motor						
Total	10	16	8	7	5	5	9	4

The overall conclusion of the archival analysis is that the common processes adopted by the case companies for sustainability are leading towards the development and implementation of longer term capabilities of firms. Many of these processes or approaches may not have immediate effect on the performance of the sample companies. However, they ensure that CSR strategies can be amalgamated with the business strategies of firms, so that dedicated sustainable development path can be generated.

The deployment of dynamic capabilities for sustainable management involves establishing deliberate organizational changing routines by which firms can constantly meet the strategic fit between external sustainability expectations and their internal resource and capabilities configuration. This requires firms to build long-term sustainable development vision and break their well-entrenched managerial cognition frame. It is by no means just introducing a set of commonly agreed procedures.

First, firms have to adopt a long-term and flexible transformation vision to gradually change their business orientation from purely profit-orientated to a more sustainable one. Firms' CSR development cannot be accomplished through the so-called radical innovation. Radical innovation means using a completely different set of rules to rebuild firms' existing organizational functions and processes in a short period of time (Henderson and Clark, 1990). However, for CSR development no such rules exist (Jennings and Zandbergen, 1995).

Second, firms cannot simply rely on the incremental change of their existing operational functions for CSR development, because the self-adjustment and continuous improvement of these functions have to follow their life-cycle trajectories (Helfat and Peteraf, 2003, Schreyögg and Kliesch-Eberl, 2007). This incremental change may satisfy current CSR needs but fail to respond to future challenges (Hart, 1997). Therefore, firms have to not only consider immediate CSR concerns, but also develop long-term vision for sustainable development, through which some business functions are retained or modified, others are discarded, and new ones are acquired, resulting in a reconfigured capabilities portfolio that incorporates both existing and new knowledge (Lavie, 2006).

Third, establishing organizational changing routines for CSR management and sustainable development requires firms to overcome their existing cognition frames. These taken-for-granted cognition frames are deeply rooted in daily activities patterns (Helfat and Peteraf, 2003; Winter, 2003), and difficult to change (Leonard-Barton, 1992). They may impede the forward looking to identify profitable investment opportunities from the seemingly unrelated social and environmental issues (Hart and Dowell, 2011). Breaking these cognition impediments needs both dedicated managerial attention and efforts (Hart and Dowell, 2011), and extensive cross-functional knowledge integration (Grant and Baden-Fuller, 1995; Sharma and Vredenburg, 1998; Hart and Dowell, 2011).

Finally, the archival analysis concludes that vast majority of the reporting companies share eight common sustainability-oriented organizational processes (see Table 4.4). Table 4.4 concludes the eight organizational processes and organizes them under the scanning capability, sensing capability and reconfiguration capability for corporate sustainability. These processes are the underlying common management processes by which firms deploy their dynamic capabilities for corporate sustainability.

Table 4. 4 - Core Themes concluded in the Archival Analysis as the Common sustainability-Oriented Organizational Processes

Common sustainability-oriented organizational processes	Dynamic capabilities for corporate sustainability
1. Communication with primary stakeholders	Scanning capability
2. Communication with secondary stakeholders	
3. Prioritizing sustainability requirements	
1. Boundary-spanning knowledge sharing and application	Sensing capability
2. Establishing and regularly updating CSR development plans and milestones	
3. Developing and managing CSR governance structure	
1. Measuring and monitoring sustainable performance	Reconfiguration capability
2. Implementing standard CSR management systems	

4.3.1 Key Processes underpinning Scanning Capability

Teece (2007) and Schreyögg and Kliesch-Eberl (2007) suggest that the monitoring role played by dynamic capabilities involves various analytical activities to sense, learn and interpret the signals reflecting emerging environmental changes. This theoretical argument can be extended into corporate sustainability by arguing that the scanning capability is manifested in a set of organizational processes by which external sustainability expectations can be received, integrated and used for firms to define their sustainable business models and CSR investment priorities. Three managerial processes and their related sustainability practices are thus categorized under the scanning capability: (1) communication with primary stakeholders; (2) communication with secondary stakeholders; and (3) prioritizing sustainability requirements (see Table 4.5).

Table 4. 5 - Key Process underpinning Scanning Capability

Top three related CSR practices	Key CSR management processes	No. of the CSR reports covering this process	Coverage percentage
1. Regular meetings/workshops with government/financial institutions	Communication with primary stakeholders	60	94%

<p>2. CSR conferences/forums with business partners</p> <p>3. Consumer satisfaction surveys and feedback</p>			
<p>1. Regular meetings/workshops with NGOs</p> <p>2. Regular meetings/workshops with local communities</p> <p>3. Regular CSR information disclosure to the public</p>	<p>Communication with secondary stakeholders</p>	<p>61</p>	<p>95%</p>
<p>1. Self check of the CSR issues that have high-level concerns to stakeholders</p> <p>2. Self check of the CSR issues that have high-level concerns to the companies</p> <p>3. Self check of the prioritized material topics for future CSR management</p>	<p>Prioritizing sustainability requirements</p>	<p>53</p>	<p>83%</p>

These processes reflect the sample companies' focus on the sustainability requirements of both primary and secondary stakeholders. While the pressure from

primary stakeholders, such as customers and governments, is still regarded as the most relevant factor affecting the firms' sustainable development, the voice of secondary stakeholders, such as Non-Governmental Organizations (NGOs) and other interest groups, has been increasingly viewed as an equally important consideration. Because the sustainability needs of secondary stakeholders are usually distant and unfamiliar to firms (Dixon and Fallon, 1989; Gladwin *et al.*, 1995; Hart and Sharma, 2004; Hart and Dowell, 2011), deliberate communication practices and routines are developed by many of the sample companies, such as regular meetings or workshops, to facilitate the constructive dialogues with these stakeholders regarding sustainability issues. For example, AstraZeneca established both formal and informal dialogue platforms with their stakeholders to ensure that the company's strategy development and risk management take account of stakeholders' feedback (AstraZeneca, 2011).

Furthermore, explicit managerial approaches are also established to identify the most legitimate and urgent sustainability concerns from the often conflicting views and interests of different stakeholders. For example, the Interactive Materiality Matrix Model developed by Ford enables the company's Ceres Stakeholder Committee to categorize and prioritize the sustainability issues according to their concern to stakeholders and their current or potential impact on Ford (Ford, 2012). In short, the initiatives of establishing open communication channels with various stakeholders reflect the possession and deployment of scanning capability of the sample companies. Scanning the sustainability requirements of stakeholders is the starting point for

companies to understand fast changing sustainability trends. The newly acquired sustainability insights are then forwarded to and interpreted by the individuals or planning units who are capable of making sense of them. By this way the new sustainability concerns of various stakeholders are categorized, compared and prioritized to navigate firms' sustainability development direction.

4.3.2 Key Processes underpinning Sensing Capability

The expectations of external stakeholders usually focus on the improvement of corporate environmental and social performance. In many cases they do not tell firms how to gain financial benefit at the same time (McWilliams and Siegel, 2001). Therefore, the sensing capability is vital. This capability enables firms to not only sense potential CSR risks, but more importantly, to identify sustainable development opportunities to meet the environmental, social and economic targets simultaneously. In this regard, three categories of organizational processes emerge from the CSR reports of the sample companies: (1) boundary-spanning knowledge sharing and application; (2) establishing and regularly updating sustainability development plans and milestones; and (3) developing and managing a clear CSR governance structure (see Table 4.6). These three organizational processes are involved in the deployment of the sensing capability of the reporting companies.

Table 4. 6 - Key Process underpinning Sensing Capability

Top three related CSR practices	Key CSR management processes	No. of the CSR reports covering this process	Coverage percentage
<p>1. CSR-related training/education programs for employees and supply chain partners</p> <p>2. CSR-related knowledge-exchange programs with external institutions</p> <p>3. Regular meetings/workshops for cross-functional knowledge sharing regarding CSR management</p>	<p>Boundary-spanning knowledge sharing and application</p>	<p>62</p>	<p>97%</p>
<p>1. Establishing CSR strategies and long-term sustainable development vision</p> <p>2. Developing</p>	<p>Establishing and regularly updating CSR development plans and milestones</p>	<p>62</p>	<p>97%</p>

mid/short-term CSR development plans			
3. Self check of the accomplishment of the established CSR development milestones			
1. Establishing board-level CSR steering committees	Developing and managing CSR governance structure	60	94%
2. Establishing various functional CSR management groups			
3. Proper staffing in key positions for CSR management			

Extensive knowledge exchange is the key to identify potential corporate sustainable development opportunities. At an inter-organizational level, the sample companies especially focus on the close collaboration with their supply chain partners, and various NGOs and higher-education institutions. The knowledge sharing with supply chain partners often targets at situation-specific, project-based sustainability initiatives to solve existing sustainability problems across the value chain. For example, the Supply Chain Risk Management Committee established within Taiwan Semiconductor Manufacturing Co. works closely with the supply chain partners to

monitor the effectiveness of continuous improvement projects and improve green procurement, environmental protection, regulatory compliance, certification acquisition, and industrial safety assurance (Taiwan Semiconductor Manufacturing Co., 2011). On the other hand, the knowledge exchange with NGOs and higher-education institutions involves more broad issues ranging from sustainability prospect analysis to new green technologies experimentation. For example, in a large-scale social service improvement program, NTT Docomo collaborates with schools, hospitals and local communities to initiate a series of ICT services to support health and medical care, environmental protection, and social security and safety (NTT Docomo, 2011).

At an intra-organizational level, the cross-functional information sharing regarding sustainable operations is encouraged and supported within and between departments. Once novel sustainability initiatives are applied and proved successful, various learning and training programmes are carried out to disseminate the newly gained knowledge within the firm. For example, Nestlé initiates various learning and training programs for their employees to effectively respond to the local sustainability needs of the regions in which they stay (Nestlé, 2011). Moreover, it is worth noting that the sample companies not only support sustainability learning activities of their employees, but also host various education programs for their supply chain partners. This finding confirms the assertion that the business partners involving in the same

value chain should work together to build the relational competence for supply chain sustainability (Lee and Klassen, 2008, Gold, *et al.*, 2010).

To support boundary-spanning knowledge sharing and application, most of the sample companies have developed clear sustainability development plans, milestones, and governance structures to manage company-wide sustainability issues, systematically obtain knowledge across organizational boundaries, and apply the knowledge to the related organizational functions through various innovation activities. These managerial approaches reflect the sample companies' possession of the outstanding sensing capabilities to secure beneficial opportunities from corporate sustainability through developing underlying organizational routines and mobilising relevant organizational resources.

4.3.3 Key Processes underpinning Reconfiguration Capability

One of the most important hindrances to effective corporate sustainable management is the capabilities trap. Capabilities trap means that firms with superior performance tend to stick to their existing capabilities to ensure reliable and efficient operation (Hannan and Freeman, 1984; Leonard-Barton, 1992; Levinthal and March, 1993). It makes an organization reluctant to change its familiar "way of doing", even when changing environmental condition has began to undermine its fundamental capabilities base (Repenning and Sterman; 2002; Schreyögg and Kliesch-Eberl, 2007).

This capabilities trap is more salient in the context of corporate sustainability (Berchicci and King; 2007). Because the link between sustainability-oriented actions and firms' economic performance is not straightforward (Hart and Dowell, 2011), to avoid the disturbance in their current operations, many firms prefer short-term based, end-of-pipe approaches to solve imposed sustainability problems, even though such an approach actually entails huge, non-productive cost (Hart, 1995; Russo and Fout, 1997). The reconfiguration capability, in this regard, helps firms to overcome the so-called capabilities trap in corporate sustainability through purposefully modifying existing unsustainable business functions and operations.

The sample companies exhibited substantial reconfiguration capabilities to overcome the capabilities trap problem through: (1) measuring and monitoring sustainable performance of their business operations against preset criteria; and (2) implementing standard management systems to modify and regulate existing business operations (see Table 4.7). These management processes share certain characteristics and reflect the reconfiguration capability possessed by the sample companies.

Table 4. 7 - Key Process underpinning Reconfiguration Capability

Top three related CSR practices	Key CSR management processes	No. of the CSR reports covering this process	Coverage percentage
1. Developing formal	Measuring and	64	100%

<p>measurement systems to monitor the sustainable performance of business operations</p> <p>2. Providing standard guidance/procedures/handbooks for employees to self check their sustainable performance in daily operations</p> <p>3. Establishing the feed-back routines for the self reporting of employees' concerns on sustainable performance of business operations</p>	<p>monitoring sustainable performance</p>		
<p>1. Implementing ISO standards (ISO 9001/14001)</p> <p>2. Designing and implementing industry-specific ethical code of conduct</p> <p>3. Implementing other self-designed CSR management systems</p>	<p>Implementing standard CSR management systems</p>	<p>61</p>	<p>95%</p>

First, the sample companies commonly use a set of measuring, auditing and risk analysis methods to evaluate sustainable performance of their operations. For example,

Unilever has developed a set of metrics to measure four prioritized environmental impact areas across the value chain: greenhouse gas (GHG) emissions, water, waste, and sustainable sourcing (Unilever, 2009). The adoption of these practices echoes the argument that when firms intend to take proactive actions towards sustainability, they should firstly make reliable estimation about the environmental and social impact of their existing operational functions, so as to inform right decision makings (McWilliams and Siegel, 2001; Berchicci and King; 2007).

Second, to regulate their CSR operations, the reporting companies engage in various sustainable management systems, such as ISO standard series (ISO 9000 or ISO14001) or ethical codes of conduct. These systems are described as the formalization of the past experience accumulated from recurrent sustainability-related innovation activities (Sharma and Vredenburg, 1998; Florida and Davison, 2001; Winter, 2003) and often recognized as “best practices” (Christmann, 2000; Eisenhardt and Martin, 2000). They can offer consistent action patterns by standardizing task execution in similar situations (Wood, 1991; Aragon-Correa, 1998; Aragon-Correa and Sharma, 2003). However, it is worthwhile to point out that the sustainable management systems adopted by the sample companies vary greatly across industrial sectors and geographic regions. This reflects the fact that although firms may use a common set of dynamic capabilities for sustainable management, their detailed managerial approaches still have to be tailored to accommodate the specific institutional environments and sustainability challenges they face.

The eight key management processes involved in the deployment of the scanning, sensing and reconfiguration capabilities for corporate sustainability (see Table 4.8) represent the common managerial routines by which dynamic capabilities for corporate sustainability are performed to develop and implement various sustainability initiatives and practices in the leading firms across different industrial sectors and geographic regions. It could be thus argued that a common set of dynamic capabilities and organizational processes do exist in the sustainable management of leading companies at least at the time of reporting. Nevertheless, it is worth noting that, because the dynamic capabilities performed by different organizations are idiosyncratic in detail (Eisenhardt and Martin, 2000), the deployment of the dynamic capabilities for corporate sustainability may result in various operational practices. Therefore, what is important is the identification and development of the underlying dynamic capabilities and the related organizational processes and routines, rather than detailed operational activities.

Table 4. 8 - Common Practices, Process and Functions underpinning Dynamic Capabilities for Corporate Sustainability

Top three related CSR practices	Key CSR management processes	Key functions	Dynamic capabilities for corporate sustainability
<ol style="list-style-type: none"> 1. Regular meetings/workshops with government/financial institutions 2. CSR conferences/forums with business partners 3. Consumer satisfaction surveys and feedback 	Communication with primary stakeholders	Searching function	Scanning capability
<ol style="list-style-type: none"> 1. Regular meetings/workshops with NGOs 2. Regular meetings/workshops with local communities 3. Regular CSR information disclosure to the public 	Communication with secondary stakeholders		
<ol style="list-style-type: none"> 1. Self check of the CSR issues that have high-level concerns to stakeholders 2. Self check of the CSR issues that have high-level concerns to the companies 	Prioritizing sustainability requirements	Prioritizing function	

3. Self check of the prioritized material topics for future CSR management			
1. CSR-related training/education programs for employees and supply chain partners 2. CSR-related knowledge-exchange programs with external institutions 3. Regular meetings/workshops for cross-functional knowledge sharing regarding CSR management	Boundary-spanning knowledge sharing and application	Positioning function	Sensing capability
1. Establishing CSR strategies and long-term sustainable development vision 2. Developing mid/short-term CSR development plans 3. Self check of the accomplishment of the established CSR development milestones	Establishing and regularly updating CSR development plans and milestones	Planning function	
1. Establishing board-level CSR steering committees	Developing and		

<p>2. Establishing various functional CSR management groups</p> <p>3. Proper staffing in key positions for CSR management</p>	<p>managing CSR governance structure</p>		
<p>1. Developing formal measurement systems to monitor the sustainable performance of business operations</p> <p>2. Providing standard guidance/procedures/handbooks for employees to self check their sustainable performance in daily operations</p> <p>3. Establishing the feed-back routines for the self reporting of employees' concerns on sustainable performance of business operations</p>	<p>Measuring and monitoring sustainable performance</p>	<p>Modifying function</p>	<p>Reconfiguration capability</p>
<p>1. Implementing ISO standards (ISO 9001/14001)</p> <p>2. Designing and implementing industry-specific ethical codes of conduct</p>	<p>Implementing standard CSR management systems</p>		

3. Implementing other self-designed CSR management systems			
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4.3.4 Common Practices, Processes and Functions underpinning Dynamic Capabilities for Corporate Sustainability

Combining the findings of both the case study and the archival analysis, Table 4.8 juxtaposes the common CSR practices and management processes identified in the archival analysis with the key functions of dynamic capabilities for corporate sustainability concluded by the case study.

First, based on the literature review, the scanning capability for corporate sustainability is defined as “*the ability of the firm to create an information processing mechanism composed of two different searching processes, one for direct stakeholders and the other for indirect stakeholders*”. The case study and the archival analysis performed in the research mainly support this definition, and further substantiate it by including a related function by which firms can prioritizing sustainability requirements from various external stakeholders (see Table 4.8). As a result, the concept of scanning capability in the research is refined as “*the ability of the firm to create an information processing mechanism searching and prioritizing various sustainability requirements from both direct and indirect stakeholders*”.

Second, the sensing capability for corporate sustainability is initially conceptualized as *the ability to sense and capitalise on, rather than merely react to, emerging external sustainability challenges and opportunities in its business environment*. The following case study and archival analysis justify this definition by illustrating the

underlying positioning and planning functions and the relevant practices and process (see Table 4.8).

Third, the reconfiguration capability for corporate sustainability is defined initially in the literature review chapter as *the ability to discard, modify, or rebuild the well-entrenched organizational routines and practices that are unsustainable*. The case study concludes and assigns the modification and leveraging functions to this capability. However, it is worth noting that, in the following archival analysis the leveraging function, represented by the organizational governance structure for CSR management, has been merged with the planning function under the sensing capability (see Table 4.8).

The common practices, process and functions concluded here will be used as a reference in generating the relevant measurement items in the following quantitative study.

4.4 Chapter Summary

Using both case study and archival analysis methods, the qualitative study in the research explores the key practices, process, and functions underpinning dynamic capabilities for corporate sustainability. The findings contribute to the literature of both corporate sustainability and dynamic capabilities. On the one hand, the research

extends the dynamic capabilities perspective to the study of corporate sustainability. The identification of common elements underpinning dynamic capabilities for corporate sustainability clarifies the seemingly complex management issues involved in process of corporate sustainable development. On the other hand, previous DCV literature mainly concentrates on the role of internal organizational efforts in the development of dynamic capabilities, such as internal organizational learning. However, the research finding suggests that collaboration across organizational boundaries is also vital to the success of corporate sustainable development strategy. For example, it is indicated in this study that the knowledge sharing across organizational boundaries, especially in the context of corporate sustainability, is an important factor for the development of dynamic capabilities.

Based on the qualitative findings, the quantitative study in the research will convert the established theoretical framework into a testable research model and empirically test the relationship between each dimension of the dynamic capabilities for corporate sustainability. The model will also be used to examine the correlations between inter-firm knowledge transfer and the development of dynamic capabilities for corporate sustainability.

CHAPTER 5 - SURVEY CONSTRUCTION AND IMPLEMENTATION

5.1 Introduction

The aim of this chapter is threefold: first, to operationalize the constructs underpinning the theoretical framework; second, to verify the measurement items through delphi method; third, to explain how the survey is implemented.

The structure of the chapter is as follows. Section 5.2 introduces Tailored Design Method and explains how it can be applied to guide survey construction and implementation. Section 5.3 operationalizes the constructs outlined in the theoretical framework. Section 5.4 continues to verify the construct validity of the measurement items that are going to be used in the survey. Then Section 5.5 and 5.6 respectively explain how measurement items are further refined, and how the questionnaire layout is finalized. Section 5.7 explains why both CA and SA models are needed in the survey study. Section 5.8 introduces how the survey is implemented. Finally Section 5.8 gives the summary of the chapter.

5.2 Use of Tailored Design Method in Survey Construction and Implementation

A key consideration of a survey study is how to follow a systematic and robust approach to collect valid and reliable data with budgeted financial and time resource. To this regard, Tailored Design Method (TDM), based on social exchange theory, argues that survey quality can be improved through perceived high reward, low cost and established trust between researcher and survey respondents (Dillman, 2000). According to the suggestions of TDM, the research designs and administers the survey in the following ways.

In terms of increasing perceived rewards for responding, the objective and importance of the survey are outlined in the beginning of the questionnaire. The time estimated to finish the survey is given. And a price drawing is held as the incentive to increase the response rate (Dillman, 2000).

In terms of reducing cost of responding, the wording of the questionnaire is revised according to the suggestions of supply chain professionals, so as to avoid academic jargons and make the questions short and easy to understand. Also, if not critical, the personal information of the respondents are not required in the survey (Dillman, 2000).

In terms of establishing trust between the researcher and survey respondents, before the survey, during a joint research event organized by one of my PhD supervisor (Dr Qile He), a focus group meeting was conducted in which 15 CILT members who are knowledgeable about sustainable supply chain management and sustainability were invited. In the focus group the objective and background of the survey were introduced. Then surrounding the idea of this survey, the CILT members provided their opinions regarding supply chain and corporate sustainability. After the focus group, under the sponsorship of CILT UK, the survey questionnaires were distributed to its members through CILT UK Environment & Sustainability Forum's internal mailing list.

5.3 Operationalization of the Constructs underpinning the Theoretical Framework

The constructs involved in the theoretical framework can be divided into two categories: (1) dynamic capabilities for corporate sustainability; and (2) sustainable knowledge transfer between supply chain partners.

5.3.1 Operationalization of Dynamic Capabilities for Corporate Sustainability

Dynamic capabilities for corporate sustainability is defined in the research as “*firms’ abilities to address the rapidly evolving sustainability expectations of stakeholders by purposefully modifying functional capabilities for the simultaneous pursuit of*

economic, environmental and social competences". These dynamic capabilities are further disaggregated into three distinctive, but related capabilities: (1) capability to scan the emerging sustainable needs of various stakeholders; (2) capability to sense opportunities or threats from the rapidly changing sustainable expectations; and (3) capability to reconfigure existing functional capabilities for corporate sustainability.

In the research the scanning capability briefly refers to the firm's ability to communicate with various stakeholders, so as to search, learn and interpret their sustainable needs. These stakeholders include both direct stakeholders such as government or customers, and indirect stakeholders such as communities and Non-Governmental Organizations (NGOs). The sustainable concerns of these stakeholders require firms to consider not only the economic outcome, but also the environmental and social impacts of their business operations.

To operationalize the construct of scanning capability, Table 5.1 gives the five measures developed from previous studies (Sharma and Vredenburg, 1998; Teece, 2007; Wang and Ahmed, 2007). These five measures also support the qualitative findings of the research. To be specific, the searching function involved in the scanning capability can be related with CS1, CS2, CS3, CS5, and the prioritization function can be related with CS4 (see Table 5.1).

Table 5. 1 - Measures of Scanning Capability

Measures of Scanning Capability		Key Processes	Key Functions
CS1	We keep positive relationships with our stakeholders	Communication with both primary and secondary stakeholders	Searching function
CS2	We keep open communications with our stakeholders.		
CS3	We have organization-wide culture to listen to the needs of our stakeholders.		
CS5	We can explain our company's point of view regarding sustainable development to our stakeholders.		
CS4	We can early sense the most relevant and significant sustainable issues.	Prioritizing sustainability requirements	Prioritizing function

Source: adapted from Sharma and Vredenburg, 1998; Teece, 2007; Wang and Ahmed, 2007.

In the research the sensing capability briefly refers to the firm's ability to explore sustainable development opportunities to meet the intersection between its environmental and social goals and its economic interests. This capability means not only the firm's ability to identify emerging sustainable development opportunities, but also it's potential to capture these opportunities through new knowledge seeking and new strategies establishment.

To operationalize the construct of sensing capability, Table 5.2 gives the five measures developed from previous studies (Sharma and Vredenburg, 1998; Teece, 2007; Wang and Ahmed, 2007). These five measures also support the qualitative findings of the research. To be specific, the planning function involved in the sensing capability can be related with CI1, CI2, CI3, and the positioning function can be related with CI4 and CI5 (see Table 5.2).

Table 5. 2 - Measures of Sensing Capability

Measures of Sensing Capability		Key Processes	Key Functions
CI1	We regularly look for feasible solutions to emerging sustainable requirements from fresh angles.	Establishing and regularly updating CSR development plans and milestones	Planning Function
CI2	We regularly look for new knowledge regarding sustainable development.		
CI3	We can identify new sustainable development opportunities from emerging social expectations and environmental regulations.		
CI4	We are able to provide adequate trainings to our employees regarding sustainable operations.	Boundary-spanning knowledge sharing and application	Positioning Function
CI5	Our employees are encouraged to share their knowledge and expertise about sustainable operations.		

Source: adapted from Sharma and Vredenburg, 1998; Teece, 2007; Wang and Ahmed, 2007.

In the research the reconfiguration capability briefly refers to the firm's ability to modify its existing functions and operations when they become unsustainable. To operationalize the construct of reconfiguration capability, Table 5.3 gives the five measures developed from previous studies (Sharma and Vredenburg, 1998; Teece, 2007; Wang and Ahmed, 2007). These five measures also support the qualitative findings of the research. To be specific, the measuring and monitoring process involved in the reconfiguration capability can be related with CR1, CR2. And the modifying process can be related with CR3, CR4 and CR5 (see Table 5.3).

Table 5. 3 - Measures of Reconfiguration Capability

Measures of Reconfiguration Capability		Key Processes	Key Functions
CR1	We regularly review our sustainable development goals and strategies.	Measuring and monitoring	Modifying function
CR2	We continuously evaluate the sustainable performance of our business operations.	sustainable performance	
CR3	We continuously improve our processes, products and systems for sustainable operations.	Modifying unsustainable functions and operations	according to emerging CSR
CR4	We are able to introduce new sustainable technologies and practices to our business operations.	operations	

CR5	We can balance our short-term economic benefits with long-term sustainable development goals.	requirements	
<i>Source: adapted from Sharma and Vredenburg, 1998; Teece, 2007; Wang and Ahmed, 2007.</i>			

5.3.2 Operationalization of Sustainable Knowledge Transfer between Supply Chain Partners

Monitor-based sustainable knowledge transfer between supply chain partners refers to a series of compliance rules and enforcement activities implemented by the focal firms to control and regulate the sustainable behaviour of their supply chain partners. Monitor-based knowledge transfer in sustainable supply chain management covers both environmental and social aspects. At environmental aspect, knowledge transfer between supply chain partners often leads to great upgrading of their ability to understand emerging environment protection needs of various stakeholders (Lee and Klassen, 2008). At social aspect, supply chain inter-firm knowledge transfer facilitates firms' capacity to sense and manage both internal and external social issues. Because these social responsible practices and activities are largely based on firms' self discretion, the sharing of social responsibility-related knowledge better informs supply chain partners the social responsibilities and benefits which they have a stake, and enables them to make more sensible decision makings (Koplin *et al.*, 2007).

To operationalize the construct of monitor-based sustainable knowledge transfer, Table 5.4 gives the five measures developed from previous studies (Vachon and Klassen, 2006; Cheng *et. al.*, 2008; Paulraj, 2011). These measures mainly focus on the sustainability standards and the related monitoring procedures commonly adopted by contemporary firms in sustainable supply chain management.

Table 5. 4 - Measures of Monitor-Based Sustainable Knowledge Transfer

Measures of Monitor-Based Sustainable Knowledge Transfer	
MKT1	We introduce formal approach (e.g. Code of Conduct) to regulate our supplier's sustainable behaviour.
MKT2	We conduct periodical audit to monitor our supplier's sustainable performance (e.g. questionnaire or site visit).
MKT3	We include environmental/ethical performance considerations in our supplier selection.
MKT4	We require our supplier to implement formal environmental management system (e.g. ISO14001).
MKT5	We regularly update environmental/ethical standards for our supplier to comply with.
<i>Source: adapted from Vachon and Klassen, 2006; Cheng et. al., 2008; Paulraj, 2011.</i>	

Support-based sustainable knowledge transfer between supply chain partners involves closer information and knowledge sharing between focal companies and their supply chain partners to jointly solve existing unsustainable problems and develop new sustainable initiatives. These activities include not only formal cross-organizational

communications, such as joint planning sessions, periodical team meetings, and employee training and education programs, but also loose social interactions of the boundary spanners in different firms to share their information and experience in daily operations (Vachon and Klassen 2006; Lee and Klassen, 2008; Pagell and Wu, 2010).

To operationalize the construct of support-based sustainable knowledge transfer, Table 5.5 gives the five measures developed from previous studies (Vachon and Klassen, 2006; Cheng *et. al.*, 2008; Paulraj, 2011). These measures reflect various boundary-spanning knowledge exchange and information processing routines embedded in sustainable supply chain collaboration.

Table 5. 5 - Measures of Support-Based Sustainable Knowledge Transfer

Measures of Support-Based Sustainable Knowledge Transfer	
SKT1	We keep close and honest communications with our supplier.
SKT2	We share information and knowledge with our supplier about sustainable development.
SKT3	We provide trainings to our supplier about sustainable development.
SKT4	We help our supplier to solve unsustainable problems.
SKT5	We work collectively with our supplier to develop new sustainable development initiatives.
<i>Source: adapted from Vachon and Klassen, 2006; Cheng et. al., 2008; Paulraj, 2011.</i>	

5.4 Verification of Construct Validity of the Measurement Items: A Delphi Test

In the research three types of dynamic capabilities for corporate sustainability, namely scanning capability, sensing capability and reconfiguration capability, are conceptualized based on an extensive review of previous studies in DCV and corporate sustainability. The key process and functions underpinning these three types of dynamic capabilities are substantiated through a case study and a large-scale archival analysis. Furthermore, the measurement items of these dynamic capabilities are also developed from related empirical studies.

However, because the scanning capability, sensing capability and reconfiguration capability are newly generated concepts, additional evidence seems necessary to further verify the construct validity of the measurement items underpinning these capabilities. Construct validity examines the alignment between conceptual constructs and the matched measurement items (Robson, 2002). For example, as explained above, the constructs of scanning capability, sensing capability and reconfiguration capability are represented respectively by three sets of measures. Each set contains five different measurement indicators. Nevertheless, because scanning capability, sensing capability are closed related concepts, a potential question is whether these indicators can correctly measure the concepts; or whether some indicators in one set should be moved to the other set, so as to reflect the real situation?

To further justify the construct validity between the measurement indicators and the theoretical constructs, a small-scale delphi test is performed. Delphi method uses a structured communication approach to obtain the most reliable consensus of a group of experts (Okoli and Pawlowski, 2004). Nine academic researchers who are knowledgeable about sustainable supply chain management and corporate sustainability are involved in the delphi test. The test process is as follows. First, a test form is sent to these researchers which explains the objective of the test, the theoretical constructs involved and the related measurement indicators (see Appendix A). This form requires the researchers to back-to-back allocate the randomly sequenced measurement items to suitable theoretical constructs based on their own judgement. Second, after receiving the feedback of the researchers, a summary of these feedback as well as the related judgement reasons is sent back to the researchers. Based on the summary, the researchers are encouraged to update their earlier answers in light of the replies of other members. Third, after two rounds of survey, satisfactory consensus rates are reached. As showed in Table 5.6, overall 89% consensus towards scanning capability, 76% towards sensing capability, 80% towards reconfiguration capability, 87% towards monitor-based sustainable knowledge transfer, and 91% towards support-based sustainable knowledge transfer are reached.

Table 5. 6 - Delphi Test Result

Item No.	Measurement Items of Scanning Capability	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	Preset	Consensus Rate
CS1	We keep positive relationships with our stakeholders	1	2	1	1	1	1	1	1	1	1	89%
CS2	We keep open communications with our stakeholders.	1	1	1	1	1	1	1	1	1	1	100%
CS3	We have organization-wide culture to listen to the needs of our stakeholders.	1	1	1	1	1	2	1	1	1	1	89%
CS4	We can early sense the most relevant and significant sustainable issues to our stakeholders.	1	1	1	2	1	1	1	1	2	1	78%

CS5	We can explain our company's point of view regarding sustainable development to our stakeholders.	1	2	1	1	1	1	1	3	1	1	89%
											Overall consensus rate	89%

Item No.	Measurement Items of Sensing Capability	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	Preset	Consensus Rate
CII	We regularly look for feasible solutions to emerging sustainable requirements from fresh angles.	2	1	2	1	2	2	2	2	2	2	78%

CI2	We regularly look for new knowledge regarding sustainable development.	2	1	2	1	2	2	2	2	2	2	2	78%
CI3	We can identify new sustainable development opportunities from emerging social expectations and environmental regulations.	2	1	2	2	1	2	2	2	2	2	2	78%
CI4	We are able to provide adequate training to our employees regarding sustainable operations.	3	2	3	2	2	1	2	2	2	2	2	67%
CI5	Our employees are encouraged to share their knowledge and expertise about sustainable operations.	2	1	2	1	2	2	2	2	2	2	2	78%

	Overall consensus rate	76%
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Item No.	Measurement Items of Reconfiguration Capability	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	Preset	Consensus Rate
CR1	We regularly review our sustainable development goals and strategies.	3	2	3	3	3	1	3	3	3	3	78%
CR2	We continuously evaluate the sustainable performance of our business operations.	3	3	3	3	3	3	3	2	3	3	89%
CR3	We continuously improve our processes, products and systems for sustainable operations.	3	3	3	3	2	3	2	1	3	3	67%

CR4	We are able to introduce new sustainable technologies and practice to our business operations.	3	3	2	3	3	3	3	3	2	3	78%
CR5	We can balance our short-term economic benefits with long-term sustainable development goals.	3	3	3	3	3	3	1	3	3	3	89%
Overall consensus rate											80%	

Item No.	Measurement Items of Monitor-Based Sustainable Knowledge Transfer	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	Preset	Consensus Rate
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MK1	We introduce formal approach (e.g. Code of Conduct) to regulate our supplier sustainable behaviour.	1	1	1	1	1	1	2	1	1	1	89%
MK2	We conduct periodical audit to monitor our supplier sustainable performance (e.g. questionnaire or site visit).	1	1	1	1	2	1	1	2	1	1	78%
MK3	We Include environmental/ethical performance considerations in our supplier selection.	1	1	2	1	1	1	2	1	1	1	78%
MK4	We require our supplier to implement formal environmental management system (e.g. ISO14001).	1	1	1	1	1	1	1	1	1	1	100%

MK5	We regularly update environmental/ethical standards for our supplier to comply with.	1	1	2	1	1	1	1	1	1	1	89%
Overall consensus rate											87%	
Item No.	Measurement Items of Support-Based Sustainable Knowledge Transfer	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	Preset	Consensus Rate
SK1	We keep close and honest communications with our supplier.	2	2	2	2	1	2	2	2	2	2	89%
SK2	We share information and knowledge with our supplier about sustainable	2	2	2	2	2	2	2	2	2	2	100%

	development.											
SK3	We provide training to our supplier about sustainable development.	2	2	2	2	2	2	2	1	2	2	89%
SK4	We help our supplier to solve unsustainable problems.	2	2	1	2	2	2	2	2	2	2	89%
SK5	We work collectively with our supplier to develop new sustainable development initiatives.	2	2	2	2	1	2	2	2	2	2	89%
									Overall consensus rate			91%

5.5 Instrument Refinement

Before survey implementation, a follow up pilot test is carried out to ensure the face validity and content validity of the measurement items. Face validity is about whether items reflect what they are intended to measure (Nunnally and Bernstein, 1994). And content validity is about whether the theoretical concept domain of a construct is represented by the measurement items (Hardesty and Bearden, 2004).

First, the initially designed measurement items are reviewed by two academic researchers who are knowledgeable about corporate sustainability and sustainable supply chain. Their opinions are used then to refine the wording of the questions. Second, the refined questionnaire is sent to two UK supply chain managers for their suggestions regarding the feasibility and relevance of the questionnaire. Based on the recommendations from both academic researchers and professional practitioners, the structure of the questionnaire is finalized as follows.

5.6 Questionnaire Structure

The questionnaire is composed as follows (see Appendix B). In the beginning, the Introduction and Objective part explains the background and objectives of the survey, the relevant key terms, and issues of confidentiality. The General Information Section (Section 1) is the screening question part with the aim to identify the profiles of the respondents and the related firm and industrial sector information (see Table 5.7). Section 2 and Section 3 are the main body of the questionnaire. Section 2 (Capabilities for Corporate Sustainable Development) asks the respondents to rate the level of the development of dynamic capabilities for corporate sustainability within

their firms. 7-point likert scale is applied to these questions with 1 indicating “strongly disagree”, 5 representing “neutral” and 7 meaning “strongly agree” (Norman, 2010). Section 3 (Knowledge Sharing Activities in Your Supply Chain Relationship) asks the respondents to evaluate the nature of the inter-firm knowledge transfer between their firms and the upstream and downstream supply chain partners. More specifically, Section 3 is separated into two parts. Part A of Section 3 emphasizes the inter-firm sustainable knowledge transfer activities between the focal firm and its main supply chain customer. Part B of Section 3 turns the focus to the inter-firm sustainable knowledge transfer activities between the focal firm and its main supply chain supplier (see Appendix B for detail). Again 7-point likert scale is used in these questions with 1 indicating “not at all”, 5 representing “moderately” and 7 meaning “great extent”.

Table 5. 7 - General Information of the Respondents

1.	The industrial sector in which your company operates
2.	How long has your company been in operation (years)
3.	Total number of employees in the company
4.	Your job title
5.	Years in this position

5.7 CA Model and SA Model Setting: An Explanation

Recall that in Chapter 2, based on established research hypotheses, a CA model and a SA model are created in the theoretical framework (see Section 2.10.4). It is necessary here to provide a detail explanation why two models are needed for the quantitative study.

Research Question 4 given in Section 1.3 is "*To what extent inter-firm knowledge transfer between supply chain partners positively impact the development of firm's dynamic capabilities for corporate sustainability?*" Because in sustainable supply chain management, inter-firm knowledge transfer between supply chain partners are either monitor-based or support-based (Vachon and Klassen; 2006; 2007; Lee and Klassen, 2008; Klassen and Vereecke, 2012), the above question can be translated into how these two types of knowledge transfer are related with the development of firm's dynamic capabilities.

Moreover, such a question considers dynamic capabilities of both supply chain buyers and suppliers. However, the sampling frame that can be accessed for the research survey is the registered professional members in CILT (UK) Environment & Sustainability Forum. In reality the survey can only obtain reliable data regarding these members' companies but fail to gain insights into the situations of their suppliers or buyers. Therefore the research designs an alternative approach. Instead of collecting data from both buyers and suppliers in a dyadic supply chain relationship, this approach only concentrates on the situations of the focal firms. However, the focal firms need to consider the relationships with both their supply chain customers and suppliers.

To this regard a special arrangement is generated in the questionnaire. While Section 2 requires survey respondents to consider the status of their firm's dynamic capabilities for corporate sustainability. The Part A of Section 3 asks the respondents to answer the questions regarding sustainable knowledge transfer between their firms

and their biggest supply chain *customer*. Then the Part B of Section 3 asks the same questions showed in Part A of Section 3, but the setting is changed to the relationship between respondents' firms and their biggest supply chain *supplier* (see Appendix B).

Then in SEM analysis, the CA model combines the data collected from the questions of **Section 2** and **Part A of Section 3** to investigate how dynamic capabilities of focal firms, when being supply chain suppliers, can be improved through knowledge transfer. And SA model combines the data collected from questions of **Section 2** and **Part B of Section 3** to investigate how dynamic capabilities of focal firms, when being supply chain customers, can be improved through knowledge transfer.

5.8 Survey Implementation

The target sample frame is consisted of about 2,500 members officially enrolled in CILT (UK) Environment and Sustainability Forum. Under the sponsorship of CILT UK, a large-scale survey is carried out among these members. The survey takes three rounds. In February 2013, an invitation letter with a brief introduction to the objective and procedure of the online survey was disseminated through CILT's internal email database. Following Dillman's (2000) recommendations, a second email was sent to non-respondents three weeks after the original mailing. Then third-round survey was carried out four-weeks later.

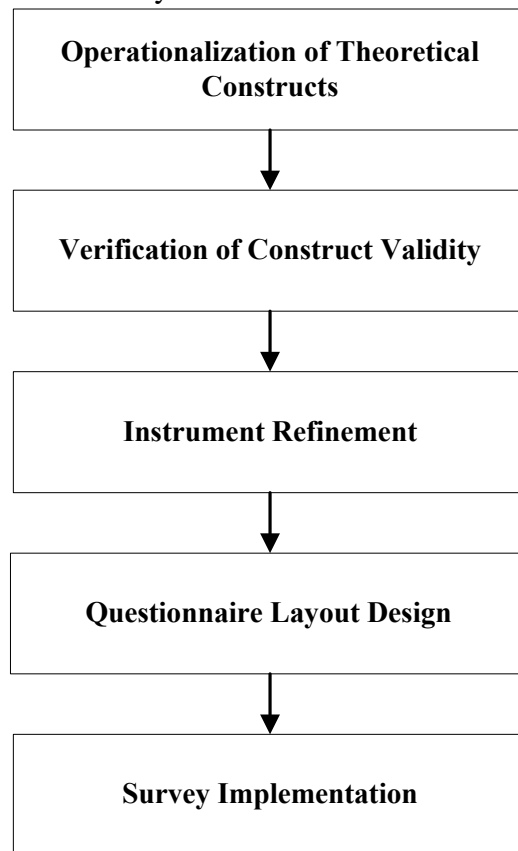
The first round of the survey receives 155 responses, with the second round of 108 responses and the third round providing additional 64 replies. Thus the total sample is

327 and the response rate is 13%, which is in line with the findings typical for surveys of senior managers (Li *et al.*, 2006).

5.9 Chapter Summary

As shown in Figure 5.1, the construction and implementation process of the survey is carried out under the guidance of Tailored Design Method (Dillman, 2000). First, the measurement indicators used in the research are largely adapted from renowned published studies and further justified by the qualitative findings explained in Chapter 4. Second, to verify the construct validity of the measures, a small-scale delphi test is performed among nine academic researchers who are knowledgeable about corporate sustainability and sustainable supply chain management. Third, the wording, relevance and feasibility of the questionnaire are reviewed by both academic researchers and supply chain professionals, so as to ensure the face validity and content validity. Then based on these reviewers' suggestions, the structure of the questionnaire is finalized. Lastly, a three-round survey is carried out among about 2500 CILT members and 327 responses are finally received. The response rate is around 13%.

Figure 5. 1 - The Process of Survey Construction and Execution



CHAPTER 6 - SURVEY DATA ANALYSIS AND RESULTS

6.1 Introduction

This chapter explains in detail how the survey data is analyzed. The chapter is composed of six sections. Section 6.2 introduces the process of data screening and preparation. Section 6.3 performs demographic analysis of the data. Section 6.4 explains why Structural Equation Modeling (SEM) and LISREL software are suitable for the data analysis. The two-stage SEM analyses, namely measurement model analysis and structural model analysis are carried out in Section 6.5 and Section 6.6 respectively. Section 6.7 concludes the main findings of the chapter.

6.2 Data Screening and Preparation

Further data analysis can be performed only after the original data have already been carefully screened and prepared. Data examination and preparation typically involves both missing data treatment and normality testing (Tabachnick and Fidell, 2007). Here missing data treatment and imputation are carried out first and normality testing is performed in Section 6.5.

Missing data is common in empirical studies, especially in survey research when respondents leave certain questions unanswered (Creswell, 2009). According to Hair *et al.* (2010), a received questionnaire containing less than 10% missing data can

generally be accepted, but the one with missing data as high as 15% should be considered to be deleted.

In the study, totally 327 responses are received. Out of them the 104 cases with missing data rate higher than 15% are deleted, and finally 223 cases are remained for later analysis. Thus the final valid response rate is about 8.9%. Table 6.1 summarizes the missing value pattern of the retained cases. The table shows no clear patterns between variables and missing values. Therefore the missing values are considered as random and replaced by the average of non-missing values of the related measurement items, because respondents tend to give similar answers to the questions under the same conceptual category (Allison, 2002).

Table 6. 1 - Summary of Missing Values of Indicators

Items	No. of Missing Value	Percentage
CS3	2	0.9%
CS5	2	0.9%
CI3	1	0.4%
CI5	1	0.4%
MKT2C	1	0.4%
MKT3C	1	0.4%
MKT5C	2	0.9%
SKTC2	1	0.4%
SKT4C	1	0.4%
SKT5C	1	0.4%
MKT3S	1	0.4%
MKT4S	1	0.4%
SKT1S	1	0.4%
SKT2S	1	0.4%
SKT23S	3	1.3%
SKT4S	2	0.9%
Total Entry	223	

6.3 Demographic Analysis

Detailed demographic information of the responses is reported in this section. A good understanding of respondents' and responding firms' background enables the researcher to better judge the quality of the survey research.

6.3.1 Status of Respondents

This survey mainly targets at UK CILT members at managerial positions. As indicated in Table 6.2, 66.8% of the respondents are at top managerial level (CEO/Management Director/Senior Manager). 26.5% of the respondents are middle or line managers. Only 6.7 of the respondents are operating staff. Because the research investigates not only sustainable knowledge transfer between supply chain partners, but also the development of firm's strategic capabilities, it is believed that managers at senior positions are much more capable of providing relevant answers to the survey questions, as they tend to have a broader understanding of their firms' scenario and the strategic partnership with their supply chain partners. In addition, another 15 respondents whose roles are operating staff but with long-term working experience are also included so as to keep a more balanced view for the survey.

Table 6. 2 - Position of Respondents

Position of Respondents	Frequency	Percentage
CEO /Managing Director /Senior Manager	149	66.8%
Department Manager /Line Manager	59	26.5%
Operating Staff	15	6.7%
Total	223	100.0%

6.3.2 Position Duration of Respondents

As showed in Table 6.3, the majority of the respondents possess 1 to 5 years experience in their job positions. The percentage of the respondents with more than 5 years job position experience is 30.5%. So totally 98.7% of the respondents have more than 1 year experience at their working area. Respondents with sufficient working experience and expertise tend to have a better understanding of their firms and their departments.

Table 6. 3 - Position Duration of Respondents

Duration	Frequency	Percentage
Less than 1 year	3	1.3%
1 - 5 years	152	68.2%
More than 5 years	68	30.5%
Total	223	100.0%

6.3.3 Working Area of Respondents

Because the majority of the respondents are at senior managerial positions, 39.5% of the respondents indicate that their working area is "general" (see Table 6.4). This means their working roles cover multiple working areas in their firms. Furthermore, 19.3% of the respondents are from distribution area, 16.6% from operation departments, and 10.3% from purchasing/procurement areas. Such a pattern ensures that the majority of the respondents are experts in the areas of firm's strategic development and supply chain management.

Table 6. 4 - Working Areas of Respondents

Working Areas of Respondents	Frequency	Percentage
General	88	39.5%
Distribution	43	19.3%
Operation	37	16.6%
Purchasing /Procurement	23	10.3%
Customer Service	22	9.9%
Design /Development	7	3.1%
Finance	3	1.3%
Total	223	100.0%

6.3.4 Size of Responding Firms

As indicated in Table 6.5, although the majority of responding firms are large organizations with more than 250 employees (69.5%), Small and medium-sized companies (SMEs) also possess 30.5% of the total sampling This relatively even sample pattern can reflect a more balanced view towards survey questions.

Table 6. 5 - Number of Employees of Responding Firms

No. of Employees of Responding Firms	Frequency	Percentage
1 - 50	44	19.7%
51 - 250	24	10.8%
More than 250	155	69.5%
Total	223	100.0%

6.3.5 Industrial Sectors of Responding Firms

The industrial sectors of responding firms are categorized according to Standard Industrial Classification of economic activities (SIC), UK. Table 6.6 shows that the survey covers 12 major industrial sectors in which "manufacturing", and "transportation and storage" are the top 2 (33.6% and 22.0% respectively). This is an

anticipated pattern because the survey is carried out in CILT members whose working areas mainly locate at manufacturing and logistics areas. Also, the inclusion of other industrial sectors provides a more holistic perspective regarding sustainable knowledge transfer and corporate sustainability.

Table 6. 6 - Industrial Sectors of Responding Firms

Sector	Frequency	Percentage
Manufacturing	75	33.6%
Transportation and Storage	49	22.0%
Information and Communication	27	12.1%
Professional, Scientific and Technical Activities	25	11.2%
Electricity, Gas, Steam and Air Conditioning Supply	14	6.3%
Mining and Quarrying	9	4.0%
Construction	6	2.7%
Wholesale and Retail Trade	5	2.2%
Agriculture, Forestry and Fishing	4	1.8%
Public Administration and Defence; Compulsory Social Security	4	1.8%
Real Estate Activities	3	1.3%
Water Supply, Sewerage, Waste Management and Remediation Activities	2	0.9%
Total	223	100.0%

6.4 Structural Equation Modeling (SEM) and LISREL

Structural Equation Modeling (SEM) combines a group of statistical techniques such as causal analysis and modelling, analysis of covariance structure, simultaneous equation modelling, and analysis of path or confirmatory factor (Tabachnick and Fidell, 2007). As a multivariate statistical method, SEM has been widely used in social, economic and management researches. The reason is that SEM is built on, but goes beyond conventional regression analysis in two ways. First, SEM allows researchers to handle a series of dependent relationships simultaneously (Jóreskog and Sorbom, 1989). Second, SEM allows the comparison of alternative models (Hair *et al.*, 1998).

SEM is considered as the most appropriate analytical method of the research due to the following reasons. First, the research considers complex relationships between supply chain sustainable knowledge transfer and the development of corporate dynamic capabilities. Therefore single measure or indicator is unlikely to reflect the underlying construct entirely. To this point SEM enables the researcher to use several observed indicators to measure a single latent variable. Second, by using SEM, various causal relationships can be measured between the exogenous latent variables at supply chain knowledge transfer side and the endogenous latent variables at dynamic capabilities side. Third, SEM allows the researcher to compare alternative models, and generate various explanations through empirical data analysis.

Various SEM techniques exist such as Linear Structural Relations (LISREL), Analysis of Moment Structures (AMOS) and Partial Least Squares (PLS) (Bagozzi and Fornell, 1982). From them LISREL is chosen in this study because of the following justifications. First, compared with PLS, LISREL normally returns a more robust estimation with the same dataset (Bagozzi and Fornell, 1982). However, the restriction is that to meet LISREL program requirement, the input sample size should exceed the threshold of 200 (Boomsma and Hoogland, 2001). Considering that the useable samples for this SEM analysis are 223, LISREL is a more appropriate choice. Second, the graphical interface of AMOS means that it is an easy-to-use software. However, compared with AMOS, the syntax program of LISREL software provides the researcher additional benefits including free control of model parameter setting, easy change of model modification process, and flexible adjustment of model specification by alternating a relatively small number of parameters (Jóreskog and Sorbom, 2004). Therefore, by comparing the above-mentioned three SEM software, LISREL (software version 8.80) has been selected for the following SEM analysis.

SEM analysis typically includes two-stage analyses, namely measurement model analysis and structural model analysis. Measurement model analysis considers the relationship between observed variables and latent variables (Gefen *et al.*, 2000; Hair *et al.*, 2006). If the validity and reliability of the model in measurement analysis can be confirmed, SEM analysis will enter the second-stage, or structural model analysis. In structural model stage, the regression, or path analysis is deployed to verify the hypothetical causal relationship between exogenous latent variables and endogenous latent variables (Hair *et al.*, 2006).

6.5 Measurement Model Analysis

Measurement model analysis normally involves six steps: (1) data preparation and screening; (2) missing data treatment and imputation; (3) normality testing; (4) Confirmatory Factor Analysis (CFA); (5) model modification; and (6) reliability and validity evaluation (Hair *et al.*, 2006).

Because Step 1 and 2 (data preparation and screening; missing data treatment and imputation) have been performed in Section 6.2 of the chapter, the analysis begins from Step 3. In addition, as illustrated in Section 2.10.4 and Section 5.7, the survey separates sustainable knowledge transfer activities between responding firms and their supply chain partners into two groups. One is with responding firms' upstream suppliers and one with their downstream customers. Therefore, there are two individual settings in the following analysis. The first is called CA model regarding focal firm's sustainable knowledge transfer with their supply chain customers (see also in Section 2.10.4 and Section 5.7). The second is named as SA model related with focal firm's sustainable knowledge transfer with their supply chain suppliers (see also in Section 2.10.4 and Section 5.7).

6.5.1 Normality Testing for CA Model and SA Model

Various estimation methods of SEM are commonly used such as Maximum Likelihood (ML), Generalized Least Square (GLS), Weighted Least Squares (WLS) and Robust Maximum Likelihood (RML) (Jóreskog and Sorbom, 1989). From them Maximum Likelihood and Generalized Least Square (GLS) are based on the assumption of multivariate normality of the observed variables (Tabachnick and

Fidell, 2007). If the normality assumption cannot be verified in data analysis, other methods, such as WLS and RML are suggested to be considered (Jóreskog and Sorbom, 1989).

It is recommended that if a data set is normally distributed, the related absolute Skewness and Kurtosis values should not be greater than 1 (Schumacker and Lomax, 2004). Table 6.7 and Table 6.8 show the normality testing results of observed variables of CA model and SA model respectively.

The normality testing result of the observed variables of CA model indicates that the Skewness and Kurtosis values of several variables is out of +1 and -1 range, which means that the normality assumption cannot be held for this dataset (see Table 6.7).

Table 6. 7 - Univariate Summary Statistics for Continuous Variables in CA model

Variable	Mean	St. Dev.	T-Value	Skewness	Kurtosis	Minimum	Freq.	Maximum	Freq.
CS1	5.435	1.37	59.232	-1.151	1.175	1	3	7	47
CS2	5.43	1.393	58.223	-1.157	1.364	1	5	7	51
CS3	5.296	1.465	53.983	-0.906	0.385	1	4	7	49
CS4	4.857	1.371	52.89	-0.363	-0.339	1	1	7	27
CS5	5.265	1.479	53.168	-0.785	0.095	1	4	7	51
CI1	4.731	1.58	44.728	-0.414	-0.559	1	6	7	31
CI2	4.816	1.602	44.905	-0.513	-0.652	1	4	7	32
CI3	4.516	1.509	44.68	-0.256	-0.773	1	3	7	18
CI4	4.466	1.442	46.259	-0.21	-0.523	1	4	7	17
CI5	4.677	1.645	42.458	-0.397	-0.617	1	9	7	33
CR1	4.57	1.603	42.56	-0.299	-0.691	1	6	7	28
CR2	4.691	1.568	44.679	-0.255	-0.718	1	3	7	34
CR3	4.709	1.639	42.911	-0.447	-0.57	1	8	7	34
CR4	4.717	1.541	45.714	-0.434	-0.319	1	7	7	30
CR5	4.511	1.556	43.286	-0.35	-0.422	1	9	7	23
MKT1C	4.776	1.754	40.666	-0.674	-0.347	1	18	7	37
MKT2C	4.502	1.867	36.013	-0.4	-0.86	1	21	7	37
MKT3C	4.821	1.764	40.808	-0.618	-0.47	1	15	7	43
MKT4C	4.413	2.218	29.71	-0.294	-1.341	1	39	7	60
MKT5C	4.126	1.953	31.55	-0.214	-1.059	1	35	7	29
SKT1C	4.937	1.508	48.878	-0.6	-0.18	1	6	7	32
SKT2C	4.09	1.763	34.636	-0.227	-0.875	1	24	7	17
SKT3C	2.946	1.78	24.717	0.498	-0.791	1	71	7	8
SKT4C	3.211	1.746	27.454	0.262	-0.93	1	54	7	8
SKT5C	3.538	1.857	28.454	0.129	-1.097	1	44	7	13

Similarly, in SA model, a set of variables' Skewness and Kurtosis levels is beyond the range of +1 and -1 (see Table 6.8). Therefore Maximum Likelihood (ML) is not an appropriate estimation method in the analysis, although ML is the most commonly used one in SEM.

Table 6. 8 - Univariate Summary Statistics for Continuous Variables in SA model

Variable	Mean	St. Dev.	T-Value	Skewness	Kurtosis	Minimum	Freq.	Maximum	Freq.
CS1	5.435	1.37	59.232	-1.151	1.175	1	3	7	47
CS2	5.43	1.393	58.223	-1.157	1.364	1	5	7	51
CS3	5.296	1.465	53.983	-0.906	0.385	1	4	7	49
CS4	4.857	1.371	52.89	-0.363	-0.339	1	1	7	27
CS5	5.265	1.479	53.168	-0.785	0.095	1	4	7	51
CI1	4.731	1.58	44.728	-0.414	-0.559	1	6	7	31
CI2	4.816	1.602	44.905	-0.513	-0.652	1	4	7	32
CI3	4.516	1.509	44.68	-0.256	-0.773	1	3	7	18
CI4	4.466	1.442	46.259	-0.21	-0.523	1	4	7	17
CI5	4.677	1.645	42.458	-0.397	-0.617	1	9	7	33
CR1	4.57	1.603	42.56	-0.299	-0.691	1	6	7	28
CR2	4.691	1.568	44.679	-0.255	-0.718	1	3	7	34
CR3	4.709	1.639	42.911	-0.447	-0.57	1	8	7	34
CR4	4.717	1.541	45.714	-0.434	-0.319	1	7	7	30
CR5	4.511	1.556	43.286	-0.35	-0.422	1	9	7	23
MKT1S	4.359	2.037	31.951	-0.405	-1.107	1	36	7	35
MKT2S	4.188	2.031	30.789	-0.272	-1.201	1	38	7	30
MKT3S	4.39	2.008	32.65	-0.365	-1.13	1	30	7	36
MKT4S	4.121	2.105	29.235	-0.208	-1.27	1	44	7	36
MKT5S	3.978	1.996	29.751	-0.137	-1.235	1	39	7	24
SKT1S	5.004	1.607	46.517	-0.77	0.083	1	10	7	42
SKT2S	4.126	1.865	33.027	-0.268	-0.937	1	32	7	23
SKT3S	3.126	1.934	24.132	0.397	-1.107	1	72	7	11
SKT4S	3.413	1.929	26.418	0.203	-1.195	1	55	7	13
SKT5S	3.664	1.938	28.231	0.102	-1.149	1	44	7	20

In addition, although Weighted Least Squares (WLS) method does not depend on the non-normality assumption, it requires a large sample size (about or over 2000) to return a fairly accurate estimation (Boomsma and Hoogland, 2001). Considering that the finalized sample size of the survey is only 223, WLS method is not suitable as well. Robust Maximum Likelihood (RML) method is thus adopted for data analysis because it does not require the non-normality assumption (Browne, 1987). Also RML

can generate more accurate estimation even with a relatively small sample size (Boomsma and Hoogland, 2001).

6.5.2 Confirmatory Factor Analysis (CFA) for CA model and SA model

Confirmatory Factor Analysis (CFA) aims to assess measurement properties in terms of the relationship between observed indicators and related latent variables (Bryant *et al.*, 1999). As suggested by Anderson and Gerbing (1988) and Hair *et al.* (2006), a combination of indices should be considered in CFA to evaluate the fit of the model, which typically includes Chi-Square/Degrees of Freedom (χ^2/df), Normed Fit Index (NFI), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standard Root Mean Square Residual (SRMR). Also it should be noticed that, because the model datasets do not follow normal distribution, Satorra-Bentler Scaled Chi-Square (S-B χ^2) is adopted instead of Chi-Square (χ^2) in computing Chi-Square/ Degrees of Freedom (χ^2/df) (Bentler and Bonnett, 1980; Bhattacharjee, 2002). Lastly, to ensure a sufficient model fit, factor loading of observed variables should be greater than 0.70 (Hair *et al.*, 2006).

(1) Chi-Square/Degrees of Freedom (χ^2/df)

Indicator of Chi-Square/Degrees of Freedom (χ^2/df) is used to assess the matching between theoretical model and observed model (Bentler and Bonnett, 1980; Bhattacharjee, 2002). The closer to 1 of χ^2/df , the better the model fit is, and the ratio of less than 3 indicates an acceptable model fit (Kline, 1998).

(2) Normed Fit Index (NFI)

Normed Fit Index (NFI) computes the difference of χ^2 s between hypothesized model and null model, so as to determine the fit improvement of hypothesized model compared with the basic model of no covariance assumptions (Hair *et al.*, 2006). Normally if the value of NFI is over 0.90, the model can be accepted (Kline, 1998).

(3) Comparative Fit Index (CFI)

Comparative Fit Index (CFI) reflects the overall improvement level of observed model over null model (Bentler and Bonnett, 1980). The model fit is acceptable if the value of CFI is over 0.95.

(4) Root Mean Square Error of Approximation (RMSEA)

Indicator of Root Mean Square Error of Approximation (RMSEA) is used to measure the average variance per degree of freedom expected to occur in the population (Hair *et al.*, 1998). A value of RMSEA ranging from 0.05 to 0.08 can be accepted (Hair *et al.*, 1998).

(5) Standard Root Mean Square Residual (SRMR)

Standard Root Mean Square Residual (SRMR) is based on the analysis of standardized residuals and indicates the average difference between the predicted and observed variances and covariances of the model (Hu and Bentler, 1998). A value of SRMR less than 0.08 suggests a good fitting model (Kline, 1998). Table 6.9 concludes the ranges and thresholds of these measurement indices.

Table 6. 9 - Summary of Typical Measurement Indices and Thresholds used in CFA

Name of Indicators	Range	Threshold
Chi-Square/Degrees of Freedom (χ^2/df)	NA	< 3
Normed Fit Index (NFI)	0 - 1	> 0.90
Comparative Fit Index (CFI)	0 - 1	> 0.95
Root Mean Square Error of Approximation (RMSEA)	0 - 1	0.05 - 0.08
Standard Root Mean Square Residual (SRMR)	0 - 1	< 0.08

As shown in Table 6.10, the CFA analysis of the original full scale CA and SA models only suggests a moderate model fit. Especially the measurements of RMSEA (over 0.08) and SRMR (surrounding 0.08) of both models fail to or just nearly pass the thresholds.

Table 6. 10 - CFA Analysis Result of CA and SA Original Models

CFA Model	χ^2/df	NFI	CFI	RMSEA	SRMR
CA original model	2.62	0.95	0.97	0.085	0.081
SA original model	2.43	0.96	0.98	0.080	0.077

Moreover, when factor loadings are examined, observed variables of CR5, MKT4C and SKT1C in CA model, and CR5 and SKT1S in SA model bear insufficient loading with correspondent latent variables (not greater than 0.70) (see Figure 6.1 and 6.2). Obviously further modification of both CA model and SA model is necessary. The

following two sections elaborate the modification processes for these two models sequentially.

Figure 6. 1 - CA Measurement Model based on Entire Samples

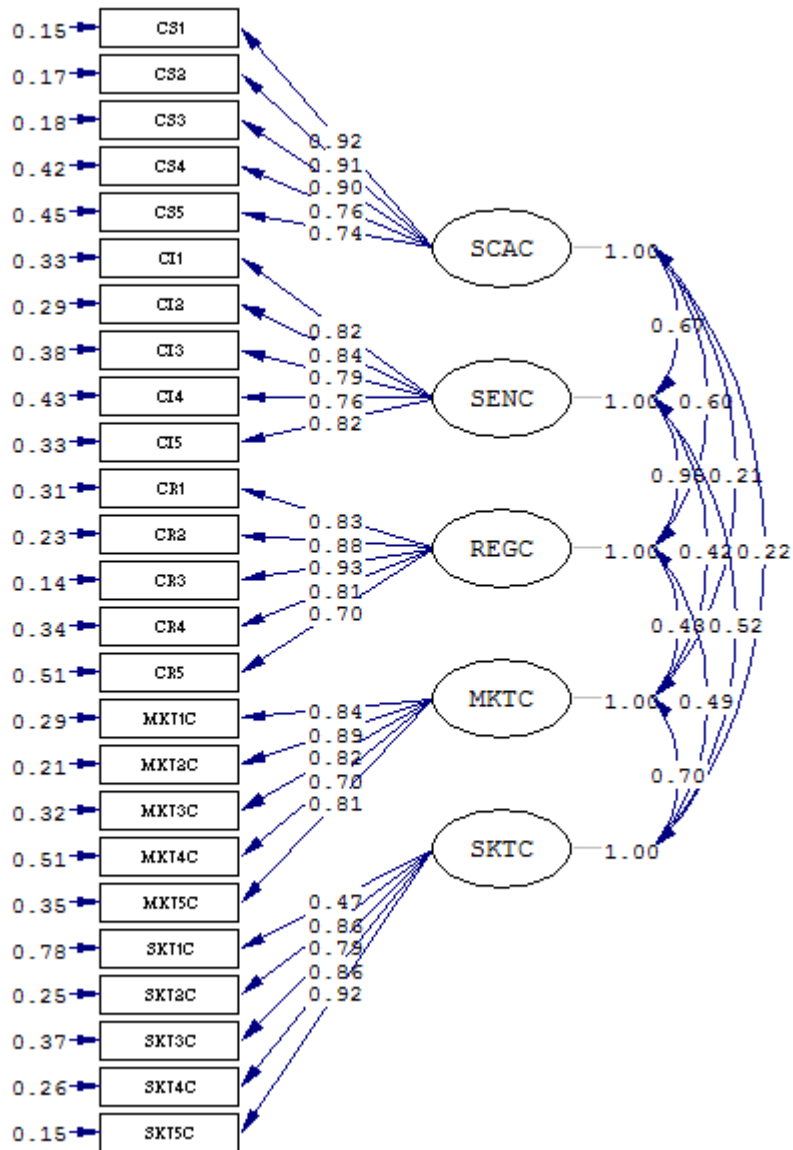
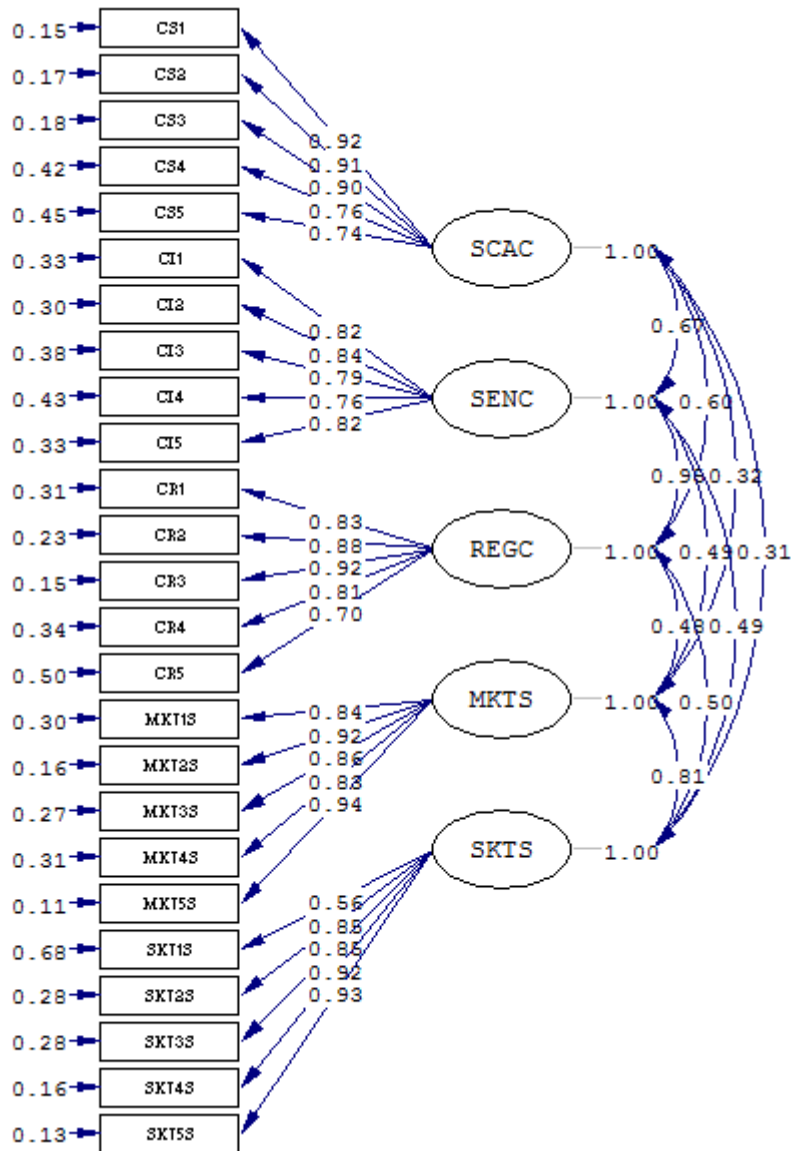


Figure 6. 2 - SA Measurement Model based on Entire Samples



6.5.3 CA Model Modification

Figure 6.1 indicates that observed variables of CR5, MKT4C and SKT1C in CA model bear insufficient loading with correspondent latent variables (not greater than 0.70). Because indicators with low loadings are problematic and might be considered as candidates for elimination (Benson and Bandalos; 1992), after a careful review of relevant item contents, CR5, MKT4C and SKT1C are removed from CA model.

Then another CFA test is conducted with the refined CA model (R1). The results show moderate improvement in model fit ($\chi^2/df = 2.41$, NFI = 0.96, CFI = 0.98, RMSEA = 0.080, and SRMR = 0.076).

Modification Indices (MI) reported in the model evaluation output shows that observed variables of CS4 and CS5 bear large modification values. The contents of these two variables are thus evaluated. CS4 is found having overlap meaning with latent constructs of SENC, REGC and SKTC, and CS5 having overlap with SENC and REGC. Therefore these two observed indicators are deleted as redundant ones in CA model (R2) (Jóreskog and Sorbom, 1989). The result shows further improvement ($\chi^2/df = 2.20$, NFI = 0.96, CFI = 0.98, RMSEA = 0.073, and SRMR = 0.059). Table 6.11 compares the CFA results of the three models and CA model R2 is accepted as the best fitting model for next-stage, structural model analysis.

Table 6. 11 - CFA Analysis Results of CA Refined Models

CFA Model	χ^2/df	NFI	CFI	RMSEA	SRMR
CA original model	2.62	0.95	0.97	0.085	0.081
CA model R1	2.41	0.96	0.98	0.080	0.076
CA model R2	2.20	0.96	0.98	0.073	0.059

6.5.4 SA Model Modification

SA model modification follows a similar process. First, two observed variables with low factor loadings, CR5 and SKT1C are removed. The CFA result of SA model (R1) shows good model fit improvement ($\chi^2/df = 2.17$, NFI = 0.97, CFI = 0.98, RMSEA =

0.072, and SRMR = 0.069). Second, according to MI, redundant indicators of CS4 and CS5 are deleted in SA model (R2) with a further improved result of $\chi^2/df = 1.91$, NFI = 0.97, CFI = 0.99, RMSEA = 0.064, and SRMR = 0.051.

Table 6.12 reports CFA results of the three models and SA model R2 is accepted as the best fitting model for next-stage, structural model analysis.

Table 6. 12 - CFA Analysis Results of SA Refined Models

CFA Model	χ^2/df	NFI	CFI	RMSEA	SRMR
SA original model	2.43	0.96	0.98	0.080	0.077
SA model R1	2.17	0.97	0.98	0.072	0.069
SA model R2	1.91	0.97	0.99	0.064	0.051

6.5.5 Reliability and Validity Evaluation of CA and SA CFA Refined Models

In SEM, measurement model analysis uses CFA to test reliability and validity of the model. Reliability represents the trustworthiness of measurement instruments, and validity indicates to what extent the instruments characterise latent constructs (Hair *et al.*, 2006).

Two indicators are typically used in reliability or internal consistency measurement, namely Cronbach's alpha (α) and Composite Reliability. Cronbach's α coefficient method tests how closely a set of items are related as a group (Tabachnick and Fidell, 2007). A minimum value of 0.70 is considered as acceptable in Cronbach's α test (Nunnally, 1978). Composite Reliability, on the other hand, compares the squared

sum of factor loadings with the squared sum of total variance, thus treating α value as lower-bound reliability estimate (Hair *et al.*, 2006). Similar to Cronbach's α method, a value of 0.70 is an acceptable threshold in Composite Reliability test (Medsker *et al.*, 1994).

Table 6.13 shows that both Cronbach's α and Composite Reliability of the constructs in CA model R2 greatly exceed the suggested threshold of 0.7. Similarly, the reliability analysis for constructs in SA model R2 also shows a very satisfactory result (see Table 6.14).

Table 6. 13 - Reliability Analysis for Constructs in CA Model R2

Construct	No. of Items	Cronbach's Alpha	Composite Reliability
SCAC	3	0.940	0.941
SENC	5	0.901	0.902
REGC	4	0.917	0.921
MKTC	4	0.903	0.906
SKTC	4	0.920	0.923

Table 6. 14 - Reliability Analysis for Constructs in SA Model R2

Construct	No. of Items	Cronbach's Alpha	Composite Reliability
SCAC	3	0.940	0.943
SENC	5	0.901	0.902
REGC	4	0.917	0.921
MKTS	5	0.943	0.943
SKTS	4	0.935	0.936

Validity test involves both convergent and discriminant validity measures. On the one hand, for convergent validity, it is suggested that: (1) all factor loadings should exceed 0.70; (2) Composite Reliability should exceed 0.70 as well; (3) Average Variance Extracted (AVE) of each construct should exceed 0.50 (Fornell and Yi, 1992). On the other hand, for discriminant validity, the AVE value of each construct should be larger than the squared factor correlations between this construct and other ones (Hair *et al.*, 2006).

Table 6.15 and Table 6.16 conclude the convergent validity analysis for CA model R2 and SA model R2 respectively. The results indicate that the convergent validity of these two models is deemed to be accepted (see Table 6.15 and Table 6.16).

Table 6. 15 - Convergent Validity Analysis for Constructs in CA Model R2

Construct	No. of Items	Standardized Factor Loading Range	Composite Reliability	AVE (Average Variance Extracted)
SCAC	3	0.89 - 0.93	0.941	0.841
SENC	5	0.75 - 0.84	0.902	0.647
REGC	4	0.80 - 0.93	0.921	0.746
MKTC	4	0.77 - 0.91	0.906	0.708
SKTC	4	0.81 - 0.92	0.923	0.750

Table 6. 16 - Convergent Validity Analysis for Constructs in SA Model R2

Construct	No. of Items	Standardized Factor Loading Range	Composite Reliability	AVE (Average Variance Extracted)
SCAC	3	0.89 - 0.94	0.943	0.847
SENC	5	0.75 - 0.84	0.902	0.647
REGC	4	0.80 - 0.93	0.921	0.746
MKTS	5	0.83 - 0.94	0.943	0.770
SKTS	4	0.83 - 0.93	0.936	0.785

In terms of discriminant analysis, in both CA and SA models the AVEs of constructs SENC and REGC are lower than the Squared Factor Correlations (see Table 6.17 and Table 6.18). This is mainly due to the strong correlation between SENC and REGC.

However, in the research SENC and REGC are still treated as two separate constructs because they are developed based on distinctive theoretical underpinnings. In this regard high or perfect correlation is not a sufficient condition to claim that these two theoretically distinctive concepts are uni-dimensional rather than bi-dimensional (Bollen and Hoyle, 1990). Moreover, as suggested by Moore and Benbasat (1991), conceptual dimensionality should be distinguished from empirical dimensionality, in that constructs are conceptually different although they tend to be viewed identically by the respondents (He *et al.*, 2006).

Table 6. 17 - Discriminant Validity Analysis for Constructs in CA Model R2

Construct	No. of Items	AVE	Squared Factor Correlations				
			SCAC	SENC	REGC	MKTC	SKTC
SCAC	3	0.841	1.000				
SENC	5	0.647	0.360	1.000			
REGC	4	0.746	0.270	0.884	1.000		
MKTC	4	0.708	0.032	0.168	0.176	1.000	
SKTC	4	0.750	0.026	0.250	0.221	0.436	1.000

Table 6. 18 - Discriminant Validity Analysis for Constructs in SA Model R2

Construct	No. of Items	AVE	Squared Factor Correlations				
			SCAC	SENC	REGC	MKTC	SKTC
SCAC	3	0.847	1.000				
SENC	5	0.647	0.360	1.000			
REGC	4	0.746	0.270	0.903	1.000		
MKTS	5	0.770	0.090	0.240	0.230	1.000	
SKTS	4	0.785	0.078	0.230	0.240	0.640	1.000

By completing the six steps involved in measurement model analysis, CA model R2 and SA model R2 are finalized for next-stage, structural model analysis (see Figure 6.3 and Figure 6.4).

Figure 6.3 - CA Model R2

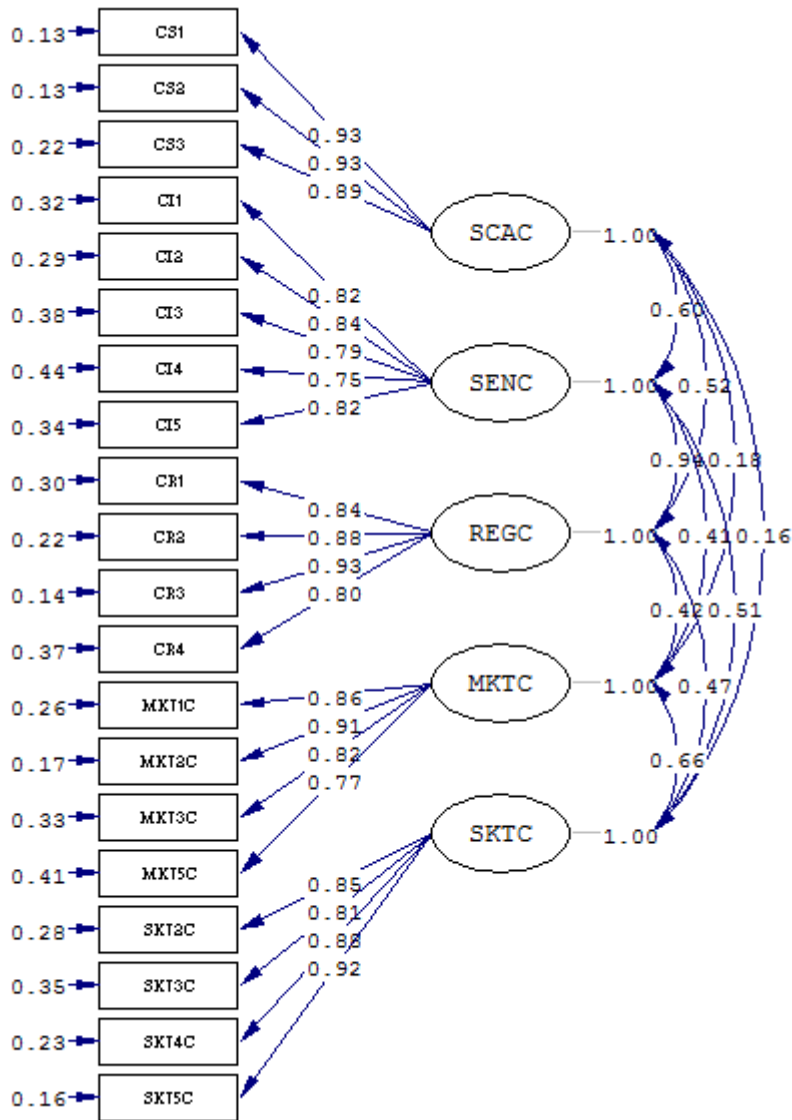
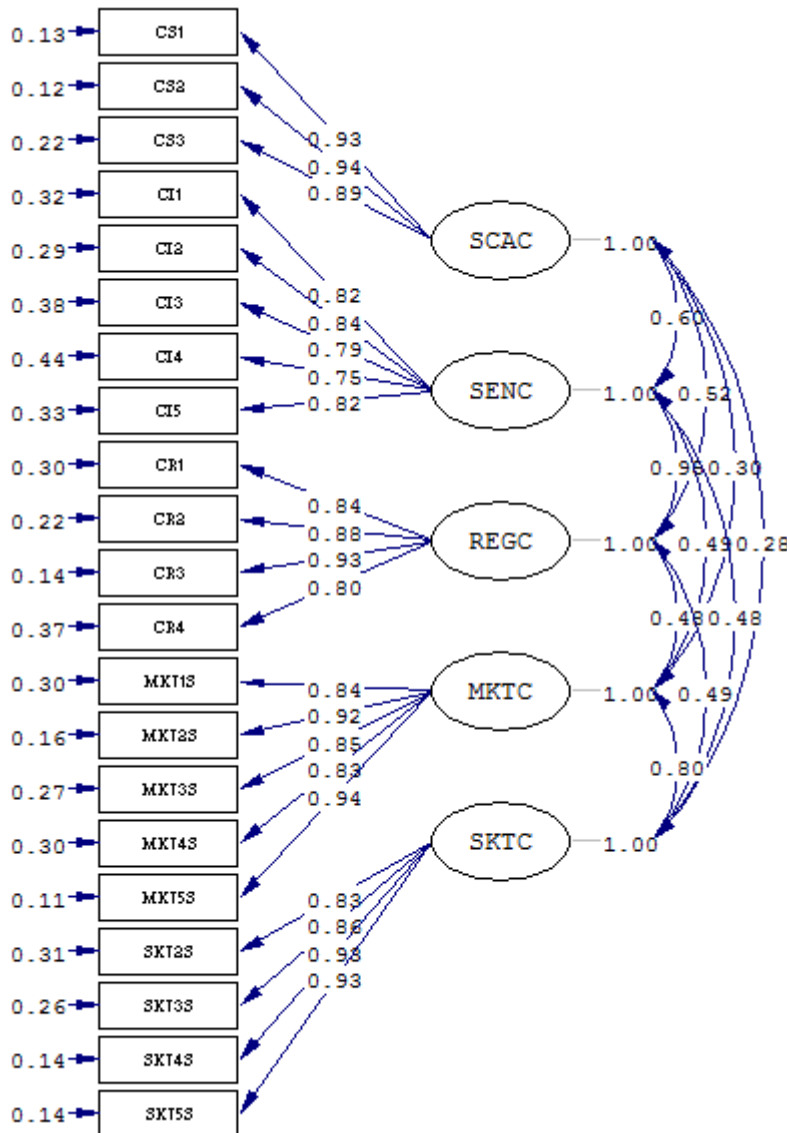


Figure 6. 4 - SA Model R2



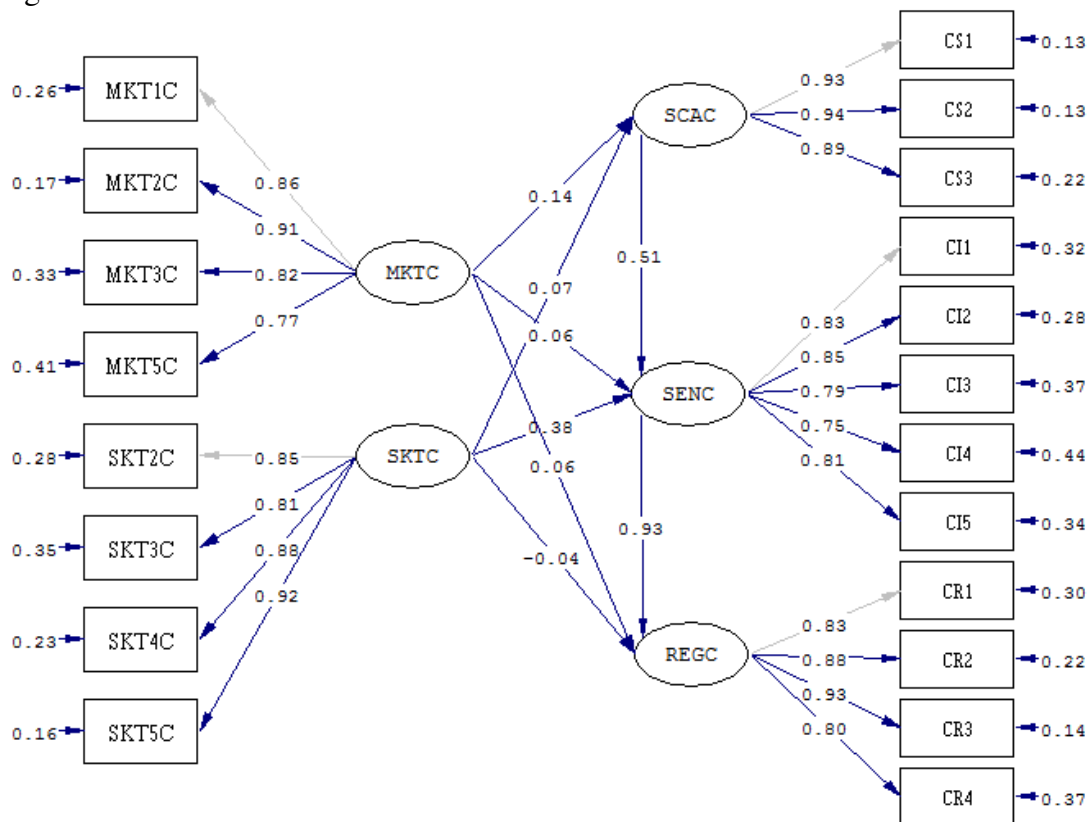
6.6 Structural Equation Modeling

Structural equation modeling follows a two-step analysis procedure. At Step One, a least restricted model is established in which all relationships between exogenous and endogenous variables are free to be estimated. This is treated as the initial model. At Step Two, based on the initial model, insignificant path estimations will be fixed one by one in the trimming process (Jóreskog and Sorbom, 1989), until further constraints will not significantly impact the overall fit of the model (Deng *et al.*, 2005).

6.6.1 CA Initial Structural Model

Figure 6.5 shows CA Initial Structural Model with all the paths from MKTC (monitor-based knowledge transfer) and SKTC (support-based knowledge transfer) to SCAC (scanning capability), SENC (sensing capability) and REGC (reconfiguration capability) free to be estimated. The model shows an acceptable model fit ($\chi^2 = 354.25$, $df = 161$, $\chi^2/df = 2.20$, NFI = 0.96, CFI = 0.98, RMSEA = 0.074, and SRMR = 0.059). However, in terms of path estimation, four path coefficients (MKTC to SENC, MKTC to REGC, SKTC to SCAC, and SKTC to REGC) fail to pass the significance threshold (with the values of 0.06, 0.06, 0.07 and -0.04 respectively).

Figure 6. 5 - CA Initial Structural Model



6.6.2 CA Structural Model Trimming

In CA structural model trimming process, path parameters with insignificant t-value (less than 1.96) are considered as candidate for fixing (Jóreskog and Sorbom, 1989). And only one path parameter is fixed at a time (Hair *et al.*, 2006).

First, path parameter between SKTC and REGC is fixed because it bears smallest path coefficient (-0.04). The result shows a slight Chi-square increase ($\Delta\chi^2 = 0.92$, $\Delta df = 1$). Moreover, the value of RMSEA reduces from 0.074 to 0.073. This suggests that path from SKTC to REGC is redundant. Second, path parameter between MKTC and REGC is fixed (path coefficient = 0.04). This time a minor Chi-square decrease is observed ($\Delta\chi^2 = -0.15$, $\Delta df = 1$). Third, with path parameter between SKTC and SCAC (path coefficient = 0.07) fixed, the Chi-square increases slightly ($\Delta\chi^2 = 0.52$, $\Delta df = 1$). Finally, path parameter between MKTC and SENC is fixed. The result shows not only a slight Chi-square increase ($\Delta\chi^2 = 1.81$, $\Delta df = 1$), but also an improved RMSEA value (0.072) (see Table 6.19).

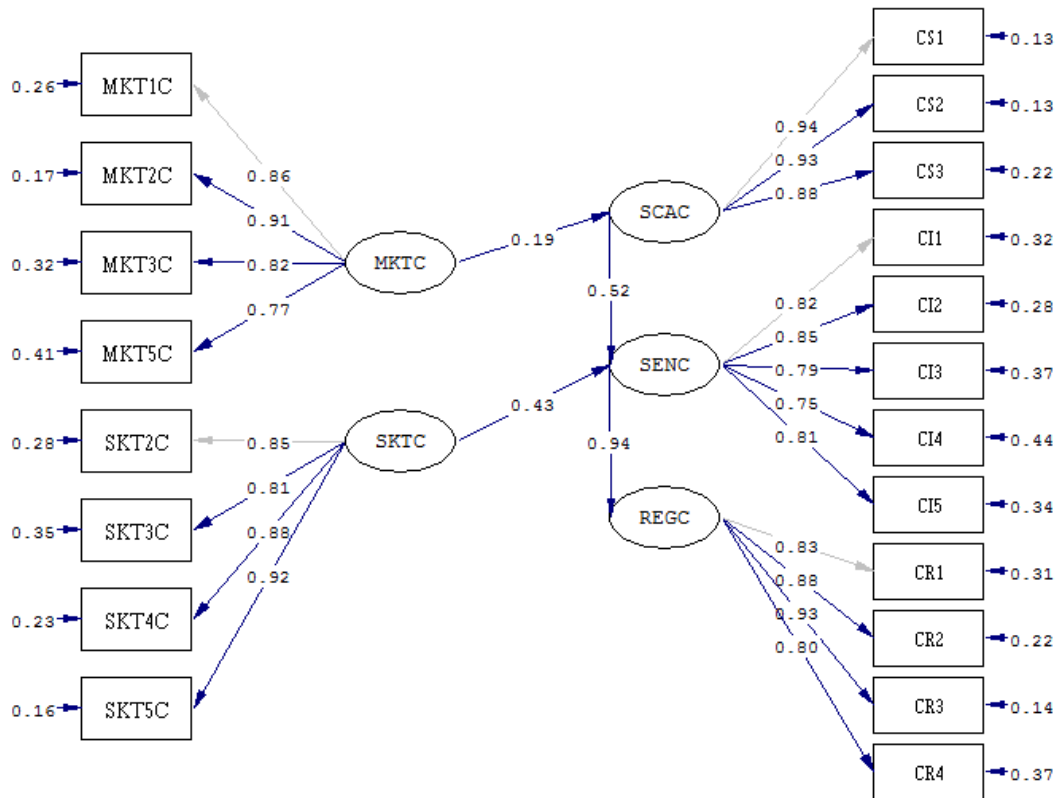
Table 6. 19 - Trimming Process of CA Structural Equation Model

CA Structural Model	χ^2	<i>df</i>	χ^2/df	NFI	CFI	RMSEA	SRMR
CA initial structural model	354.25	161	2.20	0.96	0.98	0.074	0.059
CA structural model 2 <i>(with Path SKTC-REGC fixed)</i>	355.17	162	2.19	0.96	0.98	0.073	0.059
CA structural model 3 <i>(with Path MKTC-REGC fixed)</i>	355.02	163	2.18	0.96	0.98	0.073	0.059

CA structural model 4 <i>(with Path SKTC-SCAC fixed)</i>	355.54	164	2.17	0.96	0.98	0.073	0.060
CA final structural model <i>(with Path MKTC-SENC fixed)</i>	357.35	165	2.17	0.96	0.98	0.072	0.061

Figure 6.6 shows final CA structural model. As expected, monitor-based knowledge transfer positively impacts the development of focal firms' scanning capability, and there is also a significant positive relationship between support-based knowledge transfer and focal firms' sensing capability. Hypotheses 1a and 2b are thus supported. Moreover, the development of scanning capability has a significant effect on sensing capability, which in turn facilitates reconfiguration capability. However, Hypotheses 1b and 2a are not supported, because the model fails to show significant positive relationships both between monitor-based knowledge transfer and firm's sensing capability, and between support-based knowledge transfer and firm's scanning capability.

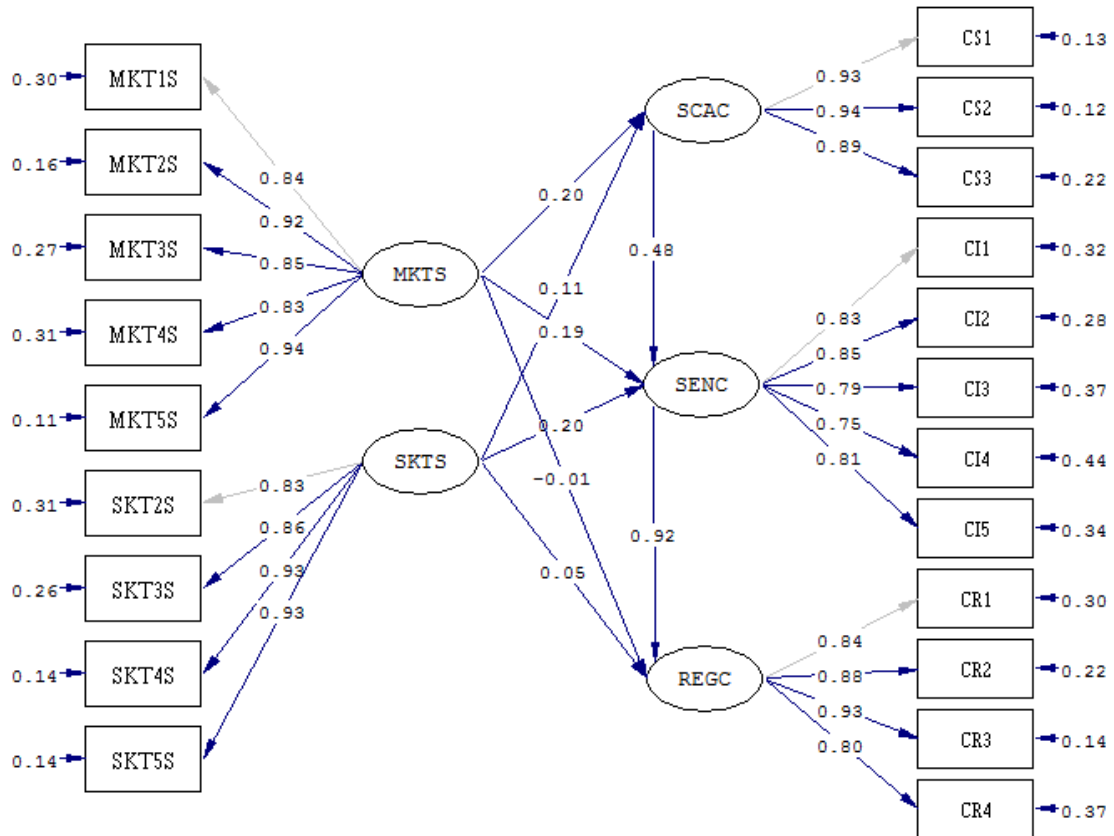
Figure 6. 6 - CA Final Structural model



6.6.3 SA Initial Structural Model

Figure 6.7 shows SA Initial Structural Model with all the paths from MKTS (monitor-based knowledge transfer) and SKTS (support-based knowledge transfer) to SCAC (scanning capability), SENC (sensing capability) and REGC (reconfiguration capability) free to be estimated. The model indicates a fairly good model fit ($\chi^2 = 354.07$, $df = 180$, $\chi^2/df = 1.97$, NFI = 0.97, CFI = 0.99, RMSEA = 0.064, and SRMR = 0.052). The model estimation also shows the smallest path coefficient between MKTS and REGC (-0.01). This path estimate is therefore fixed first in the following model trimming process.

Figure 6. 7 - SA Initial Structural Model



6.6.4 SA Structural Model Trimming

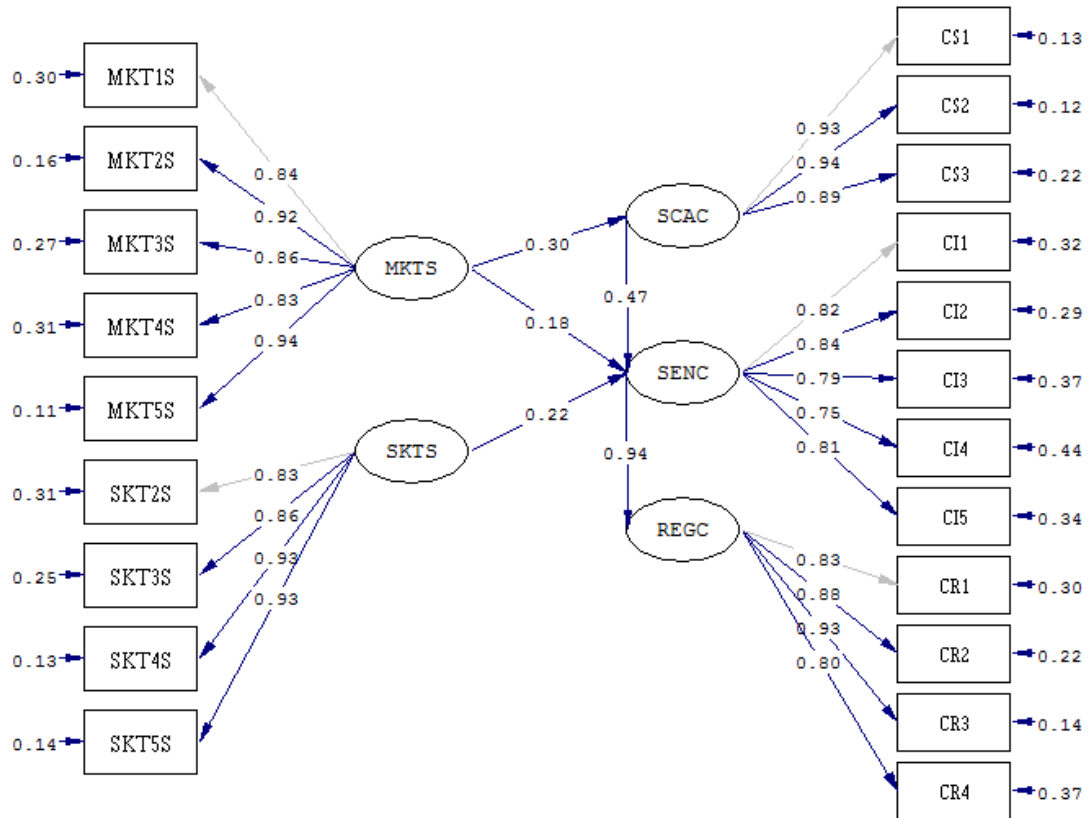
First, path parameter between MKTS and REGC is fixed because it bears smallest path coefficient (-0.01). The result shows a slight Chi-square increase ($\Delta\chi^2 = 0.24$, $\Delta df = 1$). This suggests that path from MKTS to REGC is redundant. Second, path parameter between SKTS and REGC is fixed (with path coefficient = 0.04). This time a minor Chi-square increase is observed ($\Delta\chi^2 = 0.14$, $\Delta df = 1$). Finally, path parameter between SKTS and SCAC is fixed. The result shows not only a slight Chi-square decrease ($\Delta\chi^2 = -1.07$, $\Delta df = 1$), but also an improved RMSEA (0.063) (see Table 6.20).

Table 6. 20 - Trimming Process of SA Structural Equation Model

SA Structural Model	χ^2	df	χ^2/df	NFI	CFI	RMSEA	SRMR
SA initial structural model	345.07	180	1.97	0.97	0.99	0.064	0.052
SA structural model 2 <i>(with Path MKTS-REGC fixed)</i>	345.31	181	1.91	0.97	0.99	0.064	0.052
SA structural model 2 <i>(with Path SKTS-REGC fixed)</i>	345.45	182	1.90	0.97	0.99	0.064	0.052
SA final structural model <i>(with Path SKTS-SCAC fixed)</i>	344.38	183	1.88	0.97	0.99	0.063	0.054

Figure 6.8 shows final SA structural model. The model indicates that monitor-based knowledge transfer positively impacts the development of focal firms' both scanning capability and sensing capability. And there is also a significant relationship between support-based knowledge transfer and focal firms' sensing capability. Hypotheses 1a, 1b and 2b are thus supported. Moreover, similar to CA structural model, in SA final structural model the development of scanning capability has a significant effect on sensing capability, which in turn facilitates reconfiguration capability. However, Hypotheses 2a is not supported, because the model fails to show significant relationships between support-based knowledge transfer and firm's scanning capability.

Figure 6. 8 - SA Final Structural Model



6.7 Chapter Summary

Following initial data preparation and demographic analysis, the chapter mainly carries out a two-stage SEM analysis. In the measurement model evaluation, the validity and reliability of the data are examined, and the relationships between latent variables and observed indicators are refined and fixed. This ensures a more accurate estimation of the later stage structural equation modeling. In the second-stage structural model analysis, the overall hypotheses are verified through a step-by-step process. It should be noted that the SEM analysis performed in the chapter separates the investigation of the impact of supply chain sustainable knowledge transfer on the development of focal firms' dynamic capabilities into two settings. CA model focuses on the setting between focal firms and their supply chain customers, and SA model

concentrates on the setting between focal firms and their supply chain customers. SA and CA models show different results in terms of the relationship between inter-firm knowledge transfer and the development of dynamic capabilities for corporate sustainability. These results will be further discussed in Chapter 7.

CHAPTER 7 - DISCUSSION

7.1 Introduction

The previous chapter examines the survey data in a systematic manner. In the stage of measurement model analysis, the validity of the models is verified through confirmatory factor analysis (CFA) and a further model modification. In the stage of structural model analysis, the hypothesized relationships between exogenous and endogenous variables are tested. The potential rationale for the significance and insignificance of the relationships proposed in the theoretical frameworks is thus initially explored. Because empirical studies could be largely contextualized in terms of nature of industrial sectors, locations and business environments, a more throughout examination of the findings derived from original hypotheses could potentially provide more insights into complicated issues and stimulate further interpretation (Bryman and Bell, 2003).

Therefore, the aim of Chapter 7 is to provide a more detailed explanation of the empirical findings of the research. In the research, sustainable knowledge transfer activities between focal firms and their supply chain partners are separated into two types, namely monitor-based knowledge transfer and support-based knowledge transfer. The aim is to measure the impact of these two types of knowledge transfer on the development of focal firms' dynamic capabilities for corporate sustainability. Furthermore, as indicated in Section 2.10.4, Section 5.7 and Section 6.5, the research considers two research settings: 1) the partnership between focal firms and their

downstream supply chain partners, or customers (CA Model); 2) the partnership between focal firms and their upstream supply chain partners, or suppliers (SA Model). The proposed hypotheses developed in the theoretical frameworks are empirically tested in these two settings separately. Based on the proposed hypotheses and theoretical framework, the statistical outcome of the research is compared with previous studies, and the derived implications are discussed in detail.

The structure of the chapter is as follows. Section 7.2 and Section 7.3 respectively examine the findings of CA model and SA model in which both supported and unsupported hypotheses are discussed in detail with possible explanations. Then Section 7.4 compares and analyzes both the differences and similarities between the results of CA model and SA model. Finally, Section 7.5 provides a chapter summary.

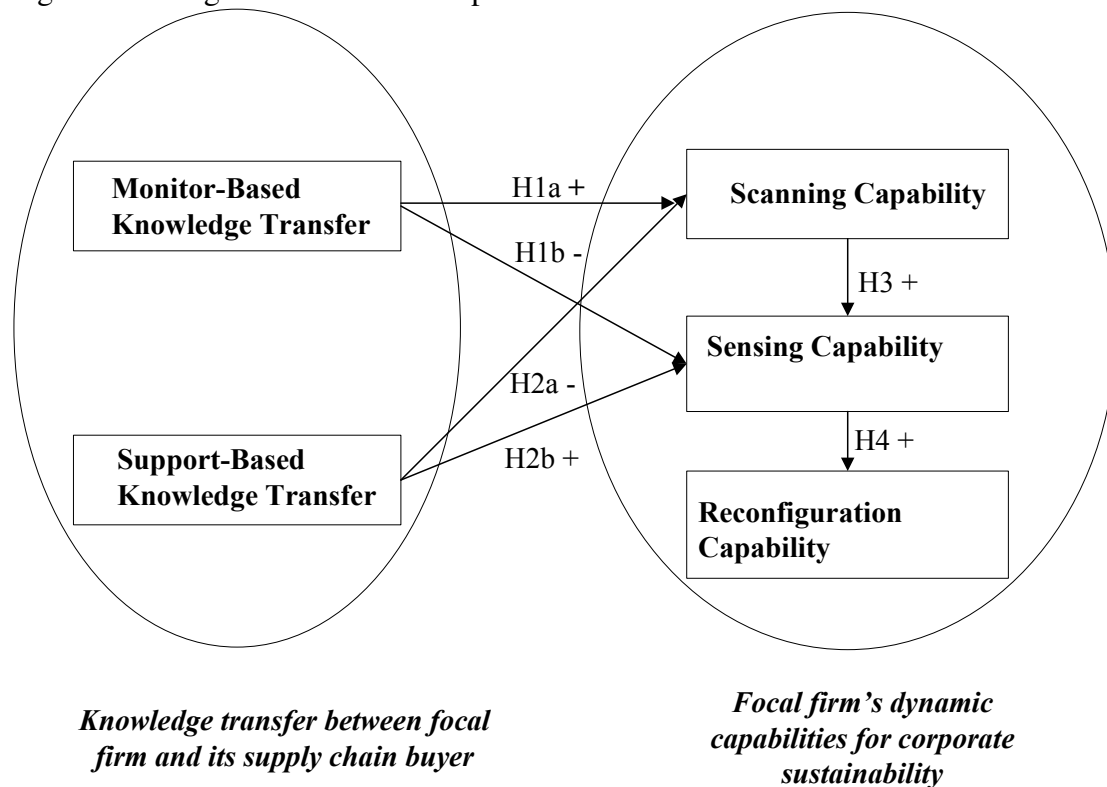
7.2 Findings of CA model

CA model sets a research setting in which the knowledge transfer between focal firm and its biggest customer is investigated. In such a setting the focal firm is supply chain supplier or the knowledge recipient, and its customer thus becomes the knowledge sender.

In Chapter 2, various hypotheses are given between two types of knowledge transfers (monitor-based and support-based) and the development of focal firm's dynamic capabilities for corporate sustainability. However, the empirical findings of CILT survey only partially justifies these hypotheses. As indicated in Figure 7.1, hypotheses H1a, H2b, H3 and H4 are justified in CA model. But hypotheses H1b and H2a fail to

be supported (In Figure 7.1, the symbol "+" following the hypothesis represents a statistically significant relationship between two constructs. The symbol "-" indicates a non-significant relationship). The following discussions take a closer look at these hypotheses and seek to provide possible explanations to these findings.

Figure 7. 1 - Significant Relationships in CA Model



7.2.1 Impact of Monitor-Based Knowledge Transfer on the Development of Supply Chain Suppliers' Scanning and Sensing Capability in CA Model

The CA model illustrates the knowledge transfer between focal firm and its biggest customer, in which the focal firm acts as the supply chain supplier or the knowledge recipient. In this model hypothesis H1a "*Monitor-based knowledge transfer between focal firm and its supply chain buyer positively impacts the development of its*

scanning capability" is supported with the coefficient value of 0.19 (see Table 7.1). Such a finding justifies the argument of previous research that the regularly updated sustainability requirements imposed by their supply chain customers through monitor-based knowledge transfer often lead to great upgrading of the suppliers' ability to understand emerging sustainability needs of various stakeholders (Green *et al.*, 2000; Lee and Klassen, 2008; Gualandris and Kalchschmidt, 2014, Huq *et al.*, 2016). Moreover, the development of supply chain suppliers capabilities can contribute to both their green strategies and future competitive advantage (Leonidou *et al.*, 2015). This is a reasonable conclusion because as suggested by Hart and Sharma (2004), supply chain partners should use their interaction routines to support the free sharing of their understandings about external sustainability issues. And such a routine is manifested as a core-to-periphery networking approach by which firms use their supply chain partners as the bridge to obtain the information about the stakeholders that cannot be directly accessed (Carter and Rogers, 2008; Meehan and Bryde, 2014).

Table 7. 1 - CA Model: Results of SEM - Standardised Path Coefficients

	Dynamic Capabilities for Corporate Sustainability		
Knowledge Transfer Activities	Scanning Capability	Sensing Capability	Reconfiguration Capability
	<i>Total Effect</i>		
Monitor-Based Knowledge Transfer	0.19* (2.32)	0.10* (2.16)	0.09* (2.17)
Support-Based Knowledge Transfer	--	0.43* (7.31)	0.40* (7.03)
	<i>Indirect Effect</i>		

Monitor-Based	--	0.10*	0.09*
Knowledge Transfer	--	(2.16)	(2.17)
Support-Based	--	--	0.40*
Knowledge Transfer	--	--	(7.03)
Note: "*" denotes significant path estimates; N=223; First value is the standardized parameter estimate; value in parenthesis is t-value.			

Nevertheless, hypothesis H1b "*Monitor-based knowledge transfer between focal firm and its supply chain buyer positively impacts the development of its sensing capability*" fails to be supported in the research. This result suggests that although monitor-based knowledge transfer may enable supplier firms to better identify emerging sustainability needs of various peripheral stakeholders, it does not necessarily lead to intensive boundary spanning communications between supply chain partners, which is the precondition of the development of supply chain supplier firms' sensing capability (Andersen and Skjoett-Larsen, 2009; Wong, 2013). Alternatively stated, the policies and procedures introduced by the monitor-based knowledge transfer can inform the recipient firms with new sustainability standards, but how to deliberately change their current operations to accommodate these standards also requires additional collaborative information and knowledge sharing between supply chain partners (Daily and Huang, 2001; Gimenez and Tachizawa, 2012).

7.2.2 Impact of Support-Based Knowledge Transfer on the Development of Supply Chain Suppliers' Scanning and Sensing Capability in CA Model

Compared with monitor-based knowledge transfer, support-based knowledge transfer involves not only formal cross-organizational communications, such as joint planning sessions, periodical team meetings, and employee training and education programs, but also loose social interactions of the boundary spanners in different firms to share their information and experience in daily operations (Vachon and Klassen 2006; Lee and Klassen, 2008; Pagell and Wu, 2010). The finding of the research supports hypothesis H2b "*Support-based knowledge transfer between focal firm and its supply chain buyer positively impacts the development of its sensing capability*" with a high coefficient value of 0.43 (see Table 7.1). This finding confirms the theoretical argument that, due to the imperfect congruence between product and knowledge domains of the firm, the potential business opportunities often can be explored through inter-firm knowledge integration (Grant and Baden-Fuller, 1995; Grant, 1996; Dangelico *et al.*, 2013). More specifically, in sustainable supply chain management, support-based knowledge transfer enables supplier firms to break their inertial mental models and information processing routines, so as to facilitate innovative learning (Krause *et al.*, 2009; Andersen and Skjoett-Larsen, 2009; Dangelico *et al.*, 2013; Blome *et al.*, 2014). Through innovative or second-order learning, supplier firm's sensing capability can be further developed based on re-constructed communication routines and flexible information flows across functional boundaries (Mason and Leek, 2008; Blome *et al.*, 2013).

However, H2a "*Support-based knowledge transfer between focal firm and its supply chain buyer positively impacts the development of its scanning capability*" fails to be

supported in the research. A possible explanation is that support-based sustainable knowledge transfer is mainly in regard to developing complex sustainability-sound processes and products through close interactions between supply chain partners (Vachon and Klassen 2006; Lee and Klassen, 2008, Tachizawa *et al.*, 2015; Sancha *et al.*, 2016). Therefore, the general information about external sustainability needs, which is within the domain of scanning capability, is not the focus of support-based knowledge transfer between the surveyed firms and their supply chain customers.

7.2.3 Interconnectedness of the Three Types of Dynamic Capabilities for Corporate Sustainability in CA model

In CA model, both hypothesis H3 "*the development of scanning capability positively impacts the development of sensing capability*", and H4 "*The development of sensing capability positively impacts the development of reconfiguration capability*" are supported. This result further justifies the theoretical proposition that the development of dynamic capabilities for corporate sustainability, namely scanning capability, sensing capability and reconfiguration capability are path-dependant and interconnected (Wang and Ahmed, 2007; Wu *et al.*, 2012; 2013; 2014).

First, in the study the scanning capability for corporate sustainability is defined as "*the ability of the firm to create an information processing mechanism searching and prioritizing various sustainability requirements from both direct and indirect stakeholders*". The communication channels with both direct and indirect stakeholders established through the deployment of scanning capability often lead to further boundary-spanning knowledge sharing and application, and also regular updates of sustainability development plans and milestones of firms, which are two key

foundations of a firm's sensing capability (Dangelico *et al.*, 2013; Wu *et al.*, 2014). Moreover, to prioritize various stakeholders' sustainability requirements based on firms' strategic sustainability objective, firm's sensing capability is required to create proper CSR corporate structure and management system (Wu *et al.*, 2014).

Second, the deployment of sensing capability is closely related with the development of firm's reconfiguration capability as well. On the one hand, firm uses its sensing capability to regularly update its corporate sustainability development plans and milestones. These plans and milestones greatly contribute to the modifying function underpinning the reconfiguration capability to measure and monitor firm's current sustainable performance (Wu *et al.*, 2012; 2013; 2014). On the other hand, in the context of corporate sustainability, the sensing capability is performed to analyze new sustainable development opportunities, and systematically link them with related organizational functions in various innovation activities (Wu *et al.*, 2013). As a result, firm's reconfiguration capability can be mobilized accordingly to re-engineer existing organizational functions that become unsustainable. Table 7.2 concludes the related hypotheses which are either supported or unsupported in CA model.

Table 7. 2 - Research Hypotheses in CA Model

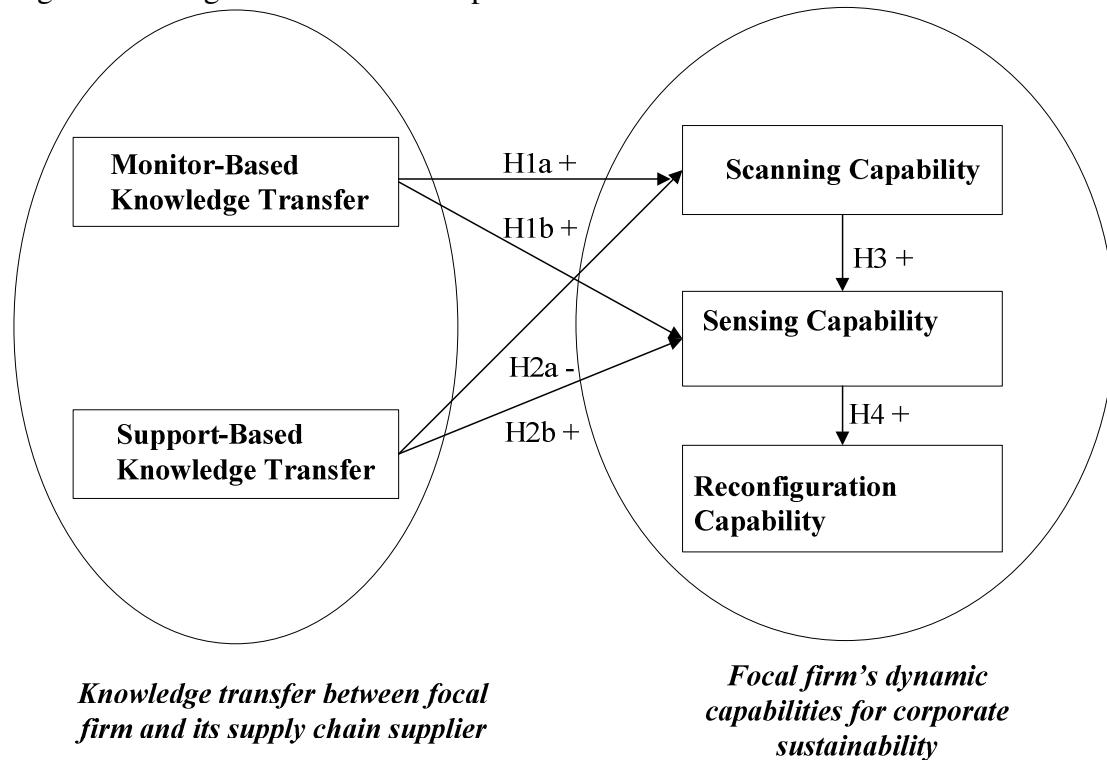
Research Hypotheses in CA Model		
H1a	Monitor-based knowledge transfer between focal firm and its supply chain buyer positively impacts the development of its scanning capability.	Supported
H1b	Monitor-based knowledge transfer between focal firm and its supply chain buyer positively impacts the development	Not supported

	of its sensing capability.	
H2a	Support-based knowledge transfer between focal firm and its supply chain buyer positively impacts the development of its scanning capability.	Not supported
H2b	Support-based knowledge transfer between focal firm and its supply chain buyer positively impacts the development of its sensing capability.	Supported
H3	The development of scanning capability positively impacts the development of sensing capability.	Supported
H4	The development of sensing capability positively impacts the development of reconfiguration capability.	Supported

7.3 Findings of SA model

SA model gives a research setting in which the knowledge transfer between focal firm and its biggest supplier is investigated. Different from CA model, in SA model the focal firm is supply chain buyer or the knowledge sender, and its supplier thus becomes the knowledge recipient. As indicated in Figure 7.2, only hypothesis H2a is not supported in SA model (In Figure 7.2, the symbol "+" following the hypothesis represents a statistically significant relationship between two constructs. The symbol "-" indicates a non-significant relationship). The following discussions take a closer look at these hypotheses and seek to provide possible explanations to these findings.

Figure 7. 2 - Significant Relationships in SA Model



7.3.1 Impact of Monitor-Based Knowledge Transfer on the Development of Supply Chain Customers' Scanning and Sensing Capability in SA Model

The SA model illustrates the knowledge transfer between focal firm and its biggest supplier, in which the focal firm acts as the supply chain customer or the knowledge sender. In this model hypothesis H1a "*Monitor-based knowledge transfer between focal firm and its supply chain supplier positively impacts the development of its scanning capability*" is supported with a high coefficient value of 0.30 (see Table 7.3). Because previous empirical studies focus more on how sustainable knowledge received from its customers enables supply chain supplier to better develop its organizational capabilities (e.g. Daily and Huang, 2001; Lee and Klassen, 2008), limited research exists regarding whether or how sustainable knowledge transfer positively impacts the capability building of supply chain buyer, or knowledge sender

as well. The related theoretical assumption is that monitor-based knowledge transfer, in the form of a series of compliance rules enforced by supply chain buying firms to regulate the sustainable behaviour of their suppliers, tends to contribute more to the capability building of suppliers as the knowledge recipient (Beamon, 1999; Daily and Huang, 2001; Roberts, 2003; Maloni and Brown, 2006; Amaeshi *et al.*, 2008). However, the empirical finding of the research only partially justifies this argument. Combining the analysis results of both CA and SA models, it is quite obvious that monitor-based knowledge transfer is equally important for the scanning capability building of both supply chain customers and suppliers. Furthermore, the co-evolution of these complementary capacities can lead to their collective competitive advantage at supply chain level.

Hypothesis H1b "*Monitor-based knowledge transfer between focal firm and its supply chain supplier positively impacts the development of its sensing capability*" is also supported in SA model with a coefficient value of 0.18 (See Table 7.3). This finding supports the argument that external sustainability pressure requires focal firms to pay closer attention to their supply chain partners' social and environmental performances, and also enables these companies to develop their own social and environmental awareness and management capacities (Koplin *et al.*, 2007; Sancha *et al.*, 2013; Paulraj and Blome, 2017). However, the corresponding hypothesis H1b in CA model is not supported. Alternatively speaking, for supply chain supplier, monitor-based knowledge transfer benefits only the development of its scanning capability. But for supply chain customer, monitor-based knowledge transfer benefits the development of both its scanning capability and sensing capability. One possible explanation to such a difference may be that in monitor-based knowledge transfer, as the knowledge sender,

supply chain customers play two roles. On the one hand, they should develop and mobilize their scanning capability to constantly sense and prioritize emerging sustainability needs from various stakeholders. On the other hand, they also need to regularly update existing sustainability compliance rules and standards shared with supply chain suppliers. This requires extensive new sustainable knowledge and information processing which has been already identified as the key foundation of firm's sensing capability (Gimenez *et al.*, 2012; Wu *et al.*, 2014). To the contrary, in monitor-based knowledge transfer, supply chain suppliers, as relatively passive knowledge receivers, can only update their scanning capability through responding to the changing sustainability requirements imposed by their customers.

Table 7. 3 - SA Model: Results of SEM - Standardised Path Coefficients

	Dynamic Capabilities for Corporate Sustainability		
Knowledge Transfer Activities	Scanning Capability	Sensing Capability	Reconfiguration Capability
	<i>Total Effect</i>		
Monitor-Based Knowledge Transfer	0.30* (4.01)	0.32* (2.91)	0.31* (2.88)
Support-Based Knowledge Transfer	--	0.22* (2.24)	0.20* (2.22)
	<i>Indirect Effect</i>		
Monitor-Based Knowledge Transfer	--	0.14* (3.61)	0.31* (2.88)
Support-Based Knowledge Transfer	--	--	0.20* (2.22)

Note: “*” denotes significant path estimates; N=223; First value is the standardized parameter estimate; value in parenthesis is t-value.

7.3.2 Impact of Support-Based Knowledge Transfer on the Development of Supply Chain Customers' Scanning and Sensing Capability in SA Model

Similar to the findings of CA model, hypothesis H2b "*Support-based knowledge transfer between focal firm and its supply chain supplier positively impacts the development of its sensing capability*" with the coefficient value of 0.22 (see Table 7.1). But the hypothesis H2a "*Support-based knowledge transfer between focal firm and its supply chain supplier positively impacts the development of its scanning capability*" fails to be supported. Alternatively stated, support-based knowledge transfer only positively relates with supply chain partners' sensing capability, but not their scanning capability.

The logic of the positive relationship between support-based knowledge transfer and the development of supply chain partners' sensing capability is obvious. As stated by Geffen and Rothenberg (2000) and Lee and Klassen (2008), through experience and practices sharing between supply chain partners, support-based knowledge transfer can generate novel solutions to complex sustainable problems. At the same time, the sensing capability of both supply chain buyers and supplier can be developed through organizational boundary-spanning knowledge sharing, articulation and codification (Sancha *et al.*, 2013; Gualandris and Kalchschmidt, 2016).

Moreover, the analysis results of both CA and SA models suggest that support-based knowledge transfer is not significantly related with the development of supply chain

partners' scanning capability. This findings suggests that compared with monitor-based knowledge transfer, support-based knowledge transfer mainly emphasizes on transforming the inter-connected supply chain entities into a complex knowledge-sharing and adaptive system to collectively address external challenges, and obtain more socially complex and causally ambiguous competitive advantage which is particularly difficult to be imitated (Lorenzoni and Lipparini, 1999; Lee and Klassen, 2008; Wong *et al.*, 2012; Ramirez *et al.*, 2014). For this reason the function of firm's scanning capability to identify newly emerging stakeholders' sustainability needs is not the focus.

7.3.3 Interconnectedness of the Three Types of Dynamic Capabilities for Corporate Sustainability in SA model

In SA model, again both hypothesis H3 "*the development of scanning capability positively impacts the development of sensing capability*", and H4 "*The development of sensing capability positively impacts the development of reconfiguration capability*" are supported. Obviously, the interconnectedness patterns of the three types of dynamic capabilities for corporate sustainability are similar between CA model and SA model. Moreover, the correlation coefficients reflecting the interconnectedness of these three dynamic capabilities are also at the similar level between CA model and SA model.

The above observation indicates that in a collaborative sustainable supply chain relationship, both buyers and suppliers should equally treat the importance of the co-evolution of their internal dynamic capabilities. In sustainable development, once external information and knowledge can be received from their supply chain partners,

they will trigger a sequential impact on both the reconfiguration of their existing resources and capabilities and the development of new capabilities. Table 7.4 concludes the related hypotheses which are either supported or unsupported in SA model.

Table 7. 4 - Research Hypotheses in SA Model

Research Hypotheses in SA Model		
H1a	Monitor-based knowledge transfer between focal firm and its supply chain supplier positively impacts the development of its scanning capability.	Supported
H1b	Monitor-based knowledge transfer between focal firm and its supply chain supplier positively impacts the development of its sensing capability.	Supported
H2a	Support-based knowledge transfer between focal firm and its supply chain supplier positively impacts the development of its scanning capability.	Not supported
H2b	Support-based knowledge transfer between focal firm and its supply chain supplier positively impacts the development of its sensing capability.	Supported
H3	The development of scanning capability positively impacts the development of sensing capability.	Supported
H4	The development of sensing capability positively impacts the development of reconfiguration capability.	Supported

7.4 Impact Patterns of Monitor-Based and Support-Based Knowledge Transfers on the Development of Dynamic Capabilities for Corporate Sustainability: A Comparison between CA Model and SA model

The outcome comparison between CA model and SA model shows both similarity and difference. The similarity is mainly reflected at the interconnectedness of the three types of dynamic capabilities for corporate sustainability in both CA and SA models. In CA final structural model (see Figure 6.6), the path coefficient between scanning capability and sensing capability for corporate sustainability is 0.52. Similarly, in SA final structural model (see Figure 6.8) this path coefficient is 0.47. Moreover, between sensing capability and reconfiguration capability for corporate sustainability, the path coefficients are equal (0.94) in both CA and SA final structural models (See Figure 6.6 and Figure 6.8).

Such a finding can be explained from two aspects. First, in a collaborative sustainable supply chain relationship, both buyers and suppliers should equally treat the importance of the co-evolution of their internal dynamic capabilities. In sustainable development, once external information and knowledge can be received from their supply chain partners, they will trigger a sequential impact on both the reconfiguration of their existing resources and capabilities and the development of new capabilities. Second, compared with the interconnectedness between scanning capability and sensing capability, the co-evolution pattern between sensing capability and reconfiguration capability seems to be more prominent. Therefore, because cross-functional knowledge exchange, as a fundamental function under the sensing capability, is necessary for novel sustainable knowledge being forwarded to and interpreted by the individuals or planning units who are capable of making sense of

them (Teece, 2007), supply chain players should concentrate on the role of their sensing capability in guiding their reconfiguration capability to recognize those existing organizational functions and operations that might be seriously challenged in further sustainable actions (Teece et al., 1997; Wang and Ahmed, 2007), and then reconfigure both these functions and their interactive patterns (Handerson and Cockburn, 1994; Hart, 1995).

The outcome difference between CA model and SA model is mainly reflected in the relationship between inter-firm knowledge transfer and the development of dynamic capabilities for corporate sustainability. First, in CA model, the path coefficient between support-based knowledge transfer and sensing capability is as high as 0.43. But the coefficient value between monitor-based knowledge transfer and scanning capability is only 0.19 (See Figure 6.6).. This comparison suggests that although supply chain suppliers can further improve their scanning capability through monitor-based knowledge transfer, they should rely more on support-based knowledge transfer as a more significant factor for the development of their sensing capability.

Second, in SA model, the path coefficient between support-based knowledge transfer and sensing capability is 0.22. And the coefficient value between monitor-based knowledge transfer and scanning capability is 0.30, which is even slightly higher (See Figure 6.8). Such a finding suggests that these two types of knowledge transfer are almost equally important in their respective impacts on the developments of supply chain buyers' dynamic capabilities.

Third, the path coefficient between monitor-based knowledge transfer and sensing capability also reaches 0.18, indicating that monitor-based knowledge transfer contributes to not only the development of supply chain buyers' scanning capability, but also its sensing capability higher (See Figure 6.8). This observation gives rise to a further argument that the role of monitor-based knowledge transfer in the capability development of supply chain buyers seems to be underestimated in existing literature, because previous empirical studies mainly concentrate on how supply chain suppliers can benefit from monitor-based knowledge transfer (e.g. Ytterhus *et al.*, 1999; Daily and Huang, 2001; Lee and Klasson, 2008; Hartmann and Moeller, 2014).

Finally, it should be noted that the above comparison is based on the data collected through the survey among the members of CILT UK's Environment and Sustainability Forum. In the survey 39.5% of the respondents indicate that their working area is "general" (see Table 6.4). This means their working roles are at a senior managerial level and cover multiple working areas in their firms. In addition, 19.3% of the respondents are from distribution area, 16.6% from operation departments, and 10.3% from purchasing/procurement areas. Such a pattern ensures that the majority of the respondents are experts in the areas of firm's strategic development and supply chain management. However, the limitation is that because the respondents are the members of CILT, their opinions reflected in the survey may mainly stand for the perspective of supply chain professionals. The findings of the survey studies focusing on other professional sectors may deliver different results.

7.5 Chapter Summary

This chapter discusses the results derived from proposed theoretical model and the related empirical study, and links them back to existing literature. The juxtaposition of CA model and SA model enables the researcher to test the inter-firm knowledge transfers between focal firms and both their downstream (CA model) and upstream supply chain partners (SA model). Because previous empirical studies mainly consider knowledge sharing between focal firms and their downstream partners, the inclusion of the SA model is an effective extension of the relevant research context.

The findings of CA model and SA model not only justify but also complement existing studies. First, the empirical result of CA model confirms previous findings that monitor-based knowledge significantly contributes to the development of supply chain suppliers' scanning capability. Moreover, extensive boundary-spanning knowledge sharing involved in support-based knowledge transfer plays a vital role in the building of the suppliers' sensing capability. Second, SA model reveals a new finding that the key impact of monitor-based knowledge transfer on the capability building of supply chain buyers (or knowledge senders) seems to be underestimated in previous research. Therefore supply chain customers need to treat both monitor-based and support-based knowledge transfers as equally important.

Following the discussion chapter, the next chapter summarises this research and the research findings. In addition, the academic and practical contributions of the research and its implications, limitations and recommendations for future studies are also discussed.

CHAPTER 8 - CONCLUSIONS

8.1 Introduction

This chapter outlines the overall research progress of the thesis and summarises the research findings. The contributions of the research are also highlighted from theoretical, empirical and practical perspectives. Finally the chapter explains the relevant research limitations and provides possible directions for future research.

8.2 Summary of Research Process

More recently, a growing number of studies propose that firm's dynamic capabilities should be further developed to cope with emerging external sustainability challenges (Garriga and Mele, 2004; Aragon-Correa and Rubio-López, 2007; Hart and Dowell, 2011; Barney *et al.*, 2011). However, limited prior research gives sufficient attention to the particular characteristics of the dynamic capabilities in the context of corporate sustainability (e.g. Aragon-Correa and Sharma, 2003; Marcus and Anderson, 2006; Defee and Fugate; 2010; Reuter *et al.*, 2010; Hart and Dowell, 2011). Furthermore, the key role of organizational boundary-spanning knowledge source in the development of firms' dynamic capabilities lacks a systematic understanding (Winter 2003; Zahra *et al.*, 2006; ; Schreyögg and Kliesch-Eberl, 2007; Hart and Dowell, 2011).

To fill these research gaps, the research aims to: 1) explore and explain the nature of the contingent dynamic capabilities in the context of corporate sustainability; 2) empirically test the potential impact of inter-firm knowledge transfer between supply chain partners on the development of these capabilities. For such an aim the research firstly carries out an extensive literature review mainly in the areas of corporate sustainability, Dynamic Capabilities View (DCV) and inter-firm knowledge transfer in sustainable supply chain management. Based on the findings of the literature review, the concept of *dynamic capabilities for corporate sustainability* is defined, and three types of dynamic capabilities for corporate sustainability, namely *scanning capability*, *sensing capability* and *reconfiguration capability* are discussed in detail. Furthermore, a theoretical model is established depicting the relationship between inter-firm knowledge transfer between supply chain partners and the development of firm's dynamic capabilities for corporate sustainability.

Because the research questions listed in Section 1.3 indicate that the research is of both exploratory and explanatory in nature, it adopts a mixed methods approach which combines both qualitative and quantitative studies. The stage of qualitative study involves both a case study and a large-scale archival analysis. The case study is regarding how a world-leading telecommunications company develops and mobilize its dynamic capabilities to meet triple bottom line, and also sustain its competitive strategic advantage over a 15 years period of time. The study identifies six major organizational functions underpinning dynamic capabilities for corporate sustainability. Following the case study, a large-scale archival analysis is performed. The data source is the CSR reports of 64 world-leading companies which cover 3 major geographic regions and 8 industrial sectors. The wide spread of regions and

industrial sectors of the selected companies ensures the representativeness of the sample and enhances generalisability of the analysis. The result of the archival analysis not only justifies the conclusion of the case study, but also identifies key practices and processes underpinning dynamic capabilities for corporate sustainability.

In the stage of quantitative study, before the survey execution, to operationalize the constructs involved in the theoretical framework, five sets of measurement indicators are developed from previous literature first. These indicators are then updated based on the findings of the qualitative study involved in the research. Second, to justify the construct validity between the measurement indicators and the related constructs, a small-scale delphi test is carried out with 9 academic researchers who are knowledgeable about sustainable supply chain management and corporate sustainability. After two-rounds of testing, a satisfactory consensus rate has been reached. Third, to ensure the face validity and content validity of the measurement indicators, the proposed measurement indicators are reviewed by two academic researchers who are knowledgeable about corporate sustainability and sustainable supply chain. Their opinions are used to refine the wording of the questions. Then the refined questionnaire is sent to two UK supply chain managers for their suggestions regarding the feasibility and relevance of the questionnaire. Based on the recommendations from both academic researchers and professional practitioners, the questionnaire is finalized.

During survey implementation, the target sample frame is consisted of about 2,500 members officially enrolled in CILT (UK) Environment and Sustainability Forum. Under the sponsorship of CILT UK, a large-scale survey is carried out. The survey

takes three rounds. The first round of the survey receives 155 responses, with the second round of 108 responses and the third round providing additional 64 replies. Thus the total sample is 327 and the response rate is 13%, which is in line with the findings typical for surveys of senior managers (Li *et al.*, 2006). Then after screening out the 104 cases with missing data rate higher than 15% (Hair *et al.*, 2010), finally 223 cases remain for the later stage analysis. Thus the final valid response rate is about 8.9%.

The validity and reliability of the collected data are then verified through a series of tests. Finally the empirical data are used to test proposed hypotheses using Structural Equation Model (SEM).

8.3 Summary of Key Research Findings

Because the research objectives and questions given in the introduction chapter of the thesis are used to guide the entire journey of the research, the resulting key research findings are concluded to address these questions.

8.3.1 Answers to Research Questions regarding the Nature of Dynamic Capabilities for Corporate Sustainability

The first research objective of the thesis is to explore and explain the nature of the contingent dynamic capabilities in the context of corporate sustainability. This objective is elaborated into two research questions.

1) What are dynamic capabilities for corporate sustainability?

In this thesis, dynamic capabilities for corporate sustainability is defined as "*firms' abilities to address rapidly evolving sustainability expectations of stakeholders by purposefully modifying functional capabilities for the simultaneous pursuit of economic, environmental and social competences*".

The word *purposefully* included in the definition indicates that the application of dynamic capabilities for corporate sustainability should be linked directly with a firm's strategic objective and managerial intent, so as to systematically derive *sustainable development opportunities* from internal and external stakeholders' demand. *Sustainable development opportunities* are those that firms can use to pursue both environmental and social values for the public and economic values for themselves.

Moreover, dynamic capabilities for corporate sustainability can be disaggregated into three distinctive, but related capabilities to: 1) *scan* emerging sustainability needs of various stakeholders; 2) *sense* opportunities or threats from the rapidly changing sustainability expectations; and 3) *reconfigure* existing functional capabilities for corporate sustainability (see Section 2.6, Chapter 2; Section 4.3, Chapter 4).

2) What are the key processes (or microfoundations) underpinning these capabilities?

Combining the findings of both the case study and the archival analysis performed in the qualitative study stage, key processes underpinning the three dynamic capabilities for corporate sustainability are provided as follows:

First, scanning capability is defined as "*the ability of the firm to create an information processing mechanism searching and prioritizing various sustainability requirements from both direct and indirect stakeholders*". Key organizational processes involved in scanning capability include communication channels with both direct and indirect stakeholders, and information process routines to compare and prioritize emerging sustainability requirements.

Second, sensing capability refers to "*the ability to sense and capitalise on, rather than merely react to, emerging external sustainability challenges and opportunities in its business environment*". Key organizational processes involved in scanning capability include organizational governance structure for cross-functional sustainable knowledge sharing, managerial process to regularly update sustainable strategic plans and milestones, and dedicated function for green technologies experiments.

Third, reconfiguration capability is "*the ability to discard, modify, or rebuild the well-entrenched organizational routines and practices that are unsustainable*". Key organizational processes involved in scanning capability include formal measurement systems to monitor the sustainable performance of business operations, and cross-functional managerial process to coordinate and leverage the interrelated sustainable efforts in different business departments and units.

8.3.2 Answers to Research Questions regarding the Relationship between Inter-Firm Knowledge Transfer and Dynamic Capabilities for Corporate Sustainability

The second research objective of the thesis is to empirically test the potential impact of inter-firm knowledge transfer between supply chain partners on the development of these capabilities. Two related research questions are:

3) What are the characteristics of inter-firm knowledge transfer in sustainable supply chain management?

In sustainable supply chain management, there are two types of inter-firm knowledge transfer, namely monitor-based or support-based ones. Monitor-based knowledge transfer is manifested in the application of a series of compliance rules enforced by supply chain buying firms to regulate the sustainable behaviour of their suppliers. Typical processes involved in monitor-based knowledge transfer are formal sustainable performance management system and periodical audit protocols established between supply chain partners (see Section 5.3.2, Chapter 5).

Support-based knowledge transfer aims to develop new sustainability-sound processes and products through close interactions between supply chain partners. Typical processes involved in support-based knowledge transfer include formal and informal knowledge sharing routines between supply chain partners, and collaboration team building to develop new sustainable development initiatives (see Section 5.3.2, Chapter 5).

4) To what extent inter-firm knowledge transfer between supply chain partners positively impacts the development of firm's dynamic capabilities for corporate sustainability?

Because in sustainable supply chain management, inter-firm knowledge transfer between supply chain partners are either monitor-based or support-based, the above question can be translated into how these two types of knowledge transfer are related to the development of firm's dynamic capabilities.

Moreover, as explained in Section 2.10.4, Section 5.7 and Section 6.5, The survey separates sustainable knowledge transfer activities between responding firms and their supply chain partners into two groups. One is with responding firms' upstream suppliers and one with their downstream customers. Therefore, there are two individual settings in the following analysis. The first is called CA model regarding focal firm's sustainable knowledge transfer with their supply chain customers. The second is named as SA model related to focal firm's sustainable knowledge transfer with their supply chain suppliers. The following two sections will answer the above question in CA model and SA model respectively.

8.3.2.1 A Summary of Findings for CA Model

The findings of CA models suggest that in the relationship with its supply chain customer, inter-firm monitor-based knowledge transfer positively impacts the development of focal firm's scanning capability with path coefficient 0.19 (see Section 7.2.1). This justifies the argument that monitor-based knowledge transfer often leads to great upgrading of the suppliers' ability to understand emerging sustainability needs of various stakeholders (Green *et al.*, 2000; Lee and Klassen,

2008; Gualandris and Kalchschmidt, 2014). However, the relationship between monitor-based knowledge and sensing capability is not statistically significant, suggesting that arm-length policies and procedures introduced by monitor-based knowledge transfer do not necessarily give rise to intensive collaboration between supply chain partners, which is the precondition for the development of sensing capability.

In term of support-based knowledge transfer, it is positively related to focal firm's sensing capability in CA model. More interestingly, the path coefficient between these two constructs is as high as 0.43 (see Section 7.22). Obviously, the important role of support-based knowledge transfer should never be underestimated by supply chain suppliers for the development of their sensing capability. Nevertheless, in CA model hypothesis "*Support-based knowledge transfer between focal firm and its supply chain buyer positively impacts the development of its scanning capability*" is not supported. A possible explanation is that support-based knowledge transfer between surveyed firms and their supply chain customers concerns more about developing new sustainability-sound processes and products through close collaboration. But the general information sharing regarding external sustainability needs, which is within the domain of scanning capability, is not the focus. Finally, as predicted in the theoretical framework (see Section 2.10.4), in a sequential order the development of scanning capability positively impacts the building of sensing capability; and the development of sensing capability positively impacts the development of reconfiguration capability.

In short, in CA model: 1) monitor-based knowledge transfer positively impacts scanning capability building; 2) support-based knowledge transfer positively impacts sensing capability building; and 3) the positive relationship between scanning, sensing and reconfiguration capabilities is justified in a sequential order.

8.3.2.2 A Summary of Findings for SA Model

In SA model, hypothesis H1a "*Monitor-based knowledge transfer between focal firm and its supply chain supplier positively impacts the development of its scanning capability*" is supported with a high coefficient value of 0.30 (See Section 7.3.1). This finding gives rise to a further argument that the role of monitor-based knowledge transfer in the capability building of supply chain customers seems to be underestimated in existing literature, because previous empirical studies mainly concentrate on how supply chain suppliers can benefit from monitor-based knowledge transfer with their customers (e.g. Ytterhus *et al.*, 1999; Daily and Huang, 2001; Lee and Klasson, 2008; Hartmann and Moeller, 2014).

Moreover, monitor-based knowledge transfer is also found to positively impact the development of sensing capability as well. One possible explanation is that as the knowledge sender, supply chain customers need to regularly update existing sustainability compliance rules and standards shared with supply chain suppliers. This requires extensive new sustainable knowledge and information processing which has been already identified as the key foundation of firm's sensing capability (Wu *et al.*, 2014).

In term of support-based knowledge transfer, similar to CA model, it is found to be positively related to sensing capability, but not with scanning capability (the possible explanations are already provided in the above section). More importantly, it should be noted that the impact patterns of inter-firm knowledge transfer on firm's scanning and sensing capabilities vary significantly between CA model and SA model (see Section 7.4).

Finally, as predicted in the theoretical framework (see Section 2.10.4), in a sequential order the development of scanning capability positively impacts the building of sensing capability; and the development of sensing capability positively impacts the building of reconfiguration capability.

In short, in SA model: 1) monitor-based knowledge transfer positively impacts the development of both scanning and sensing capabilities; 2) support-based knowledge transfer only positively impacts sensing capability building; 3) the positive relationship between scanning, sensing and reconfiguration capabilities is justified in a sequential order; and 4) the impact patterns of inter-firm knowledge transfer on firm's scanning and sensing capabilities vary significantly between CA model and SA model.

8.4 Research Contributions

As an early attempt to extend DCV to the area of corporate sustainability, the research contributes to the theories of both DCV and corporate sustainability. The study also contributes to research and practice from various aspects.

8.4.1 Contribution to Theory

First, although an increasing number of studies propose that DCV should be applied to the research of corporate sustainability for a more in-depth understanding of how firms can sustain their competitive advantage when facing rapidly changing sustainability requirements, traditional DCV research mainly focuses only on the economic bottom line of the firm. To this regard the research introduces the concept of dynamic capabilities for corporate sustainability to the literature. This special type of dynamic capabilities is further disaggregated into three sub-capabilities, namely scanning capability, sensing capability and reconfiguration capability. Moreover, key organizational functions and managerial processes underpinning these three capabilities are substantiated with the empirical evidence generated from the qualitative studies.

Second, drawing on Knowledge-Based View, the research contributes to DCV theory by introducing inter-firm knowledge transfer as a new key source for the development of firm's dynamic capabilities. The theoretical model generated in the research empirically proves that knowledge transfer between supply chain partners can significantly facilitate dynamic capabilities development of the firm in the context of corporate sustainability.

Third, in the field of corporate sustainability, the research firstly identifies the major challenges involved in the use of dynamic capabilities towards corporate sustainable change. Based on this finding, the research explains how firm can mobilize three types of dynamic capabilities to capture and realize potential sustainable development

opportunities, so as to simultaneously achieve both triple bottom line and sustained competitive advantage.

8.4.2 Contribution to Empirical Research

Previous empirical studies on supply chain partnership and supply chain knowledge transfer focus more on how knowledge received from its customers enables supply chain supplier to better develop its organizational capabilities. Limited empirical research exists regarding whether or how knowledge transfer positively impacts the capability building of supply chain buyer, or knowledge sender as well.

In this regard the study extends the relevant research by considering the perspective of supply chain buyers. The resulting findings indicate that the role of supply chain knowledge transfer in organizational capability building of supply chain buyers still lacks comprehensive understanding, and future research towards this direction is thus needed.

8.4.3 Contribution to Practice

The key practical implications of the research is that a firm's dynamic capabilities for corporate sustainability, to a large extent, determine whether the firm will be passively reactive to the various stakeholders' concerns or pro-actively seek new opportunities from environmental changes. This can also be a reason why companies have different speed and performance in their move towards sustainability.

Given that natural resources are becoming increasingly scarce, and environmental constraints are getting tighter, sustainable development is already an established element in the marketplace. The question is not whether companies should make strategic change towards sustainability, but how quickly and how well companies can develop their dynamic capabilities to make such a change. To this regard the common processes and routines underpinning dynamic capabilities for corporate sustainability, which have been identified in the research, could be a reference model. However, it is worth noting that, these commonly agreed organizational routines are just a general benchmarking framework. Managers can use their own ways to utilize this framework based on their specific business and institutional environments.

It is also important for managers to understand that the development of these dynamic capabilities is not fixed or one-off but rather a continuous process. During the change process, conventional thinking and clichéd practices should largely be avoided. Companies should be aware that new opportunities are equally likely to be identified from external knowledge sources as from internal ones. Therefore the quantitative finding of the research could be a useful guidance for firms to realize the potential of supply chain sustainable knowledge transfer in supporting their dynamic capabilities development.

8.5 Research Limitations and Directions for Future Studies

8.5.1 Research Limitations

The results of this research are subject to several limitations. At the qualitative study stage, a case study is carried out first. Although the targeted company is a typical example, given that the case study focuses on a single company in one specific industry, the finding can be context-specific. To overcome this limitation the research performs a following-up archival analysis of the CSR reports of world-leading companies across various industrial sectors. However, a related bias involved in both the case study and the archival analysis is that the sample companies are all Multinational Companies (MNCs). Therefore, the outcomes of the qualitative study mainly reflect the situations of large companies' strategic standpoints and their dynamic capabilities for corporate sustainability. There is a lack of understanding of dynamic capabilities development of small and medium-sized companies (SMEs).

At the quantitative study stage, 69.5% of responding firms are large organizations. The percentage of SMEs samples is only 30.5%. In addition, the survey covers 12 major industrial sectors in which "manufacturing", and "transportation and storage" are the top 2 (33.6% and 22.0% respectively). Clearly, the quantitative study weights more on large companies in manufacturing sector for the purpose of the research. The reason is that large manufacturing enterprises tend to play a focal role in the relationship between their downstream and upstream supply chain partners (Daily and Huang, 2001), in which more comprehensive sustainable operations and activities can

be observed in a typical supply chain partnership structure. However, in such a research setting the viewpoints of SMEs are not sufficiently included.

8.5.2 Possible Directions for Future Studies

Both the findings and limitations of the research provide opportunities for future studies to consider. First, because the research mainly focuses on large organizations, future studies may give more emphasis on SMEs to investigate whether the theoretical framework and findings generalized by the research can be applied to SEMs as well, so as to reach a more generalizable conclusion.

Second, previous studies are more interested in the effect of inter-firm knowledge transfer on the capabilities development of supply chain suppliers. However, the outcome of the research indicates that the same effect still exists on the development of organizational capabilities of supply chain customers. Therefore future studies may consider using both qualitative and quantitative approaches to gain a more throughout understanding towards this not fully explored area.

Third, one major objective of the research is to examine the relationship between knowledge transfer and dynamic capabilities development. To this regard future studies may continue to explore the relevant influential factors in such a relationship, such as supply chain partnership duration, trust, power, and cultural adaptation. These factors cannot be included in this study due to the research scope limit.

8.6 A Reflection in Research: Challenges of the PhD Journey

PhD study is an intellectually enlightening journey which is full of challenges. These challenges can be encountered at any of the following stages such as research idea initiation and refinement, research methodology design, data collection, and even final data analysis and discussion. To well prepare for these challenges, the reflection of the researcher during his PhD study is as follows. First, to establish a theoretically sound and testable conceptual framework, the researcher needs to critically review and analyze relevant literature as soon as possible. During this period regular communications with both PhD supervisors and colleagues could be a good enabler for the refinement of the researcher's theoretical viewpoint which is going to be used to guide the following research processes. Second, the researcher should focus on the suitability of the adopted research philosophical stance and methodology in the study. A robust research methodology design is a crucial factor upon which the researcher can make sure that the collected data truly reflect the phenomena of the research, and can be tested so as to verify the proposed theoretical model. Third, for data collection, the researcher should design a flexible time frame to accommodate potential variations, because the difficulties involved at this stage are always more than what have been considered in the pre-setting plan. Fourth, last but not least, the researcher should use every possible opportunity to publish his research finding in both academic conferences and journals. These publications not only mark the milestones of this PhD research journey, but also reflect the theoretical value and originality of the research.

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APPENDICES

Appendix A: A Delphi Test regarding Corporate Sustainable Development

A Delphi Test regarding Corporate Sustainable Development

Based on a survey project regarding corporate sustainable development and supply chain knowledge management, this exercise aims to test the face validity of the measurement items related with their corresponding theoretical constructs. In the following two tables the left column gives the explanation of the theoretical constructs. The column in the middle lists the measurement items corresponding to these constructs. However, these measurement items are randomized. After reading the explanation of these constructs, could you please review the measurement items to indicate which item should go to which construct? For example, if you believe the measurement item “**We keep positive relationships with our stakeholders**” should be under the construct of “**1. Scanning Capability**”, please indicate its number as “**1**”.

Table 1 – Organizational internal capabilities for sustainable development

Explanation of the constructs	Measurement items of the constructs	No.
<p>1. Scanning Capability refers to the firm’s ability to communicate with various stakeholders, so as to search, learn and interpret their sustainable needs. These stakeholders include both direct stakeholders such as government or customers, and indirect stakeholders such as communities and non-governmental organizations (NGOs). The sustainable concerns of these stakeholders require firms to consider not only the economic</p>	We keep positive relationships with our stakeholders	
	We keep open communications with our stakeholders.	
	We regularly look for new knowledge regarding sustainable development.	
	We can identify new sustainable development opportunities from emerging social expectations and environmental regulations.	
	We can balance our short-term economic benefits with long-term sustainable development goals.	
	We regularly review our sustainable development goals and strategies.	

<p>outcome, but also the environmental and social impacts of their business operations.</p> <p>2. Sensing Capability refers to the firm’s ability to explore sustainable development opportunities to meet the intersection between its environmental and social goals and its economic interests. This capability means not only the firm’s ability to identify the emerging sustainable development opportunities, but also it’s potential to capture these opportunities through new knowledge seeking and new strategies establishment.</p> <p>3. Reconfiguration Capability refers to the firm’s ability to modify its existing functions and operations when they become unsustainable.</p>	We continuously evaluate the sustainable performance of our business operations.	
	We continuously improve our processes, products and systems for sustainable operations.	
	We are able to introduce new sustainable technologies and practices to our business operations.	
	We have organization-wide culture to listen to the needs of our stakeholders.	
	We can early sense the most relevant and significant sustainable issues.	
	We can explain our company’s point of view regarding sustainable development to our stakeholders.	
	We regularly look for feasible solutions to emerging sustainable requirements from fresh angles.	
	We are able to provide adequate trainings to our employees regarding sustainable operations.	
	Our employees are encouraged to share their knowledge and expertise about sustainable operations.	

Remember: you are asked to allocate the measurement items to their corresponding constructs:

Table 2 – supply chain management approaches regarding sustainable development

Explanation of the constructs	Measurement items of the constructs	No.
<p>1. Monitor-based approach refers to a series of compliance rules and enforcement activities implemented by the focal firms to control and regulate the sustainable behaviour of their supply</p>	We introduce formal approach (e.g. Code of Conduct) to regulate our supplier’s sustainable behaviour.	
	We conduct periodical audit to monitor our supplier’s sustainable performance (e.g. questionnaire or site visit).	
	We keep close and honest communications with our supplier.	

<p>chain partners.</p> <p>2. Support-based approach involves closer information and knowledge sharing between focal companies and their supply chain partners to jointly existing unsustainable problems and develop new sustainable initiatives.</p>	We share information and knowledge with our supplier about sustainable development.	
	We include environmental/ethical performance considerations in our supplier selection.	
	We require our supplier to implement formal environmental management system (e.g. ISO14001).	
	We regularly update environmental/ethical standards for our supplier to comply with.	
	We provide trainings to our supplier about sustainable development.	
	We help our supplier to solve unsustainable problems.	
	We work collectively with our supplier to develop new sustainable development initiatives.	

If you have any questions and further suggestions about this test, please contact me through qiang.wu@beds.ac.uk.

Appendix B: Survey Questionnaire

A Survey regarding Corporate Sustainable Development and Sustainable Supply Chain Management

Introduction and Objectives

This 15-minute survey is dedicated to explore the latest managerial perceptions regarding corporate sustainable development (i.e., balancing company's **economic, social** and **environmental** goals for its long-term development). In this survey two issues are particularly addressed: First, **what are the key capabilities that enable firms to pursue sustainable development?** Second, **what is the role of knowledge management and knowledge sharing in the development of such capabilities?**

This survey addresses two fundamental questions:

(a). *What are the key capabilities that enable firms to integrate sustainable considerations into their business strategies and operations?*

(b). *What is the role of knowledge management and knowledge sharing along the supply chain in the development of these capabilities?*

Definition of Key Terms

1. Corporate Sustainable Development (CSD) refers to balancing a company's economic, environmental and social goals for long-term development.

2. Sustainable Supply Chain Management (SSCM) refers to the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account.

The survey information will be analyzed collectively for research purpose only. No individual information will be disclosed to any third party.

Thank you for your collaboration



Section 1 – General Information

Overview of your business	
1. The industrial sector in which your company operates:	
2. How long has your company been in operation (years):	3. Total number of employees in the company:
4. Your job title:	5. Years in this position:

Section 2 – Capabilities for corporate sustainable development

Degree of Agreement						
Strongly Disagree	← Neutral →					Strongly Agree
1	2	3	4	5	6	7

Note: In this section there are some statements about **your company's** capabilities related with sustainable development. Please indicate your degree of agreement.

To what extent are the following statements true in **your company**?

Capabilities related to sustainable development		Degree of Agreement							
		Strongly Disagree	1	2	3	4	5	6	Strongly Agree
CS1	We maintain/have positive relationships with our stakeholders.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CS2	We maintain/have open communications with our stakeholders.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CS3	We have an organization culture that ensures that we listen to the needs of our stakeholders.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CS4	We can early sense the most relevant and significant sustainable issues to our stakeholders.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CS5	We can explain our company's point of view regarding sustainable development to our stakeholders.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CI1	We regularly look for feasible solutions to emerging sustainable requirements from fresh angles.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CI2	We regularly look for new knowledge regarding sustainable development.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CI3	We can identify new sustainable development opportunities from emerging social expectations and environmental regulations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CI4	We are able to provide adequate training to our employees regarding sustainable operations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CI5	Our employees are encouraged to share their knowledge and expertise about sustainable operations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CR1	We regularly review our sustainable development goals and strategies.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CR2	We continuously evaluate the sustainable performance of our business operations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CR3	We continuously improve our processes, products and systems for sustainable operations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CR4	We are able to introduce new sustainable technologies and practice to our business operations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CR5	We can balance our short-term economic benefits with long-term sustainable development goals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 3 – Knowledge sharing activities in your supply chain relationship

Note: In this section there are some statements about the activities implemented **by either your biggest customer (in Part A) or your company (in Part B)**. Please indicate the degree of implementation of these activities using the following scale:

Degree of Implementation						
Not at all	← Moderately →					Great extent
1	2	3	4	5	6	7

Part A

For this part please identify your biggest supply chain customer	
1. The industrial sector in which your biggest customer operates:	2. Total number of employees in this biggest customer company (approximately):

To what extent were the following activities implemented by **your biggest customer**?

Activities		Degree of Implementation						
		Not at all	1	2	3	4	5	6
MKT1A	This customer uses formal approaches (e.g., Code of Conduct) to regulate the sustainable behaviour of our company.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MKT2A	This customer conducts periodical audit to monitor the sustainable performance of our company (e.g., questionnaire or site visit).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MKT3A	This customer includes environmental/ethical performance considerations in its supplier selection.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MKT4A	This customer requires our company to implement formal environmental management systems (e.g., ISO14001).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MKT5A	This customer regularly updates environmental/social standards for our company to comply with.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SKT1A	This customer maintains/has close and honest communications with our company.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SKT2A	This customer shares information and knowledge with our company about sustainable development.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SKT3A	This customer provides training to our company about sustainable development.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SKT4A	This customer helps our company to solve sustainability problems.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SKT5A	This customer works collaboratively with our company to develop new sustainable development initiatives.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Part B

For this part please identify your biggest supply chain supplier	
1. The industrial sector in which your biggest supplier operates:	10. Total number of employees in your biggest supplier company (approximately):

To what extent did **your company** engage in the following activities with this supplier?

Activities		Degree of Implementation								
		Not at all	1	2	3	4	Moderately	5	6	7
MKT1B	We have formal approaches (e.g., Code of Conduct) to regulate the sustainable behaviour of this supplier.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MKT2B	We conduct periodical audit to monitor the sustainable performance of this supplier (e.g., questionnaire or site visit).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MKT3B	We include environmental/ethical performance considerations in our supplier selection.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MKT4B	We require this supplier to implement formal environmental management systems (e.g., ISO14001).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MKT5B	We regularly update environmental/ethical standards for this supplier to comply with.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SKT1B	We maintain/have close and honest communications with this supplier.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SKT2B	We share information and knowledge with this supplier about sustainable development.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SKT3B	We provide training to this supplier about sustainable development.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SKT4B	We help this supplier to solve sustainability problems.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SKT5B	We work collaboratively with this supplier to develop new sustainable development initiatives.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

If you need a summary of the results, please indicate your contact information here:

Your name:	Your contact information:
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Please tick the following box if you want to be removed from our database after this research:

Thank you for your collaboration!

Appendix C: Typical Examples of LISREL Program Inputs

1. CA-CFA Model

Title CA-revisedSKT2C

DATA NI=17 NO=223 MA=CM

CM FI='C:\Users\wuq3\Desktop\data analysis\CA-KKK.cov' SY

MO NX=17 NK=5 LX=FU, FI TD=DI, FR

LA

CS1 CS2 CS3 CI1 CI2 CI3 CI5 CR1 CR2 CR3 CR4 MKT1C MKT2C MKT3C

SKT3C SKT4C SKT5C

LK

SCAC SENC REGC MKTC SKTC

FR LX(1,1) LX(2,1) LX(3,1) LX(4,2) LX(5,2) LX(6,2) LX(7,2) LX(8,3) LX(9,3)

LX(10,3) LX(11,3) LX(12,4) LX(13,4) LX(14,4) LX(15,5) LX(16,5) LX(17,5)

FI PH(1,1) PH(2,2) PH(3,3) PH(4,4) PH(5,5)

VA 1 PH(1,1) PH(2,2) PH(3,3) PH(4,4) PH(5,5)

PD

OU MI

2. SA-CFA Model

Title SA-revised-SKT2S

DATA NI=17 NO=223 MA=CM

CM FI='C:\Users\wuq3\Desktop\data analysis\SA-revisedKKK.COV' SY

MO NX=17 NK=5 LX=FU, FI TD=DI, FR

LA

CS1 CS2 CS3 CI1 CI2 CI3 CI5 CR1 CR2 CR3 CR4 MKT1S MKT2S MKT3S

SKT3S SKT4S SKT5S

LK

SCAC SENC REGC MKTC SKTC

FR LX(1,1) LX(2,1) LX(3,1) LX(4,2) LX(5,2) LX(6,2) LX(7,2) LX(8,3) LX(9,3)

LX(10,3) LX(11,3) LX(12,4) LX(13,4) LX(14,4) LX(15,5) LX(16,5) LX(17,5)

FI PH (1,1) PH(2,2) PH(3,3) PH(4,4) PH(5,5)

VA 1 PH(1,1) PH(2,2) PH(3,3) PH(4,4) PH(5,5)

PD

OU MI

3. CA Final Structural model

DATA NI=17 NO=223

CM SY FI='C:\Users\wuq3\Desktop\data analysis\CA-KKK.cov' SY

MO NY=11 NE=3 NX=6 NK=2 PS=DI GA=FU BE=FU

LA

CS1 CS2 CS3 CI1 CI2 CI3 CI5 CR1 CR2 CR3 CR4 MKT1C MKT2C MKT3C

SKT3C SKT4C SKT5C

LE

SCAC SENC REGC

LK

MKTC SKTC

FR LY(2,1) LY(3,1) LY(5,2) LY(6,2) LY(7,2) LY(9,3) LY(10,3) LY(11,3) LX(2,1)

LX(3,1) LX(5,2) LX(6,2) BE(1,2) BE(2,3)

VA 1 LY(1,1) LY(4,2) LY(8,3) LX(1,1) LX(4,2)

PD

OU MI EF

4. SA Final Structural Model

DATA NI=17 NO=223

CM SY FI='C:\Users\wuq3\Desktop\data analysis\SA-revisedKKK.cov' SY

MO NY=11 NE=3 NX=6 NK=2 PS=DI GA=FU BE=FU

LA

CS1 CS2 CS3 CI1 CI2 CI3 CI5 CR1 CR2 CR3 CR4 MKT1S MKT2S MKT3S

SKT3S SKT4S SKT5S

LE

SCAC SENC REGC

LK

MKTS SKTS

FR LY(2,1) LY(3,1) LY(5,2) LY(6,2) LY(7,2) LY(9,3) LY(10,3) LY(11,3) LX(2,1)

LX(3,1) LX(5,2) LX(6,2) BE(1,2) BE(2,3)

VA 1 LY(1,1) LY(4,2) LY(8,3) LX(1,1) LX(4,2)

PD

OU MI EF