

CKM-embedded Innovation Marketing as Success Driver for Product Innovation

Theoretical Framework and Empirical Research

vorgelegt von
Master of Science

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Von der Fakultät Wirtschaft & Management
der Technischen Universität Berlin
zur Erlangung des akademischen Grades

Doktor der Wirtschaftswissenschaften

Dr. rer. oec.

genehmigte Dissertation

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Tag der wissenschaftlichen Aussprache: 17.9.2010

Berlin 2010

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Dedication

I dedicate this dissertation to my mother and father. You have always believed in me and input lifelong prayers and supports to enable me to finish this gigantic task.

This dissertation is especially dedicated to the people of Germany, who welcomed me with open arms, with kindness, with support, with your strict style to academy and with your relaxed approach to life.

Acknowledgements

I firstly give my sincere thanks to my doctoral father Prof. Dr. Volker Trommsdorff, who is a role model for me in any professional respect. I owe a great debt of gratitude to him for his guidance, support, care and constructive criticism along the way. I am also thankful to my associate supervisor, Prof. Dr. Savas Tümis, for his continuous support and valuable guidance. The best thanks are also given to Prof. Dr. Jürgen Ensthaler and Prof. Dr. Knut Blind, who supplied plenty of valuable suggestions for the dissertation and the further research directions in the disputation.

I would like to acknowledge the contribution of my friends who took the time to help me in data collection and participation in this study. They are too numerous to list individually, even if confidentiality agreements allowed me to thank them by name. Moreover, I would like to thank the colleagues at the Marketing Chair of TU Berlin with whom I had many discussions regarding the research project, and the friends who have accompanied me in studying and living in Berlin. They have taught me the importance of striving for research that is both relevant and rigorous and of maintaining a balance between work and family.

Most importantly, I have to appreciate the support and encouragement from my family, especially my parents, who have provided havens for my heart. I would like to thank my family for their cheerleading and perseverance in forging the road ahead so that I may realize the possibilities of higher education in a myriad of ways.

Last but not least, I would like to thank Chinese Scholarship Council (CSC) and Germany Academic Exchange Office (DAAD) for the financial support during the Ph.D program.

Crossing all the hurdles and reaching this milestone is a humbling experience for me. There are many people that made this childhood dream a reality. I am eternally grateful to everyone in sharing their expertise with such patience, tenacity, intrepidity, and fortitude. If I forgot anyone, then I sincerely thank you here!

Abbreviations

B2B	business to business
B2C	business to customer
CK	customer knowledge
CKM	customer knowledge management
CKMC	customer knowledge management competence
CRM	customer relationship management
e.g.	exempli gratia (means for example)
i.e.	id est (means that is or in other words)
IT	information technology
KM	knowledge management
NPD	new product development
SGS	Stage-Gate system

Abstract

CKM-embedded Innovation Marketing as Success Driver for Product Innovation: Theoretical Framework and Empirical Research

By Hongqing Sun

Innovation is considered to be a key factor for companies since the beginning of business research (Schumpeter 1934). Thus there is no need to convince that innovation is important, especially for current economical environment with intensive competition and fast changing markets and technologies, but to make sure of that “how to innovate” is the key issue (Drucker 1998). With the increasing customer competence, the role of customers is changing from pure passive adopters of consuming products or services to coequal partners in the process of adding value as co-designers (von Hippel 2001; Reichwald, Piller et al. 2003). Therefore, one important approach that has emerged in the last decades on “how to innovate” more successfully is to integrate customers earlier and more deeply into the innovation process (von Hippel 2001; Thomke and von Hippel 2002).

Customer relationship management (CRM) has been accused for over-promising but under-delivering frequently. Recent studies conducted in the domains of CRM and knowledge management (KM) have proposed that these two approaches can have great synergies, which lead to customer knowledge management (CKM) as an integrated management approach and competence that can exploit and use customer knowledge (CK) systematically and dynamically to enhance the business performance. The basic theme behind CKM is to generate and utilize CK to add value

to customers as well as to companies, by delivering the right product/service, at the right price, to the right people, at the right time and location, and through the right distribution channel (Al-Shammari 2009). This study confirms this idea by conceptualizing the term of CKM and key elements of customer knowledge management competence (CKMC), and develops a CKM-embedded innovation marketing framework as well as a theoretical model to explore how CKMC impacts on new product advantage, relationship quality and other factors.

In short, with emphasis on relationship management and interaction management in innovation marketing, this study proposes and empirically tests a theoretical framework for CKM-embedded innovation marketing to explore challenges and chances of customer integration under CKMC in new product development (NPD), and to manifest CKM-embedded innovation marketing is a success driver for product innovation. This theoretical framework of CKM-embedded innovation marketing is proposed to serve as a point of origin to reveal possible lacks of relationship management in innovation, knowledge management in CRM and to be a possible explanation for the mechanisms of CKMC in NPD. The related theoretical model based on structure equation modeling (SEM) and hypotheses have been tested quantitatively by examining the paths between CKMC, Intensity of customer interaction, customer relationship quality, knowledge exchange quality and new product advantage. The analysis report shows that CKMC not only influences new product advantage directly, but also influences it in an indirect way positively and significantly through interaction and relationship quality. Thus, it proves the particular importance of relationship management in innovation, especially in the context of China. Based on theoretical deduction and empirical testing, this study discusses strategies for cultivating CKMC and managing customer knowledge and relationship in innovation marketing processes, to improve the innovation performance. Limitations and further research directions are also discussed at the

end.

This study contributes to the literature on CKM in NPD in several ways:

- (1) by reflecting traditional CRM from customer, relationship and management aspects respectively and developing a complementary knowledge-enabled CRM framework, named CKM, to strengthen the competitive strategy that businesses need in order to stay focused on customers' needs and to integrate a customer-oriented approach throughout an organization;
- (2) by developing a comprehensive understanding of CKM-embedded innovation marketing as a high-involvement product attribute approach to build long-term interactive relationships with customers and as a success driver for product innovation;
- (3) by developing a construct that captures the defining characteristics of the CKMC composed of knowledge management infrastructure capability and customer knowledge process capability, which implicates the "Wave-Particle Duality" of knowledge management (Allee 1997a) with both object management and process management;
- (4) by providing an empirical test of the proposed theoretical model, which indicates the direct and indirect impacts of CKMC on new product advantage as well as the importance of relationship quality in the innovation processes.

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Chapter I Introduction

In the aftermath of the knowledge economy, smart corporations begin to realize that the proverbial “if we only knew what we know” also includes “if we only knew what our customers know.” (Gibbert et al. 2002)

1.1 Background: Innovation and Customer Integration

Innovation^① is considered as a key factor for companies since the beginning of business research (Schumpeter 1934). Thus there is no need to convince that innovation is important, especially in the current economical environment with intensive competition and fast changing markets and technologies, but to make sure that “how to innovate” is the key issue (Drucker 1998).

As we know, innovation is a complex undertaking, requiring companies to find a balance between business goals, regulatory guidelines, the requirements of the distributor and retailer, and consumer demand. Therefore, customer^② integration in NPD projects has become an increasingly popular method of improving product effectiveness (e.g. product cost and quality) and project efficiency (e.g. development cost and time). This integration may range from giving minor design suggestions (e.g. to give a complementary idea or to improve a component’s manufacturability) to being responsible for the complete development, design and engineering of a specific part or sub-assembly (Wynstra and Pierick 2000).

^① Innovation is concerned in many fields, such as product, process, organization, and so on. This study concentrates on product innovation, or new product development.

^② The term “customer” in this study should be widely defined as organizations’ stakeholders, such as consumers, suppliers, distributors, partners, joint ventures and alliances, competitors, and so on. These customers have a relationship with the organization – past, present or future.

While customer integration method is widely used by many companies, they are skilled at collecting and analyzing data about their customers and at using this information to formulate a “brand message”: those things a company wants to communicate to customers, the expectations that should be set in the customer’s mind, and what feelings and association customers should take away from an interaction with the company and its products (Oppenheimer 2005). However, although the information may be useful for understanding demographic and economic aspects of customers, customer integration does not certainly help the company understand how the product and user should interact – how the product and user should “talk” to each other, and accordingly, does not certainly guarantee the NPD success and does not always lead to improvements in project effectiveness and efficiency. Collaboration with customers in new product development (NPD) projects takes time, effort and money in terms of coordination and communication; not only for customers, but also for companies. From pilot case studies, the practitioners who have conducted customer involvement and interaction in their business processes expressed that they did not lack information from customers with the assistance of CRM programs, whereas they still couldn’t understand customers well and lost themselves in mass data processing. In short, given its potential and high cost, the focus of customer integration as well as CRM has been mostly on technology, e.g. database and data mining. The focus, however, must shift to other factors due to the high failure rate of CRM projects and a high risk of innovation.

Nevertheless, this does not imply that customer integration is a poor strategy or CRM is a wrong philosophy. However, something is considered to be lost in translation as a product goes from being an innovative idea or a potential demand, to being an actual product design or a physical object that a customer must communicate with and must manipulate. Meanwhile, something is lost in translation as information from customers and market to useful knowledge for product innovation. Most existing

typologies have not addressed in much detail the issue of how the involvement of different customers can or should be managed. They only provide guidelines regarding the phases of customer involvement with the course of a development project (e.g. from the concept phase until the end vs. only in the detail engineering phase) and the extent of involvement (e.g. the supplier only receives functional specifications vs. almost complete blueprints) (Wynstra and Pierick 2000). Therefore, customer integration should be managed carefully and customer knowledge should be managed effectively.

1.2 Research Objectives and Research Questions

While the exchange of information has been a key to good relationships with customers in many areas of customer management, many academicians and practitioners emphasize the imperativeness of setting an appropriate system to manage customer knowledge (CK), in order to support the generation of better new products and services to secure customer loyalty and to obtain the synergy of collaboration between companies and customers (Chen and Su 2006). Recently customer knowledge management (CKM) has drawn much attention by combining both the technology-driven and data-oriented approaches in CRM and the people-oriented approach in knowledge management (KM) with a view to exploit their synergies (Davenport, Harris et al. 2001; Garcia-Murillo and Annabi 2002; Su, Chen et al. 2006). This is also the original motivation of this study. Three key words are paid much attention to in this study: customer knowledge, new product and customer relationship.

1.2.1 An Overview of CKM Context

CRM and KM are two significant concepts in business and academia, as well as in innovation management. Although they are mostly separately presented in different

domains of the bibliography, their mutual synergies have drawn much attention of a number of studies and have led to the emergence of customer knowledge management (CKM), which is the convergence of both the technology-driven and the data-oriented approach of CRM and the people-oriented approach of KM.

As knowledge is regarded as an important asset of an organization and CK is widely adopted by organizations through customer integration nowadays, a KM system manages an organization's knowledge through the processes of creating, structuring, disseminating and applying knowledge to enhance organizational performance and supports many business processes to create value, especially in developing innovative products. While CRM is an IT-enabling management tool, which manages the relationship with customers mostly through the customer database and data mining to understand, target, and attract them, with the objective of satisfying and retaining customers (Dyche 2002). That is, traditional CRM focused on the transactional exchanges to manage customer interactions. Customers can only receive information passively during the process of developing from the product concept to the actual product itself, and can only select from the products that are currently on sale in the market (Liao, Chen et al. 2010). However, "given the important role being played by KM systems in the customer-centric business environment, there is a lack of a simple and overall framework to integrate the traditional CRM functionalities with the management and application of the customer-related knowledge, particularly in the context of marketing decisions (Bose and Sugumaran 2003)", so that CRM programs face the challenge of achieving a good relationship by manage customer knowledge.

As showed in literature, the integration of CRM and KM at process level are beneficial for both management approaches. A CRM-oriented KM focuses on customer knowledge, which is most valuable to the company, while KM-oriented CRM builds a

framework to manage the knowledge required for high quality relationships in a cost effective way. Both approaches interface in the area of information management, as both decide which content should be explicated and disseminated (Gebert, Geib et al. 2002), and bring the dynamics between customer knowledge and customer relationship into focus in a new way (Rollins and Halinen 2005). Thus, true CRM is possible only by integrating customers and managing interaction with KM systems to create knowledge-enabled CRM processes that allow companies to cultivate customer relationships such as customer satisfaction, customer profitability, or customer loyalty and to support their business decisions and performance (Bose and Sugumaran 2003). This trend leads this study to provide a comprehensive understanding of customer knowledge management (CKM) as an integrated management approach.

In the current decade, some researchers have manifested their reflections on CKM in issues such as: (1) identification of different characteristics of CKM and distinction among CRM, KM and CKM (Gibbert, Leibold et al. 2002); (2) procedure for adding “human data” onto “transaction data” in the knowledge discovery process to capture customers’ attitude toward products (Davenport and Marchand 2000); (3) employment of psychological elements for an insight to aid knowledge identification (Pazzani 2000); (4) interaction of customer knowledge with other components of a company’s knowledge so as to pursue the synergy of organizational collaboration (Garcia-Murillo and Annabi 2002); (5) an emphasis on customers’ evaluation difference between radical innovative products and incremental innovative products (Veryzer 1998a); and (6) establishment of an adequate process to select and gather exact sorts of customers’ knowledge that a company desires to have (Koenig and Srikantaih 2000; Chen and Su 2006). Some major contributions (but not all) to CKM literature include Li and Calantone (1998), Gibbert et al. (2002), Garcia-Murillo and Annabi (2002), Rowley (2002a), Rowley (2002b), Gebert et al. (2003), Kolbe et al.

(2003), Campbell (2003), Bueren et al. (2005), Smith and McKeen (2005), Chen and Su (2006), Paquette (2007), Lopez-Nicolas and Molina-Castillo (2008), Al-Shammari (2009).

In short, CKM is not just a tool (like traditional CRM) about data nor just about customer relationships with social (people-based) or transactional (technology-based) attribute; rather, CKM is a "multiple-paradigms one-solution" holistic business framework and a customer-oriented and knowledge-based business strategy enabled by a holistic organizational reinvention manifested by changes in people, structure, processes and technology (Al-Shammari 2009).

1.2.2 Statement of Problems

Although many ardent researches contributed their effort on developing CKM theory and have enriched our understanding of CKMC, four key limitations in prior literature on CKM in NPD projects can be observed:

- First, although there is a general understanding that CKMC plays an important role in NPD and customer knowledge development occurs through a bilateral process of company-customer interaction across the various stages of NPD (Leonard-Barton and Leonard 1998; Prahalad and Ramaswamy 2004), this understanding has not been formalized in terms of a theoretical construct yet. Therefore, it is essential to develop a formal conceptualization of the process of customer knowledge development to build the systematic body of empirical research that is necessary to advance the understanding of this process.
- Second, "specific organizational actions that can foster customer knowledge development have so far not been identified, to the best of our knowledge. Furthermore, the extent to which project characteristics can enhance or mitigate (i.e., moderate) the impact of organizational actions on customer knowledge

development is not known” (Joshi and Sharma 2004). This lack of attention to the interrelated impact of different organizational factors on NPD activities is also a general limitation in the NPD literature (Henard and Szymanski 2001).

- Third, though previous research suggests that customer orientation and customer integration influence organizational behavior in NPD, few studies provide empirical results regarding the effect of CKMC on product innovation activities.
- Fourth, because most knowledge about customer knowledge development until now was grounded in case studies, large-scale empirical evidence for its antecedents, moderators, and effects on new product performance is lacking.

1.2.3 Research Objectives and Research Questions

The most significant challenges in implementing CKM effectively are organizational, not technical. Four significant hurdles that must be overcome as part of any program of CKM include structural challenges, cultural challenges, competency challenges and privacy concerns (Smith and McKeen 2005). Successful CKM implementation requires transformation of organizations from product-centric to customer centric, from vertical to network structure, from individualistic to collective work, from hoarding to sharing culture, from ceremonial to results-oriented practices, from functional to process work orientation, and from centralized to distributed computing (Al-Shammari 2009). CKM should no longer be a tool like traditional CRM, but be a strategic process that captures, creates and integrates customers dynamically (Smith and McKeen 2005).

This study addresses these gaps by presenting a theoretical framework and testing a conceptual model of CKMC in NPD, especially in the innovation marketing process. In this study, the objectives are:

- (1) to address how to manage customer integration and customer knowledge effectively and efficiently by CKM system, which consists of learning activities that have the potential to influence a company's innovation performance and customer relationship in NPD;
- (2) to conceptualize and develop a measure of CKMC, which is becoming a strategic asset of an organization (Glazer 1991) and a core organization competence (Hamel and Prahalad 1994), as well as to identify what types of capabilities might facilitate CKM activities and examine their contributions to CKMC;
- (3) to explore how CKMC in innovation marketing processes influences customer interaction intensity, customer relationship quality, knowledge exchange quality and new product advantage.

Synthesizing marketing, CRM, knowledge management and NPD bibliography, this study seeks answers to four primary questions:

- (1) How is innovation leveraged through CKM? What is the direct and indirect impact of CKMC on new product advantage?
- (2) How does relationship marketing play a role in customer-integrated innovation? Does customer interaction be enhanced by CKMC and influence new product advantage?
- (3) How does CKMC affect knowledge quality? What customer knowledge activities contribute to CKMC?
- (4) What is the relationship between customer relationship quality and knowledge exchange quality? What is the role of customer knowledge between customer relationships and customer-centric new products?

This study will provide some insights into these research questions which will help organizations to develop more successful products and cultivate more valuable

customer relationships.

1.3 Significance of Research Study

Based on the research background and research objectives, this study contributes to the literature in several ways.

Initially, this study attempts to contribute to CKM literature by providing an integrated framework based on the synergies of CRM and KM, conceptualizing and operationalizing CKM from a relationship perspective, and identifying the key elements of CKMC based on existing literature. From a theoretical standpoint, the results of this study give a better understanding of the role of customer knowledge playing as an intermediary in the innovation marketing processes.

Customer integration is regarded as a vital method to improve innovation performance, while CRM becomes a contemporary management tool that conducts customer orientation and manages customer relationships by employing information technology such as database management, data analysis, and data mining to understand, target, and attract customers, with the objective of satisfying and retaining them (Dyche 2002). However, the unidirectional communication channel and transactional data analysis restrain the success rate of CRM projects. To improve the management effectiveness of customer knowledge and customer relationship, this study emphasizes the significant role of tacit knowledge from customers to product innovation, which can only be exploited by an interactive approach. Accordingly, this study emphasizes a bi-directional communication channel in innovation marketing processes and demonstrates the new perspective of customer integration, which is taken interaction as professional service for customers to improve relationship quality. CKM is conceptualized to describe the convergence of

both the technology-driven and data-oriented approach in CRM and the people-oriented approach in KM with a view to exploiting their synergies based on prior studies (Garcia-Murillo and Annabi 2002; Gebert, Geib et al. 2003; Chen and Su 2006). Therefore, this study integrates both streams by providing a link to customer knowledge and customer relationship. Key elements of CKMC, composed of customer knowledge process capability and knowledge management infrastructure capability, are explored to help understand the internal firm processes necessary to create customer knowledge management competence.

Second, the effects of CKMC on customer interaction activities and new product advantage are examined in a single model by integrating CKM theory and the customer-integrated approach, especially integrated relationship quality and knowledge quality as intermediaries. From a theoretical standpoint, the findings of this study give a better understanding of the moderating and mediating factors influencing the relationship between CKMC, customer integration and innovation performance.

This study investigates the direct effects of CKMC on innovation marketing activities, which, in turn, are expected to contribute to new product advantage; and also indirect effects, where it is supposed that relationship quality and knowledge quality play an important role in CKM-embedded innovation marketing processes and contribute to new product advantage. This enables companies not only to assess their CKMC and innovation performance from a knowledge perspective, but also to build their CKMC using relationship marketing approaches, thereby providing a more effective approach to improve innovation success through customer-centred products and valuable long-term relationships.

Third, from a managerial standpoint, this study provides guidance on identifying the

key elements for CKMC as well as constructive inputs for intensive customer interaction, and the results of this study assist managers in developing a strategy to conduct CKM and cultivate CKMC in an interactive way. An examination of the theoretical model reveals that innovation teams should pay much attention to relational investments in order to encourage knowledge sharing willingness and cultivate valuable customer partnerships.

Although CKM may be regarded as a worthwhile effort, making it happen across an organization can be a tall order and challenge. Paquette (2005) identifies several cultural challenges in CKM implementation. Desouza and Awazu (2005) point out four major challenges to CKM: segmentation, integration, distribution, and application. Smith and McKeen (2005) indicate that four major hurdles that CKM must overcome: structural challenges, cultural challenges, competency challenges, and privacy concerns. It can be a daunting task to establish CKMC that will ultimately make organizations more effectively.

Getting started on the right path is often much more difficult, and staying the course can mean that even more roadblocks spring up along the way. The framework of this study is intended to activate a feasible start and ease the way to understand and implement CKM with the key elements identification and operational path testing, even as organization may be struggling to understand the issues, tactics, and tools necessary for a successful CKM journey. This work helps companies to navigate towards true institutionalization by laying out the characteristics, mechanisms, components, requirements, and action steps of CKM implementation.

1.4 Organization of Dissertation

This dissertation is structured along six chapters following the research methodology.

Chapter I provides an introduction to the study, presents the motivation and research questions, and explains the importance of the study. Based on a conceptual pre-understanding of customer-integrated innovation, Chapter II focuses on intensive desk research and delves into the theoretical foundations, underpinning customer knowledge management by reviewing and integrating the relevant conceptual and empirical literature, primarily from the domains of NPD, CRM, KM, intellectual capital and customer competence theories; and provides a detailed description of the CKM-embedded innovation marketing framework for managing customer knowledge in innovative product development. Chapter III presents the augmented hypothesized model and supporting literature as well as deduction. Chapter IV outlines the research design and methodology, including an explanation of the research procedure and descriptions of the scales used to operationalize the constructs. Chapter V reports the data analysis and discusses the preliminary findings of the empirical research. Chapter VI draws the conclusions of this study, provides a detailed discussion of theoretical and managerial implications structured around the research questions, addresses the research limitations and indicates the future research directions.

Chapter II Theoretical Foundations of Customer Knowledge Management

Innovations are very essential for companies to secure and expand their positions in the market (Larson 2001) and business sustainability is embedded in the firm's ability to manage its innovation processes (Shani, Sena et al. 2003). The importance of customer relationship management (CRM) and customer involvement into innovation processes is also acknowledged by many academicians and practitioners. However, many companies have encountered various difficulties of knowledge management capability and customer relationship management in innovation processes. They need a new framework to manage customer interaction efficiently, to turn customer, knowledge and management into organizational intelligence as a whole, and to gain customer satisfied solutions as well as valuable customer relationships. Therefore, this study develops customer knowledge management (CKM) theory based on the synergies of CRM and knowledge management (KM) and a CKM-embedded innovation marketing framework to support the performance of CRM and Innovation.

This chapter is organized accordingly. A brief outline of innovation, the necessity and feasibility of customer-integrated innovation under an overview of the changing nature of the market and marketing activities is presented firstly, followed by a general portrait of customer-integrated innovation marketing. Afterward an analysis of the nature of customer knowledge (CK) in innovation processes is analyzed. Based on the synergies of CRM and KM, a discussion of the role of CK as a foundation for relationship marketing and KM as a complement for CRM, a definition of Customer Knowledge Management (CKM), and a conceptual framework of customer

knowledge management competence (CKMC) with key elements are supplied. Finally, a CKM-embedded innovation marketing conceptual framework is designed in this study.

2.1 Customer as Innovation Partner

“A company has to realize the fact that it does not employ all smart people there are and the necessity to work with clever people outside its company borders” (Gassmann and Wecht 2005).

Customers are used to be seen as passive buyers with a predetermined role of consumption (Prahalad and Ramaswamy 2000). While the changing dynamics of business, the role of customers^③ is also changing continually. Customers are becoming more active and innovative, customers' input has become a valuable component of innovation processes and customers are taken as one part of the enhanced network of companies (Prahalad and Ramaswamy 2000). Customers, interacting with other environmental variables, are changing the nature and rules of market competition. A customer-centered era is coming, which is not only a challenge but also a chance for any company. However, as yet, little systematic attention has been paid to customers as knowledge development partners (Gibbert, Leibold et al. 2002).

^③ Customers should be differentiated between business customers and consumers, but here both are included in the empirical research of this study. That means, customer in this study is a big concept and refers to distributors, suppliers, competitors, consumers and so on. This is done in consideration with two reasons: on the one hand it enables us to structure the whole following customer integrated innovation framework - customer is the leading actor in this series - and on the other hand – most importantly – it contributes to fill a research gap, for there are little specific studies as yet available focusing on the customers' perspective of involvement into the innovation process, especially the end users.

2.1.1 Innovation

Generally, the concept of innovation is discussed from three perspectives – organizational, systematic, and firm levels. Innovation was firstly mentioned by Joseph Schumpeter who viewed innovation as the driving force of economy; going even further, the concept of innovation encompasses the emergence of new products and strategies, new sources of supply of raw materials, markets, and organizational changes. It is acknowledged there are different forms of innovative activity with different contextual origins and there has been substantial effort since Schumpeter (1934) in defining common elements. The nature and the types of innovations have been studied in many researches, i.e. product, process, business concept, incremental, radical, architectural, disruptive, and value innovations. In this paper, innovation is mostly concerned about product innovation, or new product development^④, and is recognized as a coupling of inventions with commercialization (Robert 1988). Innovation is a process that defines problems and develops new knowledge to solve them (Nonaka 1994).

Even in the 20th century several studies have already demonstrated that NPD or product innovation has become an increasingly important vehicle in developing or maintaining a strong position in an increasingly competitive arena (Cooper and Kleinschmidt 1986; Brown and Eisenhardt 1995). But the demands on NPD performance, in terms of speed, cost and performance, have become more stringent and difficult to meet. Most innovations fail when brought to market (Chesbrough 2003). However, if companies do not try to innovate continually, they die.

^④ Innovations management is generally synonymous with R&D management and product development in literature. Thus this study will use innovation, product innovation and new product development in this paper synonymously.

Innovation is generally categorized as incremental innovation and radical innovation in the literature. However, Henderson and Clark (1990) notice that the Incremental-Radical dichotomy alone is not sufficient to explain what a company would be in a better position to innovate and under what circumstances, and this simple category can't explain why some innovations seem small but can have a tremendous competitive results in some industries, such as the automotive industry, manufacturing industry and so on. Scholars have tried to shape a more profound understanding of innovation and distinguish different types of innovation from different perspectives.

Table 1 Categories of Innovation

Scholars	Innovation types
Marquis(1969)	incremental innovation; radical innovation; system innovation
Abernathy and Clark (1985)	architectural innovations; revolution innovations; niche creation innovations; regular innovations
Tushman and Nadler (1986)	competence enhancing; competence destroying
Henderson and Clark (1990)	incremental innovation; architectural innovation; modular innovation; radical innovation
Betz (1993)	incremental innovation; radical innovation; system innovation; next-generation technology innovation
Atuahene-Gima(1996)	reformulated new product; original new product
Chandy and Tellis (1998)	incremental innovation; market breakthrough; technological breakthrough; radical innovation

Source: summarized by this study

Henderson and Clark (1990) argue that new knowledge in innovation processes can either enhance current knowledge or destroy current knowledge, and divide the technological knowledge required to develop new products, and consequently to introduce innovations, along two new dimensions: knowledge of the components and knowledge of the linkage between them, which is called architectural knowledge. The Henderson-Clark model combines the nature of knowledge and the types of innovation, and is consistent with the framework of this study which explores the customer-integrated innovation and customer knowledge management through the nature of knowledge. Therefore, this study will take the Henderson-Clark framework as the analysis foundation.

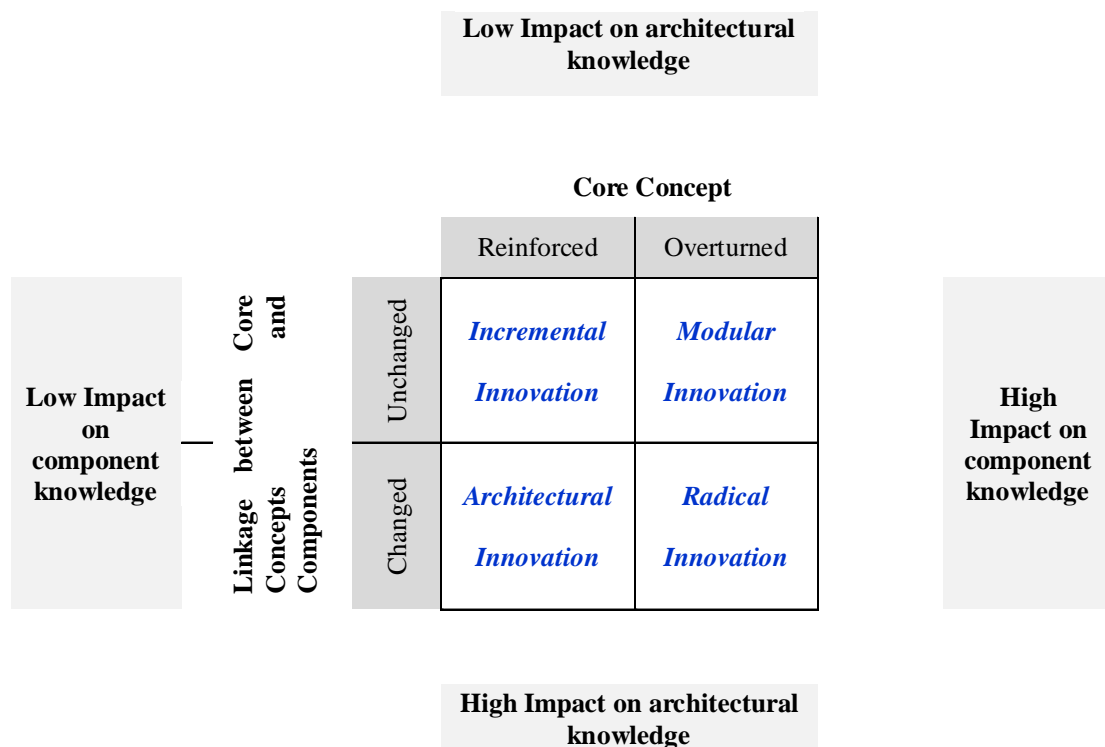


Figure 1 A Framework for Defining Innovation

Source: revised from Henderson and Clark (1990)

2.1.2 Necessity Analysis for Customers as Innovation Partner

“Business Competition used to be a lot like traditional theater: On stage, the actors had clearly defined roles, and customers paid for their tickets, sat back, and watched passively.” (Prahalad and Ramaswamy, 2000, p79)

Nowadays the quality and characteristics of general products and services are growing convergent, which results in a structural shortage and a buyer's market situation at the same time, especially in the Chinese market. Therefore, unprecedented fierce competition for customers is a challenge for any company. On the other hand, customers are growing to be more mature, having more changeable demands and requirements in the products, services, prices, channels and communication and owing more choices. The power to choose has shifted from companies to customers.

The changing roles of customers

In traditional business, companies, distributors, and suppliers understood and adhered to their well-defined roles in a corporate relationship (Prahalad and Ramaswamy 2000). Companies supply products and service, while customers choose to accept them.

But under the global and cruel competition nowadays, the real competition is for customers. Companies must try their best to satisfy their customers and retain or enlarge their market share. Companies should not only listen to but also cooperate with customers to the greatest extent, in order to supply products or services which can meet customers' needs and expectations. In this case, some powers are shifting to customers.

Thanks largely to the information and internet era, the knowledge and competence of customers are becoming more and more powerful and useful, and customers have been increasingly engaging themselves in an active and explicit dialogue with companies of products and services. Customers have become from isolate individuals to connected networks, from unconscious to well-informed, from passive to active. The customers' competence brings knowledge and skills they process, their willingness to learn and experiment, and their ability to engage in an active dialogue. The market has become a forum in which customers play an active role in creating and competing for value (Prahalad and Ramaswamy 2000).

Table 2 The Changing Role of Customers

	Customers as a Passive Audience			Customers as Active Players
	Persuading predetermined groups of buyers	Transacting with individual buyers	Lifetime bonds with individual customers	Customers as cocreators of value
Time frame	1970s, early 1980s	Late 1980s and early 1990s	1990s	Beyond 2000
Nature of business exchange and role of customer	Customers are seen as passive buyers with a predetermined role of consumption			Customers are part of the enhanced network; they cocreate and extract business value. They are collaborators, codevelopers and competitors.
Managerial mind-set	The customer is an average statistic; groups of buyers are predetermined by the company.	The customer is an individual statistic in a transaction.	The customer is a person; cultivate trust and relationships.	The customer is not only an individual but also part of an emergent social and cultural fabric.
Company's interaction with customers,	Traditional market research and inquiries; products and services are	Shift from selling to helping customers via help desks, call centers,	Providing for customers through observation of users; identify	Customers are codevelopers of personalized experiences.

and development of products and services	created without much feedback.	and customer service programs; identify problems from customers, then redesign products and services based on that feedback.	solutions from lead users, and reconfigure products and services based on deep understanding of customers.	Companies and lead customers have joint roles in education, shaping expectations, and cocreating market acceptance for products and services.
Purpose and flow of communication	Gain access to and target predetermined groups of buyers. One-way communication.	Database marketing; two-way communication.	Relationship marketing; two-way communication and access.	Active dialogue with customers to shape expectations and create buzz. Multilevel access and communication.

Source: Prahalad and Ramaswamy (2000)

The Change of Consumer Behavior

In the traditional business times, customers' selection criteria is "good" or "bad"; in emotional consuming times, customers' selection criteria is "like" or "unlike"; and in the experience-driven times, customers take the level of participation and satisfaction as selection criteria. Contemporary customers need not only buy those products which meet their needs with proper price, but also those products which can represent their personalities and values. They want their voices to be heard and take the experience which co-creates product and service as a part of consumption.

The Challenge of IT and Internet

The information explosion changes the information asymmetry between companies and customers significantly. Companies can't control market information and dialogues with customers in one way, for customers can get enough information through Internet and many choices as well as negotiation power through

E-Commerce. The customer loyalty built with the traditional marketing mix becomes very weak in Internet and E-Business times. Thus, companies need new countermeasures to increase customer stickiness to companies and build real loyalty in the new economy era.

2.1.3 Feasibility Analysis for Customers as Innovation Partner

It is not only necessary to involve customers into innovation processes, but also possible and feasible to take customers as innovation partners. Some evidences are presented as follows.

Convergence of Values

Innovation is an interest-driven behavior. Companies want to develop successful products which meet the customers' needs and expectations via customer integration, and customers also expect benefits from cooperative innovations, e.g. experience benefits from innovation processes or financial benefits from future discounts or rewards and so on. But both parties want to develop high value products or services which satisfy customers.

Support by IT and Internet

Communication and interaction between a company and customers were restricted in industry times, for information process capability was inadequate and it caused also high cost. With the development of information technology and internet technology, not only have much more interactive communication channels emerged out, but also the information processing capability of companies has increased greatly. This improves the breadth and depth of cooperation between companies and

customers infinitely. Customers can communicate with companies, give their needs and feedback to companies and involve themselves in the innovation processes through information platform with a small cost, meanwhile companies can understand and grasp customers' needs through the real time information and provide personalized solutions to meet the customers' requirements.

Enhancement of Customer Competence

Customer competence is a function of knowledge and skills they process, their willingness to learn and experiment, and their ability to engage in an active dialogue (Prahalad and Ramaswamy 2000). In the knowledge era, customer knowledge is developing very quickly. Customers may keep more valuable information than firms, and some tacit knowledge of customers' maybe means high value for product innovation. Customers own the capability to cocreate with companies, and IT as well as Internet makes the cocreation and interactive dialogue possible. Von Hippel (1997) finds out that many important product innovations did not stem from companies which produce these products, but from end users.

2.2 Customer Integration in Innovation Marketing

2.2.1 The Previous research on Customer Integration in NPD

It has been recognized widely in theory and practice for years that customers as an external resource can improve innovation success, although some researchers argued that customer integration also has negative effects and inherent risks. The following table shows some main research attributes of customer integration in NPD and key issues in some classical literature.

Table 3 Literature on Customer Integration into Innovation Processes

Attributes of customer integration in NPD	Key issues	Authors
Roles of customer in NPD	Customer integration ranges from lead user to first orderer	(von Hippel 1986; von Hippel 1988; Brockhoff 2003; Lettl 2004)
Customer contribution to NPD	Activities in <ul style="list-style-type: none"> ● Concepts development ● Product design ● Performance testing and validation 	(Kleinschmidt and Cooper 1991; Lengnick-Hall 1996; Nambisan 2002; Ulwick 2002)
Enhancement of new product success	More new innovation and product success through customer integration	(Gruner and Homburg 2000; Lilien, Morrison et al. 2002)
Influence of customer integration on product success	Positive impact of customer integration on innovation process	(Kleinschmidt and Cooper 1991; Souder, Sherman et al. 1998; Salomo, Steinhoff et al. 2003; Callahan and Lasry 2004)
Benefits of customer integration	Increase in innovation process's effectiveness and efficiency	(Leonard-Barton and Sinha 1993; Atuahene-Gima 1995; Brown and Eisenhardt 1995; Lengnick-Hall 1996; Wayland and Cole 1997; Rigby and Zook 2002)
Customer integration in the case of radical innovation	Characteristics of customer contribution and profile, as well as the interaction and impact's dimension	(Urban and von Hippel 1988; Schoormans, Ortt et al. 1995; Lynn, Morone et al. 1996; O'Connor 1998; von Hippel, Thomke et al. 2000; Lilien, Morrison et al. 2002; Lettl 2004)
Success factors of customer integration	Proposal on team organization, development process, knowledge generation, culture etc.	(Bruce and Biemans 1995; Littler, Leverick et al. 1995; Mohr and Spekman 1996)
Prerequisites for customer integration	Defining clear roles and objectives and key enabling figures	(Biemans 1992; Riggs and von Hippel 1994; Bruce and Biemans 1995; Brockhoff 1998; Hauschildt and Kirchmann 2001)
Empiric investigations on the importance of customer integration	User constitute a major source of innovation	(von Hippel 1986; Urban and von Hippel 1988; von Hippel 1988; Herstatt and von Hippel 1992; Morrison, Roberts et al. 2000;

		Lüthje 2004)
Consumer research methods for opportunity identification in NPD	Methodologies for developing and introducing innovative products to market through customer integration	(Leonard-Barton and Sinha 1993; Lynn, Morone et al. 1996; Noori and Munro 1999; Ulwick 2002; Kleef, Trijp et al. 2005)
Negative aspects of customer integration	Illustration of negative side effects and inherent risks of customer involvement	(Pisano 1990; Camagni 1993; Robertson and Langlois 1995; Becker and Peters 1998; Campbell and Cooper 1999; Enkel, Perez-Freije et al. 2005)

Source: revised from Enkel et al. (2005)

2.2.2 Innovation Marketing and New Product Development

2.2.2.1 Innovation Marketing: Definition

Innovation marketing is one part of innovation management, which represents a wide range of management functions of marketing in innovation processes (Hauschildt 2004; Trommsdorff and Steinhoff 2007). We can understand innovation marketing as “Innovation + Marketing”, which is the combination of innovation and marketing, or as market oriented product innovation. The nature of innovation marketing is: Innovation Marketing = Customer-oriented Generation of Innovation + Customer-oriented Marketing of Innovation^⑤.

In this study the definition by Trommsdorff is used. Following his opinion, innovation marketing is understood as the targeted management of the development, introduction and maintenance of new products (Trommsdorff 1995; Trommsdorff and Steinhoff 2007). Innovation marketing includes all the marketing activities from idea generation to market launch in NPD and is fully integrated marketing which

^⑤ Reinhard Prügl(2004), Wie kommt das Neue in die Welt? From IS 20 22 MarketingXXX 16.12.2004, <http://www.inna.at/data/IS%2020%2022%20MarketingXXX.pdf>, accessed on 18 August 2008.

combines the activities of every type of marketing tools at once.

2.2.2.2 Innovation Marketing and New Product Development

From the definition of marketing innovation, we can already learn that it belongs to new product development. Generally there are two main types of activities in NPD, which are marketing and technology (BoozAllen&Hamilton 1982; Cooper and Kleinschmidt 1986; Calantone and di Benedetto 1988), and innovation marketing process is often called the "Fuzzy Front-End" of the NPD process. We can also have a clear insight from the following figure.



Figure 2 Marketing and Technology in Innovation Process

Source: revised from Trommsdorff and Steinhoff (2007)

2.2.2.3 Sub-Phases of NPD and Innovation Marketing

Kuczmarski (1992) notices that the NPD process can be divided into different stages according to requirements, such as 2 stages, 4 stages, 7 stages, 10 stages, etc. The more stages, the more detailed information for decision-makers and managers to monitor and guide the NPD process. Dividing a NPD process into sub-phases can also help organization to apply Stage-Gate® System (Cooper 2008), which can control (go

or kill) the innovation projects in sub-stages. From the literature analysis, we can also find out that divisions of NPD phases are different according to the different perspectives of researchers and different industry characteristics.

The following figure is one typical subdivision of NPD phases including marketing and technical activities.

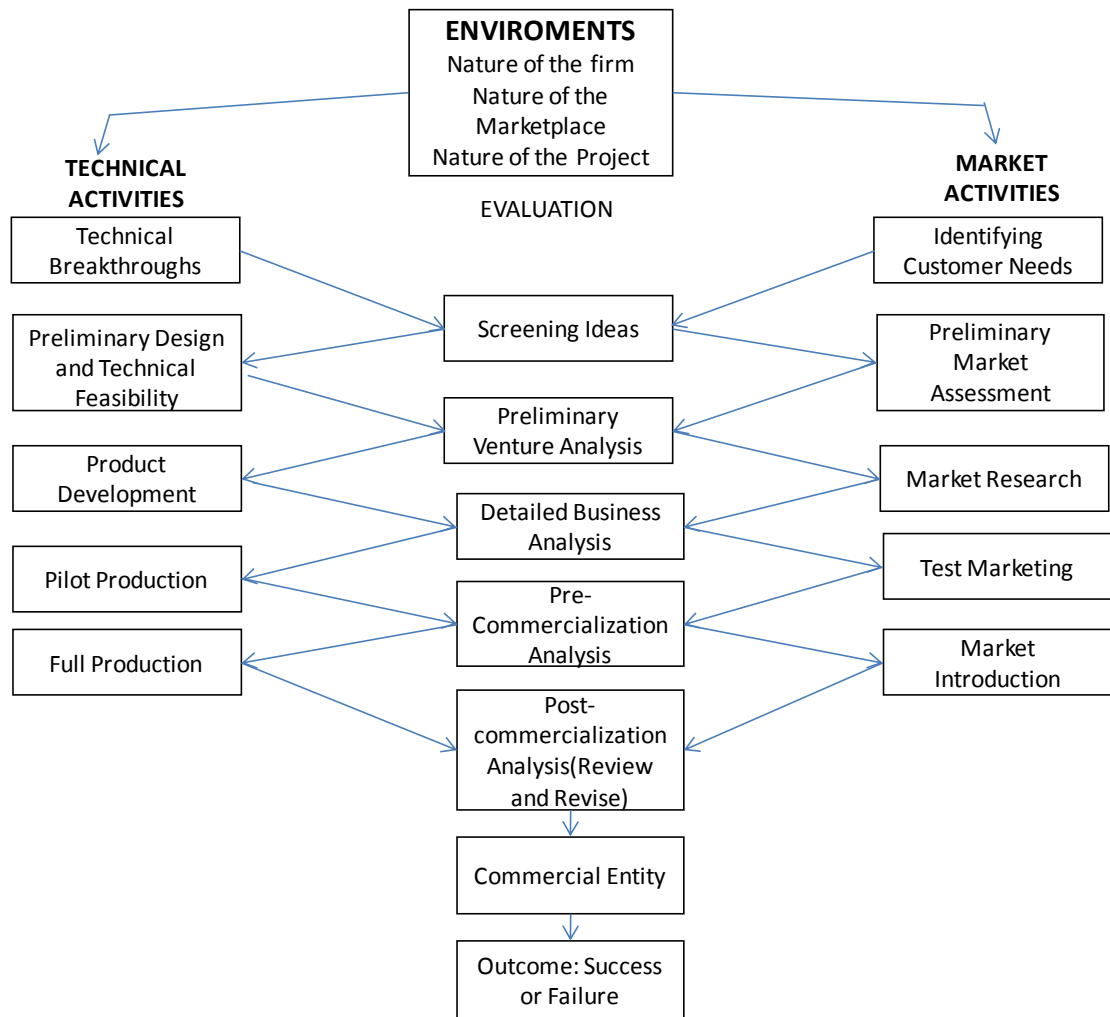


Figure 3 A Modified Model of NPD Phases

Source: Calantone & di Benedetto (1988)

Based on Gruner and Homburg (2000) and Kausch et al. (2005), eight stages are preferred in this study, which are stages of : (1) opportunity identification and Idea generation; (2) idea selection; (3) concept definition; (4) business evaluation and

selection; (5) prototype development; (6) prototype testing; (7) market launch, and (8) market review.

2.2.3 Advantages of Customer Integration into Innovation Marketing

The customer integration approach is widely acknowledged by academics and managers. The trigger for customer integration is the high failure rate of innovation (Atuahene-Gima 1995) and changing customer requirements as well as market trend.

A few empirical studies have founded that an active involvement of customers into the innovation process has positive influence on innovation success (Gruner and Homburg 2000; Gassmann and Wecht 2005). Some major reasons are summarized here.

- First, customer-integrated innovation help companies to touch the market pulse and understand customers, to know what they really want and need and thus to guarantee that new products are developed accordingly, by integrating customers into innovation processes and communicating with them interactively. Through dynamic dialogue and communication, companies will understand the ideas and thoughts of customers, much non-relevant information and knowledge will be abandoned immediately.
- Second, customers can provide major inputs which improve the quality of innovations (Campbell and Cooper 1999). A number of studies have detected that knowledge gained from customers allows companies to capture market information more effectively and contribute more innovative ideas or new ways.
- Third, customer co-innovation reinforces the complexity of many products and capability of innovation. A company never possesses all the necessary knowledge, resource or expertise to develop new product. The shortage can be

complemented by customer partnership or customer competence.

- Fourth, customers constitute a reliable buyer potential based on the adequate information exchange and satisfied cocreation experience. Customer trust and customer satisfaction built during innovation partnership influence the future buy decision (Kausch, Enkel et al. 2005).
- Last but not least, customer integration minimizes the risk of a late change of construction due to customers' wishes and so prevents an increase in costs by a delayed market introduction (Atuahene-Gima 1995; Murphy and Kurmar 1997), and eliminates the projects which can't meet market trends and so prevents more budget waste (Kausch, Enkel et al. 2005).

2.2.4 Risks of Customer Integration into Innovation Marketing

Because customers as innovation partners in NPD processes appears to be a logical outcome of firms' desire to better understand their customers' needs, the tone of academic and business literature on co-development with customers has generally been positive. It means, the necessity and the advantages of integrating customers into the innovation process are widely recognized. There are, however, some inherent risks of customer integration that can be reduced by comprehensive risk management methods.

Companies have to realize the fact that they haven't employed and can't enroll all intelligent people into their own entities, thus they should face and embrace the challenges to cooperate and work with customers outside their organization's borders. Also because customers are not employees and have no obligations to companies, companies should also encounter the risks of customer integration, for example, dependence on customers, risks of selecting the wrong customers, dependence on customers' views and interests, dependence on customers'

experience, dependence on customers' demands or personality, loss of know-how and other company-related risks (Kausch, Enkel et al. 2005).

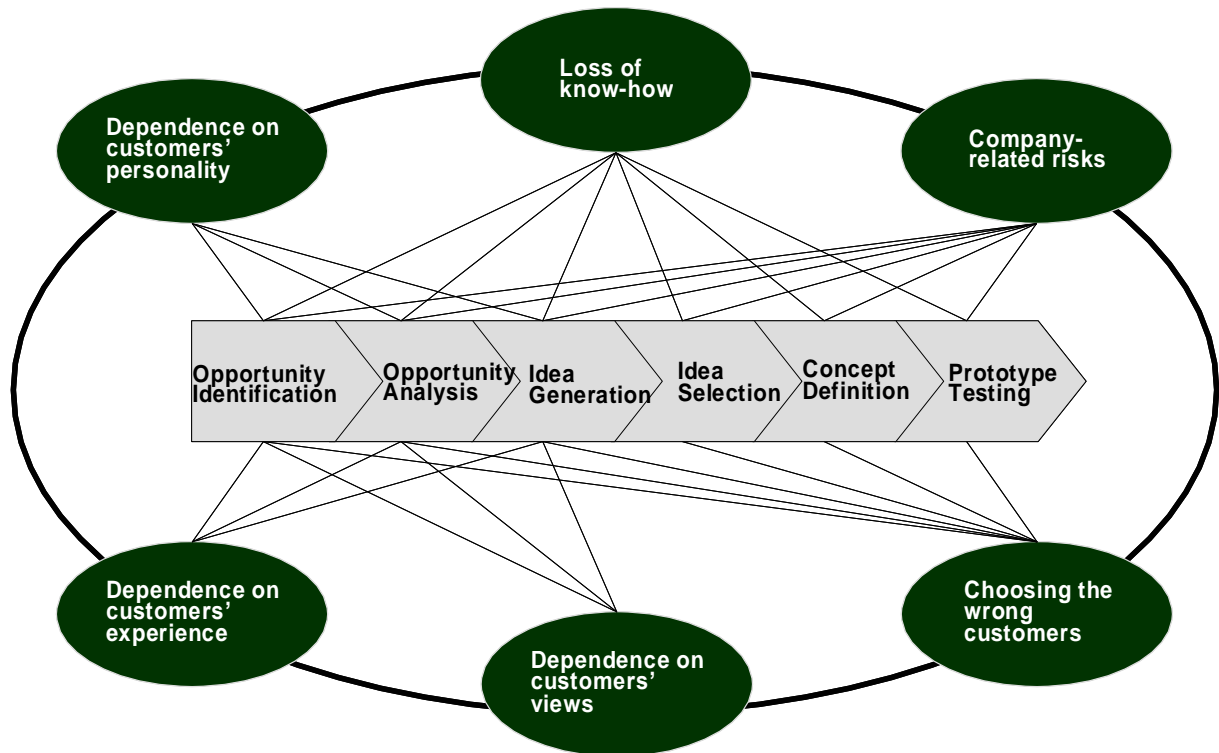


Figure 4 Negative Effects of Customer Integration in Innovation Processes

Source: Kausch et al. (2005)

Therefore, another important task of customer-integrated innovation or CKM is how to eliminate the risks of customer integration while exploiting and using customer knowledge.

Based on desk research, a detailed description of the various risks is provided.

- (1) **Loss of Know-How.** Customer integration may let know-how of a company open, which can be caught by competitors. Or the prototype is open to public too early to miss the right market launch time.
- (2) **Proprietorship.** Customer integration may bring problems of intellectual property (IP), that is, who can own how much benefit of the cooperative innovation?

- (3) **Limitation of customer knowledge.** Customers may not have enough speciality knowledge to lead the trend of new products, which may result in the inefficiency of product innovation.
- (4) **Desire of knowledge sharing from customers.** Customer integration may depend on the willingness of customers: how long can they bear to be integrated into the innovation process? How much are they willing to devote to the innovation of a company? How much knowledge are they willing to share with the company?
- (5) **Selection of customers.** Not all customers are willing to be integrated into innovation processes, and likewise not all customers are important for innovation. Integrating wrong customers into the innovation process may bring disaster to the company.
- (6) **Motive of integration.** How can integrated customers be stimulated to devote more valuable knowledge to innovation projects? How can the enthusiasm be upheld as long as possible? Knowledge sharing motivation of customers is a big challenge for companies to deal with.
- (7) **Cost.** Customer integration may increase R&D expenditure and the overall costs of a NPD project, which may countervail the excess profit brought by innovation.
- (8) **Contradiction of personality and mass customization.** One goal and one result of customer integration is personal customization, which also means high cost. This contravenes the general rules of industry era: mass customization. Customer-integrated innovation may serve a niche market only.
- (9) **Conflict of multicultural communication.** It means not only the communication problems between different national cultures, but also conflict between different personal cultures.
- (10) **Limitation of radical innovation.** Too much dependence on customer may add risk to business operations, and companies may be limited to perform only incremental innovations.

- (11) **Customer knowledge management capability.** Customer integration generates immense customer information and may leads to “information overload”. How to manage customer knowledge effectively and efficiently is a challenge for any company.

Enkel et al.(2005) offer some advices on how to minimize the difference risks of customer–integrated innovation, which are summarized in the following figure.

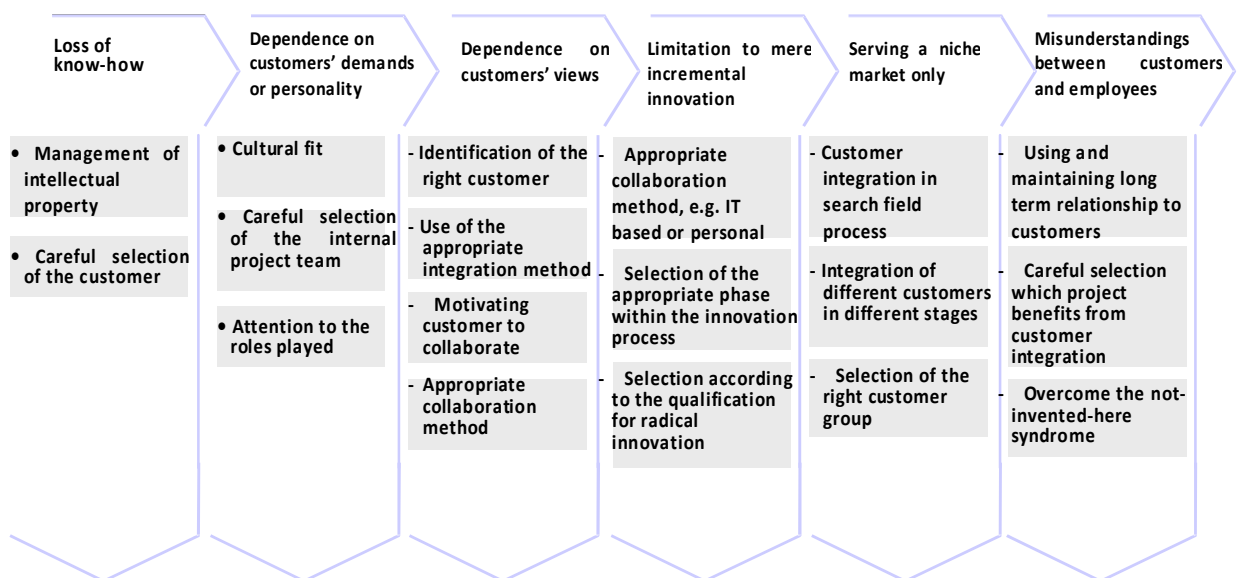


Figure 5 Activities Minimizing the Risks of Customer Integration

Source: Enkel, Kausch et al. (2005)

2.2.5 Integrating Stage-Gate® System into Innovation: Dynamic Equilibrium of Innovation and Control

From the discussion above, we can understand that customer-integrated innovation is not only a chance but also a challenge to a company. Thus, an important mission of knowledge management in innovation is to keep the dynamic equilibrium of the innovation force and control force, because innovation without control may conduce to fail and control without innovation may lead to die. The contributions of

Stage-Gate® System (SGS) assist innovation marketing to enhance the CKMC and keep the balance of innovation force and control force, which can ensure the proper direction of innovation to promote the chance of innovation success and wash out those low value projects to reduce the risk of innovation.

2.2.5.1 Brief Introduction of Stage-Gate System

The Stage-Gate® System (SGS) that pioneered and developed by Dr. Robert G. Cooper is a comprehensive approach that can make NPD more effective and a blueprint for managing the new product success. Nowadays Stage-Gate® Method is implemented and trusted in product innovation processes worldwide.

The Stage-Gate® System divides NPD efforts into distinct stages separated by management decision gates and is a conceptual and operational roadmap for moving a new product project from idea to launch (Cooper 2000c; Cooper 2008).

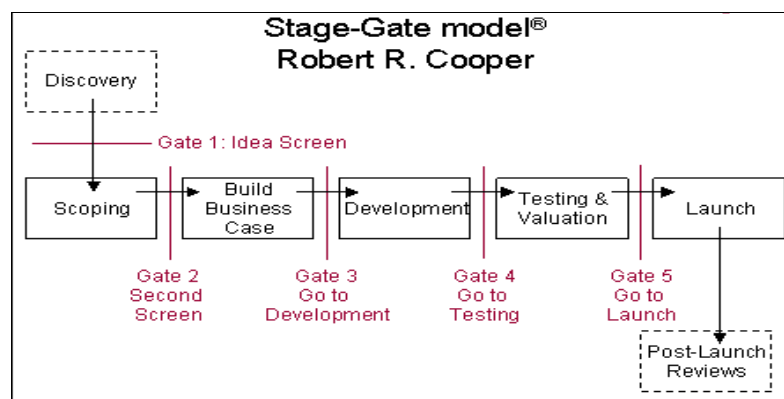


Figure 6 The Stage-Gate Model

Source: Cooper (2000c)

- **Stage 0: Discovery.** Pre-work designed to discover opportunities and to generate new ideas.
- **Stage 1: Scoping.** A quick, preliminary investigation of each project to provide inexpensive information by desk research and narrow the number of

projects.

- **Stage 2: Building the business case.** A much more detailed investigation by primary marketing and technical research to build product definition, product justification and product plan.
- **Stage 3: Development.** A detailed design and development of the new product, as well as a production plan and a market launch plan.
- **Stage 4: Testing and Validation.** Extensive prototype tests in the market, lab and plant.
- **Stage 5: Launch.** Beginning of full production, marketing and selling. Post-Launch Reviews are performed.

Each stage consists of a set of prescribed cross-functional and parallel activities with certain criteria which must be successfully completed by cross-functional innovation teams prior to obtaining management approval to proceed to the next stage of NPD (Cooper, Edgett et al. 2002; Cooper 2008).



The entrance to each stage is the Gate, which is normally meetings to control the innovation process with (1) quality control; (2) Go/Kill check points (Readiness-checks, Must-Meet criteria and Should-Meet criteria); and (3) Marker for action plan for the next phase.



Table 4 From Idea to Market Launch: A typical Stage-Gate Model

Idea	Discovery Stage
Gate 1	Idea Screen

	Does the idea merit any work?
Stage 1	Preliminary Investigation Prelim market assessment Prelim technical assessment Prelim financial & business assessment Action plan for stage 2
Gate 2	Second Screen Does the idea justify extensive investigation?
Stage 2	Detailed Investigation User needs & wants study Competitive analysis Value proposition defined Technical feasibility assessment Operations assessment Product definition Financial analysis
Gate 3	Decision to develop Is the business case sound?
Stage 3	Development Technical development work Rapid prototypes Initial customer feedback Prototype development In-house product testing Operations process development Full launch & operations plans
Gate 4	Decision to Test Should the project be moved to external testing?
Stage 4	Testing & Validation Extend in-house testing Customer field trials Acquisition of production equipment Production/operation trials Test market/trial sell Finalized launch and operations plans Post-launch & life cycle plans
Gate 5	Decision to Launch Is the product ready for commercial launch?
Stage 5	Launch Market launch & roll-out Full production/operations

	Selling begin Results monitoring Post-launch & life cycle plans under way
Post-Launch Review How did we do vs. projections? What did we learn?	

Source: Cooper (2000c)

2.2.5.2 Integrating Stage-Gate System into Innovation

From the literature on the Stage-Gate System, we can understand two fundamental principles of innovation. First, doing projects right. Innovation teams should listen to the voice of customers, make good preparation for technology innovation, set up cross-functional cooperation and control every stage. Second, doing right projects. Innovation teams should execute strict business evaluation and selection and project go/kill management. Stage-Gate theory states that NPD is a process which can be managed, not just relying on talent and luck, and product value is realized and promoted mostly by innovation marketing from idea to market launch. Vast customer knowledge will be filtered through Stage-Gate System stage by stage, which promotes the utilization of customer knowledge and the effectiveness of innovation.

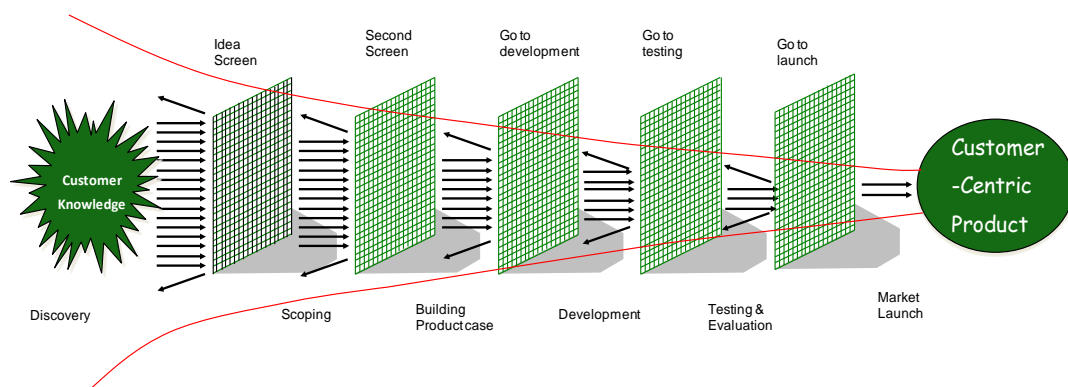


Figure 7 Knowledge Funnel in Stage-Gate-integrated Innovation

Hence, integrating the SGS into innovation marketing will enhance the CKMC of a company in the customer-integrated innovation, improve the innovation performance and reduce the risks of innovation. SGS-integrated innovation marketing helps companies to reach the dynamic equilibrium of innovation force and risk control force.

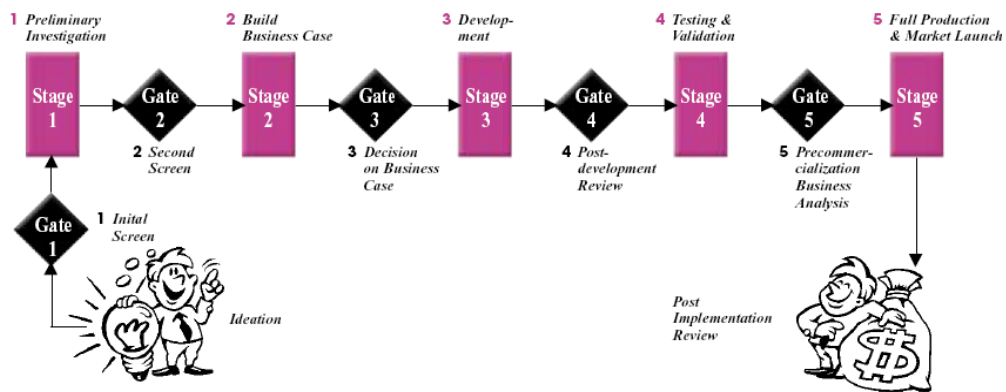


Figure 8 Stage-Gate-integrated Innovation: Success from Idea to Market Launch

Source: Cooper (2008)

2.3 Reflections on Customer Knowledge and Customer Interaction in Customer-integrated Innovation

NPD Processes are not only a sequential list of activities, but also the complex and dynamic processes closely linked to KM. Hereby, this section will reflect the roles and characteristics of CK in the customer-integrated innovation processes, and corresponding propose a new perspective of customer interaction simultaneously.

2.3.1 Customer Knowledge in Customer-integrated Innovation

According to Drucker (1993), we are now stepping into the “knowledge society”, in which “the basic economic resource is and will be knowledge”. The need for deepened customer knowledge is emphasized by market uncertainty, development of business model based upon relationships, and continuous striving for

differentiation and innovation (Dahlsten 2004). The understanding of knowledge is essential to comprehend the concept of customer knowledge (CK) and the soul of knowledge management. The following section defines knowledge and identifies various types of customer knowledge which involved in the customer-integrate innovation processes.

2.3.1.1 Data, Information, Knowledge and Wisdom



source: <http://blog.donews.com/peiyf/archive/2005/06/29/447590.aspx>

Many studies have used the terms customer information, customer data and customer knowledge interchangeably, and this caused confusion between these concepts (Paquette 2006). Interestingly, the first ever mention of the hierarchy and the difference among data, information, knowledge and wisdom is neither in the Knowledge Management field, nor the Information Science domain, but in an unexpected place: poetry. A poet named T.S. Eliot wrote "The Rock" in 1934[®]:

"Where is the Life we have lost in living?

Where is the wisdom we have lost in knowledge?

Where is the knowledge we have lost in information?"

[®] T.S. Eliot, *The Rock* (Faber & Faber 1934).

Someone else added another interesting sentence to this poem:

"Where is the information we have lost in data?"

This ideology leads to Data, Information, Knowledge, Wisdom, DIKW system, which has been gaining popularity in many domains. Russell Ackoff (1989) is often cited as the initiator of the DIKW hierarchy^⑦ in most KM literature and the hierarchy is frequently referred to as the "Knowledge Hierarchy" or the "Knowledge Pyramid".

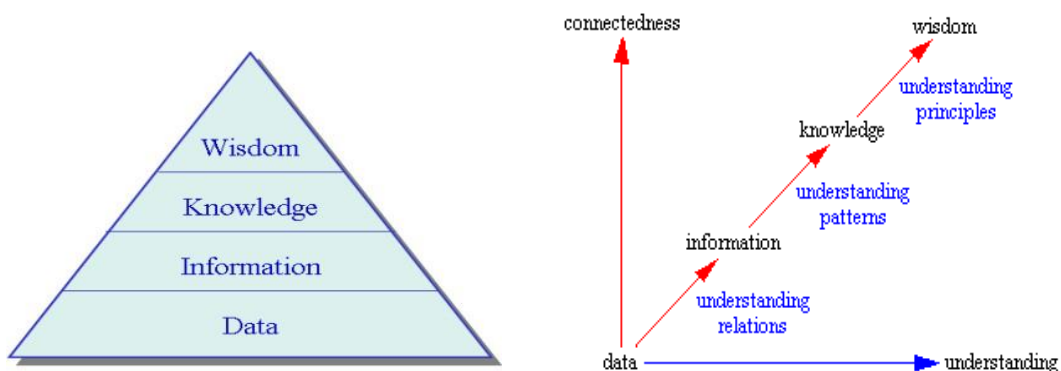


Figure 9 Data, Information, Knowledge and Wisdom

Source: <http://www.systems-thinking.org/dikw/dikw.htm>

We can understand data, information, knowledge and wisdom as follows^⑧.

Data = Fact. Data is raw and has no significance beyond its existence (in and of itself). It can exist in any form, but simply exists, usable or not. It does not have meaning of itself.

Information = Data + meaning. Information is data that has been given meaning by way of relational connection. This "meaning" can be useful, but does not have to be.

Knowledge = Information + Understanding + Reasoning. Knowledge is a

^⑦ Because in the article "Management Support Systems: Towards Integrated Knowledge Management" on *Human Systems Management*, Zeleny details out the DIKW hierarchy in 1987. Zeleny builds the knowledge hierarchy by equating Data, Information, Knowledge and Wisdom to various knowledge forms: "know-nothing", "know-what", "know-how" and "know-why" respectively.

^⑧ This understanding is mostly based on Bellinger, Castro and Mills (2004), Data, Information, Knowledge, and Wisdom, from <http://www.systems-thinking.org/dikw/dikw.htm>, accessed on 18.08.2008

deterministic process and the appropriate collection of information, such that its intent is to be useful. Knowledge is the skills to solve questions.

Wisdom = Selection of Knowledge. Wisdom is an extrapolative and non-deterministic, non-probabilistic process and calls upon all the previous levels of consciousness, and specifically upon special types of human programming (moral, ethical codes, etc.).

This study agrees Davenport and Prusak (1998) who define knowledge as:

“Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, process, practices, and norms.”

From the above discussion we can understand that there are two basic kinds of knowledge: (1) the kind that is reflected in a person's internal state as well as in that same person's capability for action, and (2) the kind that has been articulated and frequently recorded (Nickols 2000). This brings us to gain an insight into the concepts of customer knowledge and its components.

2.3.1.2 Definition of Customer Knowledge

Because knowledge itself is a very complex and abstract concept, different scholars define it from different perspectives. Therefore, it is also very difficult to define customer knowledge with a unitary standard. Some similar terms appeared in the literature, such as Marketing Intelligence (Kerkhof, van den Ende et al. 2003)、Marketing Knowledge (Hanvanich, Dröge et al. 2003)、Market Knowledge (Li and Calantone 1998; Deshpande 2000), and so on. Based on the studies of Blosch (2000), Gebert et al. (2003) and Gibbert et al.(2002), **this study defines customer knowledge**

as the dynamic combination of customer experience, values, scenarios and expertise, which are required, created and absorbed in the transaction and communication processes between companies and customers. The framework that customer knowledge constitutes can provide evaluation and absorb new experiences and information.

2.3.1.3 Components of Customer Knowledge

Gebert et al. (2002; 2003) categorize CK into three types: (1) knowledge for customers, (2) knowledge about customers, and (3) knowledge from customers, according to the origin of CK. And going further, Smith and McKeen (2005) divide CK into four categories based on Gebert et al. (2002; 2003) and Bueren et al.(2004): (1) knowledge of customers, (2) knowledge for customers, (3) knowledge from customers, and (4) knowledge co-creation.

Broadly absorbing previous accomplishment, this study is intended to classify customer knowledge into five types:

- (1) Knowledge of customers.** This is knowledge embedded or embodied in customers, which represents what customers knows and experiences.
- (2) Knowledge about customers.** This is knowledge in the domain of traditional CRM systems, which is accumulated to understand customers' motivations and wants and to address them in a personalized way. It includes not only basic "tombstone" data about a customer (e.g., name, contact information) but also record about his transactions history with companies and certain personal preferences (Smith and McKeen 2005).
- (3) Knowledge from customers.** This kind of CK often appears in the domain of customer service or marketing and is acquired from customers through interaction about knowledge of products, suppliers and markets (Garcia-Murillo

and Annabi 2002), which is to understand what customers know (their experience, needs, feeling and the emotional and functional drivers of relationship) and sustain continuous improvement. It is a very important but unfortunately neglected part of an organization's knowledge (Rowley 2002b; Wood 2003).

(4) Knowledge for customers. This kind of CK includes everything that an organization provides to its customers and is required in CRM processes to satisfy customers' knowledge needs (Gebert, Geib et al. 2003).

(5) Knowledge co-created with customers. It derives from a two-way relationship and is the new knowledge developed from interaction between customers and companies. For example, Microsoft shares its "beta-ware" with key customers in order to learn with them and cocreate new knowledge to improve its products.

Each kind of CK represents a different source of value and a different time frame in which this value is delivered. Knowledge about customers should lead to improvements in the effectiveness and efficiency of internal business processes. Knowledge for customers, on the other hand, works by improving customer experience with a company, thereby making the company easier to work with and giving it more credibility in the customer community. Both types of knowledge deliver important short-term benefits. Knowledge of customer concerns of customer competence, which decides the value of customer. Knowledge from customers will deliver value in the medium term by helping a company develop radical innovative ideas or make continuous improvements to its products and services over time. Knowledge co-creation with customers delivers long-term strategic value around developing innovative products and services (Smith and McKeen 2005).

Surely there is no "one size fits all" approach to CKM. In an ideal organization, CKM would involve each of these dimensions at least to some extent. However, in practice,

because of limited resources and capacities, many organizations may involve only one or two types, while the remaining are leaving other companies to deal with or just ignore.

2.3.1.4 The Nature of Customer Knowledge in Customer-integrated Innovation

Developing from Polanyi (1967), Nonaka and Takeuchi (1995) substantiate the distinctions between tacit and explicit knowledge. **Tacit knowledge** is defined as personal, context specific knowledge that is difficult to formalize, record, articulate, or encode (Nonaka 1991; Davenport, De Long et al. 1998; Davenport and Prusak 1998). **Explicit knowledge**, which is on the contrary, can be codified and transmitted in a systematic and formal representation or language, i.e., words or numbers stored in databases that can be shared via information technology systems (Rowley 2002b; Rollins and Halinen 2005).

Table 5 Differences between tacit and explicit knowledge

Explicit Knowledge (objective)	Tacit Knowledge (subjective)
Knowledge of rationality (mind)	Knowledge of experiences (body)
Sequential Knowledge (there and then)	Simultaneous Knowledge (here and now)
Digital Knowledge (theory)	Analog Knowledge (practice)

Source: Nonaka and Takeuchi (1995)

Customer knowledge can be further categorized into explicit knowledge, tacit knowledge and implicit knowledge (Nickols 2000; Nambisan 2002) as shown in the following figure. Knowledge that can be articulated but hasn't is **implicit knowledge**, whose existence is implied by or inferred from observable behavior or performance

and it can often be teased out of a competent performer by a task analyst, knowledge engineer or other person skilled in identifying the kind of knowledge that can be articulated but hasn't. For simplicity, this study classifies knowledge as tacit knowledge and explicit knowledge.

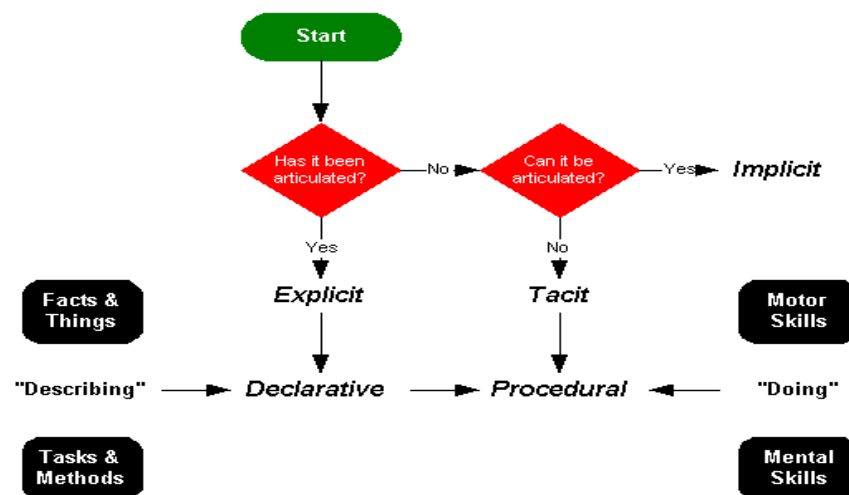


Figure 10 Explicit, tacit and implicit knowledge

Source: NICKOLS (2000)

Johannessen et al. (1999) develop this tacit-explicit paradigm and set a typology of knowledge according to difficulty of communication and comprehension, which are explicit knowledge, systemic knowledge, relationship knowledge, tacit knowledge and hidden knowledge.

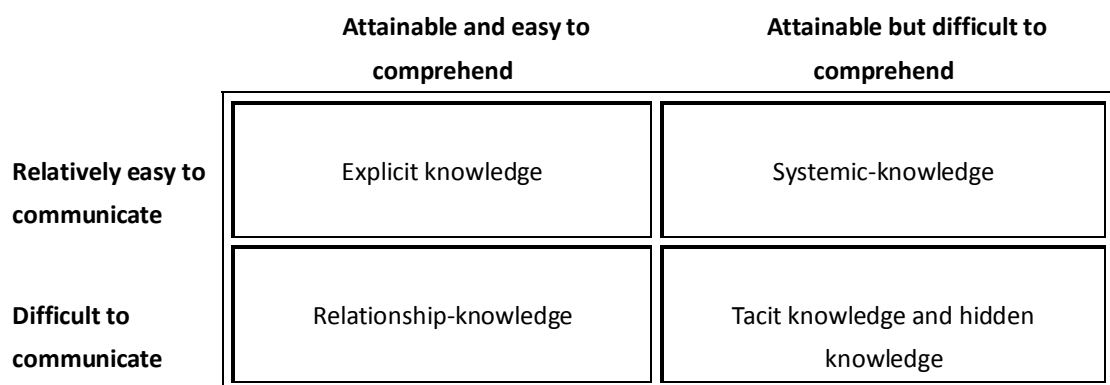


Figure 11 A typology of knowledge

Source: Johannessen et al. (1999)

The attributes of all kind of knowledge are as follows.

Table 6 Different Types of Knowledge

Types of knowledge	Learning by	What is learned	How to share it	Media
Systemic knowledge	Studying patterns	Know why	Computer-simulation, scenario-planning etc.	Systemic tools
Explicit knowledge	Listening / Reading	Know what	Communication	Books, lectures, electronic media etc.
Tacit knowledge	Using / Doing /Experimenting	Know how	“Brainstorming camps” structured as apprenticeship	Practical experience, Apprenticeship relationship
Hidden knowledge	Socialization	Knowing how we know	Focus groups	Questioning underlying assumptions and mental models
Relationship knowledge	Interacting	Know who	Partnership and teamwork	Social settings

Source: Johannessen et al.(1999)

As discussed in the above section, there are five different types of customer knowledge in customer-integrated innovation. Actually, these five types of customer knowledge are also in accordance with the Tacit-Explicit paradigm and the typology of Johannessen et al. (1999), which can be interpreted as follows.

- **Knowledge of customers.** It is viewed from customer’s side and refers to the skills, experience, cognition of customers and other knowledge learnt or owned by customers. It is the important indicator for customer competence. Except for those documents owned by customers, most of this knowledge is tacit knowledge, which must be exploited through interactive communication by innovation teams.

- **Knowledge about customers.** It is viewed from company's side and refers to collected and codified knowledge with normative forms. This kind of knowledge is acquired from data to information to knowledge and mostly explicit knowledge, which can be express and transfer in a normative way.
- **Knowledge from customers.** It is cognitions and ideas of customers and highly individualized knowledge, which is tacit knowledge and must be acquired by the interactive communication between employees and customers.
- **Knowledge for customers.** It is normative knowledge about new products and services transferred to customers in formal channel. Most of this knowledge is explicit.
- **Knowledge co-created with customers.** It is new knowledge generated during the cooperation and interaction based on the problem solution, mostly tacit knowledge and systemic knowledge.

Knowledge about customers is widely used in CRM programs. However, the most valuable technical and commercial knowledge is tacit knowledge, because it is inimitable and can't be easily transferred (Hitt, Lee et al. 2002). What's more, tacit knowledge like knowledge from customers and knowledge co-created with customers reinforce the innovation force and indicate the customers' needs and wants, which lead to new product advantage. Thus, a great challenge for an organization is to exploit the tacit knowledge from customers and turn it into explicit knowledge to use.

A famous knowledge transformation model named SECI model is demonstrated to understand the dynamic nature of knowledge creation by Nonaka and Takeuchi (1995), which describes knowledge creation is a spiraling process of interaction between explicit and tacit knowledge through socialization, externalization, combination and internalization. SECI Model illustrates the nature of customer

knowledge as well as the continuous knowledge transformation in the customer-integrated innovation processes, and implicates how to manage such a dynamic KM process effectively.

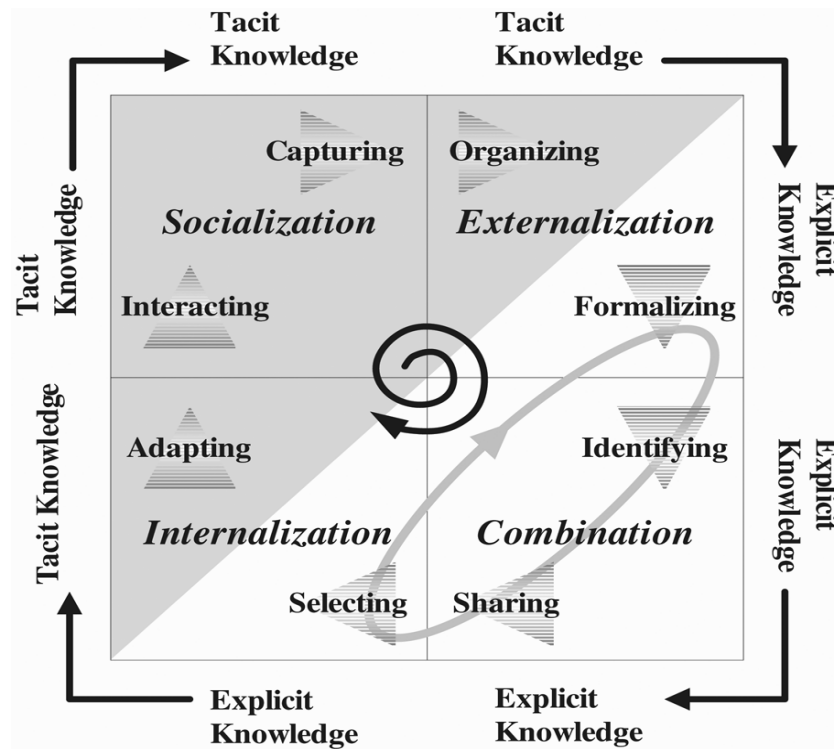


Figure 12 SECI Model

Source: Nonaka and Takeuchi (1995)

2.3.2 Customer-Integrated Innovation Marketing as an Intensive Knowledge Management

In a sense, NPD or product innovation is the process for enterprise and its innovation partners to generate, integrate and utilize customer knowledge. New products and services are only some kinds of materialized forms of knowledge creation. Therefore, customer-integrated innovation is an intense knowledge management process.

2.3.2.1 Knowledge Management

Knowledge Management is: "Systematic approaches to help information and knowledge flow:

- to the right people

- at the right time

- in the right format

- at the right cost

so they can act more efficiently and effectively.

Find, understand, share and use knowledge to create value

Knowledge is information in action". (Suarez 2007)

The role of knowledge management (KM) is to obtain the greatest value from knowledge available in an organization and the importance of KM is widely acknowledged. There are many different definitions from different perspectives in literature. Generally, we can understand KM from perspectives of management, business and IT.

- **Management perspective:** "Knowledge Management is the systemically and organizationally specified process for acquiring, organizing, and communicating knowledge of employees so that other employees may make use of it to be more effective and productive in their work." (Alavi and Leidner 1999).
- **Business perspective:** "Knowledge Management is an audit of 'intellectual assets' that highlights unique sources, critical functions and potential bottlenecks which hinder knowledge flows to the point of use. It protects intellectual assets from decay, seeks opportunities to enhance decisions, services and products through adding intelligence, increasing value and providing flexibility." (Gray 2000). Knowledge Management is also a framework within which the organization views all of its processes as knowledge processes, which involve creation, dissemination, renewal, and application of knowledge toward

organizational sustenance and survival (Majchrzak, Malhotra et al. 2002).

- **IT perspective:** “Knowledge Management is a system for managing, gathering, organizing, refining, analyzing, and disseminating of knowledge in all of its forms within an organization for certain purposes. It supports organizational functions while addressing the needs of the individuals within a purposeful context.”(Abdullah, Zamli et al. 2009).

More but not all definitions are available as an overview in the table below.

Table 7 Definitions of Knowledge Management

Author	Definition of knowledge management
Quintas et al. (1997)	KM is to discover, develop, utilize, deliver, and absorb knowledge inside and outside the organization through an appropriate management process to meet current and future needs.
Allee(1997b)	KM is managing the corporation’s knowledge through a systematically and organizationally specified process for acquiring, organizing, sustaining, applying, sharing and renewing both the tacit and explicit knowledge of employees to enhance organizational performance and create value.
Gupta et al. (2000)	KM is a process that helps organizations find, select, organize, disseminate, and transfer important information and expertise necessary for activities.
Bhatt (2001)	KM is a process of knowledge creation, validation, presentation, distribution and application.
Holm (2001)	KM is getting the right information to the right people at the right time, helping people create knowledge and sharing and acting on information
Horwitch and Armacost (2002)	KM is the creation, extraction, transformation and storage of the correct knowledge and information in order to design better policy, modify action and deliver results
OECD (2005)	KM involves activities related to the capture, use and sharing of knowledge by the organization. It involves the management both of external linkages and of knowledge flows within the enterprise, including methods and procedures for seeking external knowledge and for establishing closer relationships with other enterprises (suppliers, competitors), customers or research institutions. In addition to practices for gaining new knowledge, knowledge management involves methods for sharing and using knowledge, including establishing value systems for sharing knowledge and practices for codifying routines.

Source: from this study

Different types of KM schools are summarized by Earl (2001) based on case studies, interviews, workshops and literatures, and showed in the following table. This category method is so clear and thus widely accepted by most scholars.

Table 8 Schools of Knowledge Management

School	Sub-School	Focus	Aim	Critical Success Factors	Example	Principal IT Contribution	Philosophy
Technocratic	Systems	Technology	Knowledge Bases	Content Validation Incentives to Provide Content	Xerox	Knowledge based Systems	Codification
	Cartographic	Maps	Knowledge Directories	Culture/Incentives to share, Knowledge Networks to Connect People	AT&T	Profiles and Directories on Internets	Connectivity
	Engineering	Processes	Knowledge Flows	Knowledge Learning and Information Unrestricted Distribution	HP	Shared Databases	Capability
Economic	Commercial	Incomes	Knowledge Assets	Specialist Teams Institutionalized Process	IBM	Intellectual Asset Register and Processing System	Commercialization
Behavioral	Organizational	Communities	Knowledge Pooling	Social Culture Knowledge Intermediaries	Shell	Groupware and Intranets	Collaboration
	Spatial	Place	Knowledge Exchange	Design for Purpose Engagement	Skandia	Access and Representational Tools	Contactivity
	Strategic	Business	Knowledge Capabilities	Rhetoric Artifacts	Unilever	Eclectic	Consciousness

Source: Earl (2001)

Avoiding to get lost in the different definitions and schools of KM, we can understand KM with the help of Sveiby's KM framework from two tracks: IT-track and

people-track; and two levels: organizational level and individual level (Sveiby 1996), which shows as following.

Table 9 What is Knowledge Management

Knowledge Management		
Track/Level	IT-Track Knowledge = Object	People-Track Knowledge = Process
Organization Level	<i>Re-engineers</i>	<i>Organization theorists</i>
Individual Level	<i>AI-specialists, E-specialists</i>	<i>Psychologists</i>

Source: Sveiby (1996)

From the above table we can understand that (1) **IT-Track KM = Management of Information**, to researchers and practitioners in this fields who tend to have their education in computer and/or information science, **Knowledge = Object** that can be identified and handled in information systems; and (2) **People-Track KM = Management of People**, to researchers and practitioners in this fields who usually have their education in philosophy, psychology, sociology or business/management, **Knowledge = Processes**, which is a complex set of dynamic skills, know-how etc., that is constantly changing (Sveiby 1996).

Allee (1997a) expatiates the “Wave-Particle Duality” of knowledge and considers that knowledge has both attributes of object and process, similar to the properties of light. Actually neither wave-like nor particle-like is the real properties of light, they are properties of our interaction with light, which are how we choose to look at it. The same is knowledge. “The properties of knowledge that we choose to focus on depend on how we view its relationship to action, performance, and results. Knowledge has the properties of an object in that we can catalogue, organize, and

even measure it to some degree. It also has properties of processes in its continual movement through creation, adaptation, enhancement, and application (Allee 1997a). Both of these ways of thinking about knowledge are useful for understanding different qualities and performance of KM.

Therefore, another way of addressing knowledge relies on an organic metaphor, which is knowledge viewed as a complex, self-organizing system. In this way we come to the organic perspective of KM: KM is a systematic approach to help information and knowledge flow to the right people, at the right time, in the right format, at the right cost, so they can act more efficiently and effectively; and to find, understand, share and use knowledge to create value (Suarez 2007). KM is more like the art of creating value from intangible assets (Sveiby 1998).

2.3.2.2 Customer integrated NPD as an Intensive Knowledge Management

From the idea generation stage to the market launch stage, the creation and use of new knowledge can be viewed as the central theme of NPD processes (Madhavan and Grover 1998). Knowledge centric activities of developing new products are becoming the primary source of sustainable competitive advantage in an era characterized by short product life cycles, dynamic markets and complex processes (Ramesh and Tiwana 1999). Thus, NPD has been acknowledged as a knowledge-intensive activity in the literature (Nonaka and Takeuchi 1995; Iansiti and MacCormack 1997; Davenport and Prusak 1998; Song and Montoya-Weiss 1998; Ramesh and Tiwana 1999) and the essence of NPD is the creation, utilization and exploitation of new knowledge (Shani, Sena et al. 2003).

The recognized positive effects of customer integration have also led to the almost

general consensus that CK is an indispensable prerequisite for successful innovation when it has the biggest impact on R&D activities (Biemans 1991). Paquette (2006) explains that “customers can provide unique knowledge that allows an organization to learn and acquire knowledge to improve its internal operations, including innovation. In turn, the organization provides to the knowledge of its products and services which improves the functionality to the customer”. Therefore, we can safely come to the conclusion that customer integrated innovation is also an intensive knowledge management.

2.3.3 Important Factors in Customer-integrated Innovation

Because customers as innovation partners appears to be a logical outcome of companies’ desire to better understand their customers’ needs and expectations, the tone of academic and business literature on the co-development with customers has generally been positive. Nevertheless, some empirical investigations demonstrate that overall customer partnering projects are no more successful than in-house projects (Campbell and Cooper 1999). Difficulties and uncertainty associated with customer involvement as innovation partnership may arise from issues such as customer partner selection, determining the timing and intensity of customer integration, customers’ ability and willingness to provide the right knowledge, and the nature and extent of the knowledge to be embodied (Leonard-Barton 1995a; Campbell and Cooper 1999), as well as damaged relationship with key customers. Thus, customers integrated as innovation partners does not automatically guarantee success (Bidault and Cummings 1994), and should be reinforced with proper approaches to solve the issues like identifying customers, willingness to cooperation and knowledge exchange quality.

2.3.3.1 Identifying Key Customers

Not all customers are important for a company and not all customer knowledge is critical for innovation. Seeking in the dark and gathering all information from customers blindly leads to not only “information overload” but also to high costs and risks. However, how can a company distinct between relevant knowledge and non-relevant information? A suitable and a more canonical approach is, not to choose knowledge, but choose the right customers, who keep valuable tacit knowledge (Gurgul, Rummyantseva et al. 2002).

To identify the appropriate customers with relevant knowledge, companies need to study the characteristics of customers, and target the valuable groups. Von Hippel (1988) and many of his advocators suggest to use lead user as the right customer group, who has the relevant knowledge and experience in the field with products than other customers, to foster the invention and later the innovation. Other customer classifications are also shown in literature, e.g. Gruner and Homburg (2000) identify four customer characteristics which are important to innovation: technical attractiveness, financial attractiveness, closeness of relationship with customer and lead user characteristic. Brockhoff (2003) identifies five types of customers who have different capabilities and traits and should be integrated in different phases of innovation: the launching customer, the lead user, the reference customer, the demanding customer and the first buyer.

This study agrees to Enkel et al. (2005) who state there are different risks in different phases of innovation processes and companies should choose right customers in different stages with proper approaches to cooperate with each other, in order to exploit valuable knowledge from appropriate customers and minimize risks of customer integration.

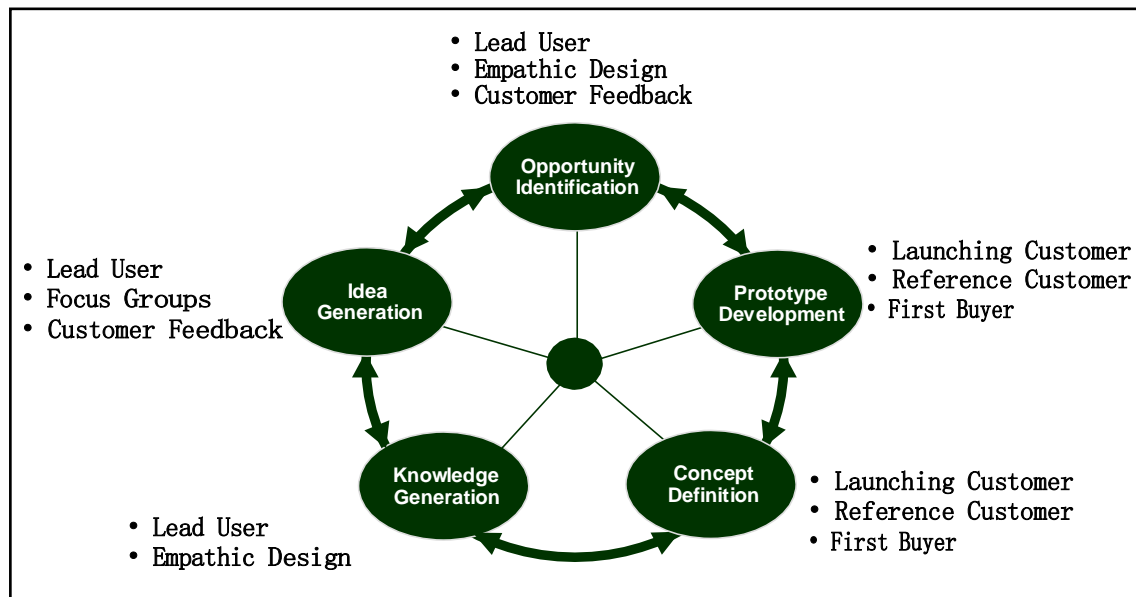


Figure 13 Integrating different customers in different phases in NPD

Source: Enkel, Kausch et al. (2005)

2.3.3.2 Willingness to Cooperation

In all difficulties and uncertainty, customers' knowledge sharing willingness is a key issue for customer-integrated innovation, because customers are not employees and must not coincide with an organization's concerns. For a customer, knowledge sharing will improve the overall level of organizational knowledge, but he himself may not benefit from it, while he should input time and painstaking effort for the integration and co-innovation. It is conscious for the customer to evaluate the benefits from knowledge sharing with his input costs, opportunity costs, transaction costs, etc.. When a customer prognosticates that he can't get reasonable compensation for his cost and effort, it is reasonable for him not to share his tacit knowledge.

The questions of motivation, rewards and incentives arise. The first reward for customers is a solution to their problem or an improvement of their personal situation (Pitta, Franzak et al. 1996), which will lead to customer satisfaction. Beyond

it there is a set of tangible and intangible possibilities that might include payment, early access to new products, or a special honorary status (Gurgul, Rumyantseva et al. 2002), or other incentives, e.g. solution of existing problems, extraction of knowledge, reimbursement, cost reduction, special guarantees, better offers, reduction of complaint and rework cost (Kleinaltenkamp, Fleiss et al. 1996). In a conclusion, customers who are integrated into innovation processes expect not only material rewards (including compensating payment and incentive payment) but also nonmaterial incentives (including knowledge needs and relational needs).

2.3.4 New Perspectives of Customer Integration

As discussed above, most valuable knowledge in customer-integrated innovation is tacit knowledge, e.g. knowledge from customers and knowledge co-created with customers. Tacit knowledge, however, must be exploited in an interactive way. Hereby, interaction management plays a very important role in customer-integrated innovation.

Complementary to the majority of existing researches, this study tries to emphasize a new perspective of customer integration according to the expert interviews of the empirical research, that integration is regarded as a professional knowledge and relational service. That means, companies should not only make use of customers but also supply knowledge service and relational service to key customers in the interaction process to achieve valuable customer relationship in the integration processes.

2.3.4.1 Knowledge perspective

The motivation for some customers who integrated into innovation may be not mainly for material rewards, but for knowledge development and cocreation. During

the interactive process, if a company supplies more background information or skills training etc. as knowledge for customer, this kind of knowledge service is proposed to improve the motivations of cooperation and help customers to cocreate new knowledge. Customers will be satisfied with knowledge benefits as well as new product solutions. At meanwhile, knowledge service in interaction process enlarges the dimension of knowledge for customers and helps customers know more about new products, which leads to less additional service after sale. That means, forwarding the knowledge service on sale and after sale to NPD processes. Based on the discussion above, this study emphasizes the knowledge service in customer integrated innovation to build profitable knowledge partnership, because “a successful knowledge partnership with the most valuable and important customers can not only strengthen these business relationships, but also create a competitive advantage that is difficult for the competition to duplicate (Paquette 2006).”

2.3.4.2 Relationship perspective

Existing studies of supplier involvement or customer integration in NPD have mainly focused on project-related short-term processes and success factors. However, Athaide et al. (1996) view that the successful innovation for the businesses requires stimulating not only adoption by customers, but also successful implementation of the innovation by customers, in other words, “effective management of seller-buyer relations during the development and commercialization process go a long way toward determining the success of a high-tech process innovation”. They identify eight strategic marketing objectives that underlie the relationship marketing activities employed by successful innovations and find out that successful firms engage in relationship marketing activities throughout all phases rather than simply trying to close a deal, and these firms “seek active involvement from potential customers, ranging from co-designing of products to seeking feedback on product

related problems or desired modifications” (Athaide, Meyers et al. 1996). Echtelt et al. (2008) validate and extend an existing exploratory framework, which comprises both long-term strategic processes and short-term operational processes that are related to supplier involvements, with a multiple-case study of supplier collaborations at a manufacture in the copier and printer industry. They argue that companies will not be sufficiently able to capture possible long-term technology and learning benefits through individual projects, and suggest that the success of involving suppliers in NPD is reflected by the company’s ability to capture both short- and long-term benefits. However, if a company wants to keep long-term collaboration benefits in NPD processes, it must depend on some relational activities, such as building collaborative learning routines and interactive communication, which satisfy the interest of both parties, to build long-term relationships with key customers. Based on this perspective, this study emphasizes that interaction management in customer integrated innovation is an opportunity for companies to supply relational service to customer and to improve customer value and relationship quality.

2.4 CKM: Synergy of CRM and KM

2.4.1 Integrating CRM into Innovation

Not so many in-depth studies have been conducted to investigate the organizational and behavioral CRM factors that lead to usable and effective CRM systems, which achieve the basic goals of CRM to develop and maintain good relationships with customers. This study tries to integrate CRM into the NPD processes and to explore the correlations of both systems.

2.4.1.1 Thesis: Theoretic Advantages of CRM

The origin of CRM is going to help an organization both in terms of delivering more

value to customers and also in terms of gaining more from them. There are several benefits attached to a properly managed and maintained CRM system, which were reported in literature and have made it the buzzword within the business community.

- (1) **Providing better customer service.** CRM systems help an organizations to identify the characteristics of customers effectively and easily adjust the level of service to reflect the customers' importance or status, and give the organization the ability to personalize relationships with customers regardless of which employee is servicing them.
- (2) **Increasing customer revenues.** Using database and data mining within CRM systems, marketing campaigns can be coordinated more effectively and focus on target group quickly. CRM also ensures higher customer retention by introducing loyalty programs. What's more, CRM enables the organizations to identify potential customers and potential opportunity, e.g., CRM systems facilitate cross-selling (offering customers complimentary products based on their previous purchases) and up-selling (offering customers premium products in the same category).
- (3) **Making organizations more effectively.** CRM systems with information technology and internet help companies promote business processes and operate more effectively. They also enable companies to get continuous feedbacks from customers on the products they have bought, leading to efficient innovation and service.

As shown in the literature, companies are motivated to adopt CRM to create and manage the relationship with their customers more effectively. Ngai (2005) points out that an enhanced relationship with customers can ultimately lead to greater loyalty and retention and, also, profitability.

2.4.1.2 Antithesis: Practical Problems of CRM

Because of the ideal advantages and vision of CRM, there is a broad agreement among practitioners and researchers that building relationships with customers is critical to success (Gibbert, Leibold et al. 2002; Wood 2003). Unfortunately, the majority of CRM implementations are considered failures (Rowley 2002b; Bose and Sugumaran 2003), the discussion about the failure of CRM applications is growing intensive. 55% of all CRM projects don't produce results, according to Gartner Group (2002). Up to 80% of CRM implementations fail and academics express skepticism about the viability of interpreting customer data in such a CRM way that it generates useful insights into customer behavior (Rowley 2002b). Over one half CRM programs fail because of complex data quality and data integration process (Cigliano, Georgiadis et al. 2000; Woodcock and Starkey 2001).

A widely accepted classification of CRM is as following (Schwede 2000).

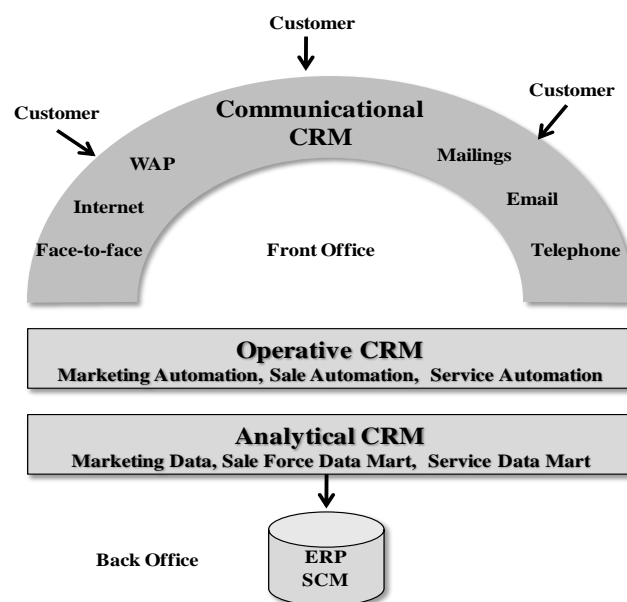


Figure 14 Overall CRM Systems

Source: Schwede (2000)

Whereas operational CRM systems focus on the support of distinct front-office

business processes, analytical and collaborative CRM systems only have a supporting role for operational CRM in practice. Many companies try to use CRM to understand customers better based on data mining from customer database, but they ignore to integrate CRM with ERP, SCM and other fundamental organization structures. Such CRM systems seem powerful and do make organizations more efficiently, but they have failed to build relationships, which is the origin and vision of CRM. “CRM projects fail because these applications don’t serve customers any better and fail to integrate disparate data sources or provide the right kind of information to the right people (Bose and Sugumaran 2003).” Therefore, there is an urgent need for better management of customer knowledge and customer relationship.

From literature, we can understand CRM in three different main aspects: (1) customer-centered philosophy; (2) business process or solution; and (3) software. Although most of CRM definitions do not stray from a customer-centered philosophy and accepted by many managers, CRM systems are more like software in practice. After literature review, this study summarizes eight main questions for CRM applications: (1) implementing CRM as software narrowly; (2) operating CRM in static mode; (3) understanding customer value insufficiently; (4) understanding the importance of customer knowledge insufficiently, (5) understanding customer relationship in an incomplete way; (6) incomplete systematic preparation for CRM implementation; (7) lack of sufficient performance evaluation systems to balance customer value and business value; and (8) lack of strong support and involvement of senior managers.

2.4.1.3 Synthesis: Integrating CRM into Innovation as Solutions of Paradox

Many academics and practitioners insist that CRM systems, as a combination of

relationship marketing and information technology, should be an ideal philosophy and effective tool to manage customer relationship, while they work hard to explore the solutions and improvements of CRM. Many new forms of CRM are mentioned in literature, such as electronic CRM (eCRM), intelligence CRM (iCRM), mobile CRM (mCRM), integrated CRM (ICRM), et al. In order to find out the new vitality of CRM implementation, this study is trying to integrate CRM into NPD processes based on the convergence of these CRM strategies into one extensible concept.

Close interaction with customers during the NPD process is widely acknowledged as an effective way to enhance new product success (von Hippel 2001), because customer interaction can lead to innovations of better quality by facilitating an in-depth understanding of customer needs (Sethi 2000). Accordingly, NPD processes are increasingly characterized by customer integration and close interactions between firms and customers (Sioukas 1995). However, customer interaction can't lead to innovation success automatically. The interaction between companies and customers is a complex process, in which huge information exchange and relational activities happen the whole time. If there is no effective management of customer relationship and knowledge, interaction can't guarantee innovation performance. This is why this study focuses on the CRM implementation in customer-integrated innovation processes.

CRM should also be enhanced by customer interaction, especially interaction during NPD processes. Reflecting on the literature of CRM, we can find out that the key myth of CRM is interpreted by each word of CRM itself, that is, each of the three words from Customer Relationship Management has a particular indication: "Customer" provides the direction, "Relationship" gives the focus, and "Management" represents the approach (Law, Lau et al. 2003). Firstly, Law et al. (2003) suggest that the key point is that CRM should be started from taking

customers as an active group, but not passive, and CRM should be changed to make customers as the starting point to this approach. Secondly, the relationship pattern with customers should also be changed, not only by approaches from one-to-one (1to1) to one-network-one (1N1) or customer-network-company (CNC), but also by dimensions from short-time transactional relationship to long-time interactive cooperation relationship. Thirdly, the strategies of management approach should be developed from another perspective. The static mode of traditional CRM mostly with database and data mining can't acquire in-time information and loyal relationship, because customers are dynamic and most valuable knowledge are embedded in customers as tacit knowledge, which can only be exploited in an interactive and dynamic way.

Moreover, the CRM process is not limited to customer interaction, but also concerned with the way CRM is managed. To be effective as a process and as a strategy, CRM obtains information regarding customer dynamics, which is assimilated into business operations associated with customer interaction. Ineffective customer relationship management with potential buyers during NPD can be an important contributor to new product failure (Athaide and Klink 2009) and well-managed relations can moderate the effects of inadequate product performance (Priluck 2003).

In brief, huge synergies are indicated in CRM and NPD fields. Integrating CRM into product innovation will benefit and promote both parties. A new integrated CRM system can be developed on this basis.

2.4.2 Synergy of CRM and KM

Recent studies conducted in the research domains of KM and CRM have proposed

that these two approaches can have great synergies (Rollins and Halinen 2005). Both approaches focus on allocating resources to supportive business activities in order to gain competitive advantage (Gebert, Geib et al. 2003). The trigger is customer knowledge, which can be managed to support R&D (Gibbert, Leibold et al. 2002), to improve innovation, to facilitate sensing of emerging market opportunities and to support the management of long-term customer relationship (Darroch and McNaughton 2003; Rollins and Halinen 2005). Managing CK has been the most important aspect of KM in many companies (Stefanou, Sarmaniotis et al. 2003), and meanwhile, KM capabilities have been found to be crucial factors in successful CRM implementations (Croteua and Li 2003; Rollins and Halinen 2005).

A number of traditional CRM projects fail because these applications don't serve customers any better and fail to integrate disparate data sources or provide the right kind of information to the right people (Bose and Sugumaran, 2003). Nowadays, many organizations have many tools to gather customer data from various contact points with customers, and to structure it into customer information. However, converting enormous amounts of customer data into customer information, and furthermore, CK, is very challenging for organizations depending on market research and marketing information systems by experts (Davenport, Harris et al. 2001), either for organizations to utilize huge customer knowledge and deliver it to the right people. Therefore, KM is urgently needed in CRM systems.

KM became an emerging discipline at the end of the 20th century due to organizations' need to manage their knowledge resources more efficiently (Rollins and Halinen 2005). Only the information which generates value can be regarded as knowledge. Therefore, CK is very important for a company's knowledge management. Most valuable CK is exploited by communicational CRM. Thus, CRM systems will improve the performance of knowledge management.

Traditional CRM systems are used to focus on the transactional exchange to manage customer interactions, while KM systems manage an organization's knowledge through the process of creating, structuring, disseminating and applying knowledge to enhance organizational performance and create value (Bose and Sugumaran 2003), there is a gap between CRM and KM. That means, a new CRM application is possible by integrating all useful CK to create knowledge-enabled CRM processes that allow firms to improve not only customer relationship quality but also product innovation performance.

Nevertheless, not so many studies have been established to address customer knowledge management in the context of CRM implementation (Xu and Walton 2005). Bang (2005) finds in his dissertation that not IT, but a well-designed CRM process is critical for CRM performance in business. These findings highlight the importance of well-designed CRM processes and the understanding of the customers' perspective in relationship cultivation.

In short, there is a need for better management of customer knowledge based on the synergies of CRM and KM. The purpose of this study is to provide a better understanding of CKM as an integrated management approach and examine the competence it requires.

2.4.3 Previous Studies about CKM

2.4.3.1 Definition of CKM

Two key studies which significantly influence the concept of CKM are identified and cited by most CKM studies. The first is Gibbert et al. (2002), who describe that "CKM

is the strategic process by which cutting edge companies emancipate their customers from passive recipient of products and services, to empowerment as knowledge partners. CKM is about gaining, sharing, and expanding the knowledge residing in customers, to both customer and corporate benefit. It can take the form of prosumerism, mutual innovation, team-based co-learning, communities of practice, and joint intellectual property (IP) management.” In their study CKM refers to the management of knowledge from the customer, i.e. knowledge residing in the customer, in contrast to knowledge about customers, which is classic knowledge used in CRM systems. “While both KM and CRM focused on gaining knowledge about the customer, managing customer knowledge is geared towards gaining knowledge directly from the customer.” So argue the authors and they have given more details on the differences among KM, CRM and CKM in this study. The second is Gebert et al. (2002; 2003) from University of St. Gallen, who develop their CKM concept by reflections on CRM and use knowledge gathered to encounter with customers in order to support business processes. The task of CKM is to design the knowledge flow inside and between the CRM processes and to allocate relevant knowledge gained from customer-related processes to others. Three main styles of CK are classified in their studies: knowledge for customers, knowledge about customers, and knowledge from customers.

Another relevant definition is by Rollins and Halinen (2005) who defined CKM as “an ongoing process of generating, disseminating and using customer knowledge within an organization, and between an organization and its customer”.

Ngai (2005) argues that: “CKM is an attractive area for not only research but also practice because of its relative novelty and exploding growth. But I would like to take it as a complement to CRM, because CRM is also still a new phenomenon for many businesses.” This study agrees with it and takes CKM as a complement and

improvement to CRM, but not denial and replacement of CRM. Based on literature and empirical study, **this study describes CKM as: a dynamic process of identifying, acquiring, transferring, utilizing, co-creating and protecting valuable explicit and tacit customer knowledge based on support of KM infrastructure, developing customer satisfied solutions and cultivating long-term valuable customer relationship in the customer-oriented organizations.**

2.4.3.2 CKM Models from Previous Studies

Since the late 20th century many academics try to develop CKM systems to promote business performance. Below are some important studies about CKM.

Wayland and Cole (1997) divide knowledge management process into six steps in their CKM Loop Model: focus, generate, codify, share, leverage and plan.

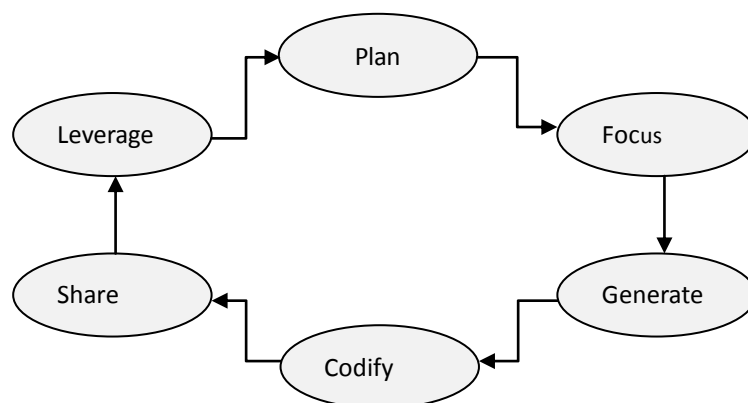


Figure 15 Customer Knowledge Management: A Closed-Loop Process

Source: Wayland and Cole (1997), p. 46

Gibbert et al.(2002) argue that CKM creates new knowledge sharing platforms and processes between companies and their customers. They propose five styles of CKM, which can be prosumerism, group learning, mutual innovation, communities of creativity, and joint intellectual capital, and exemplify them to describe the characteristics of CKM. Any company which depends on the nature of its various

customers can apply several of these five styles of CKM simultaneously.

Table 10 Five Styles of Customer Knowledge Management

Style/ Characteristic	Prosumerism	Team-based Co-learning	Mutual Innovation	Communities of Creation	Joint IP/Ownership
Focus	Developing tangible assets and benefits	Creating corporate social capital	Creating new products & processes	Mission-specific. Professional expertise	Tangible customer IP sharing
Objective	Improved products & resulting benefits	Facilitate team learning for dealing with systemic change	Create max. return from new ideas	Obtain & explicate professional expertise	Max. returns on IP (jointly)
Processes	Pre-, concurrent- & post- production integration	Teamwork, empowerment, case development, quality programs	Idea fairs; brainstorming; customer Incubation	Best practices CoP's, expert networks	Apprenticeships Formal training programs On job training
Systems	Planning, control and decision supply systems	Knowledge sharing systems, digital 'nervous' systems, customer visits in teams	Idea generation support systems	Expert systems, shared e-workspaces, group support systems	Group IP support systems
Performance Measures	Effectiveness & efficiency, customer satisfaction & success	Systems productivity, quality, customer satisfaction & success	ROI from new products & processes, customer success	K-sharing behavior, timeliness of decisions, Rate of hyperlinked results	Value of new IP, incremental ROI on new revenue streams
Case Examples	Quicken; IKEA	Amazon.com; Xerox, Holcim, Mettler Toledo	Silicon Graphics, Ryder	Microsoft; Sony; eBay, Holcim	Skandia
Intensity of Interaction	Relatively low	Low to high	Relatively low	Relatively high	Relatively high
Type of Knowledge	More explicit	Explicit and tacit	More tacit	More tacit	More explicit

Source: Gibbert et al. (2002)

Gebert et al.(2002; 2003) describe the linkage of CRM and KM in their St. Gallen CKM Model as follows. On one side this model reflects the CRM processes with marketing, sales and service, on the other side it reflects the four main aspects of KM with content, competence, collaboration and composition. Six relevant business processes are comprised: campaign management, lead management, offer management, contract management, service management and complaint management, and additional activities for the implementation of customer interface: interaction management and channel management.

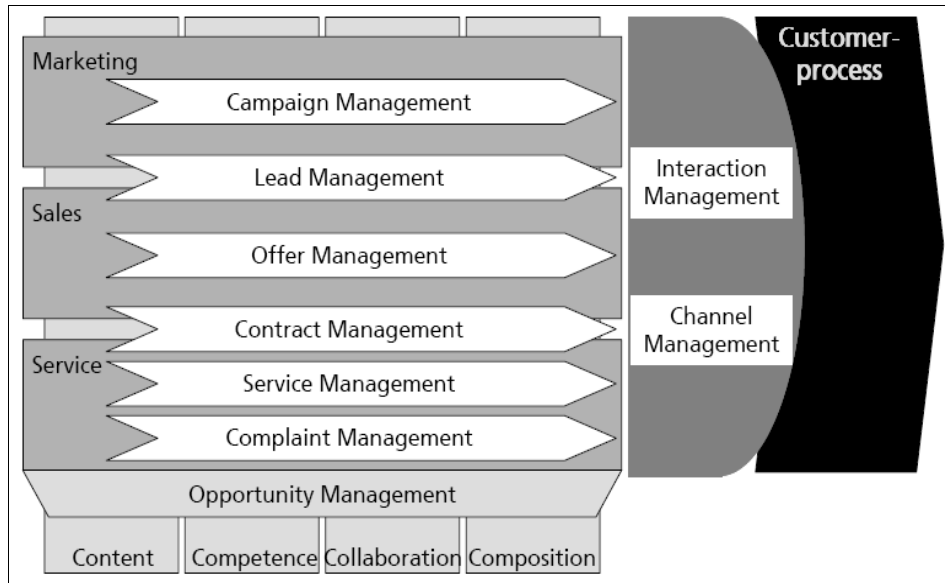


Figure 16 CKM Model of University St. Gallen

Source: Gebert et al. (2003)

Stauss (2002) brings the different forms of CK (knowledge of customers, knowledge from customers and knowledge about customers) into KM processes in his study and develops a CKM cycle as following. He designs a continual process according to different steps and tasks of KM and describes the relevant methods used.

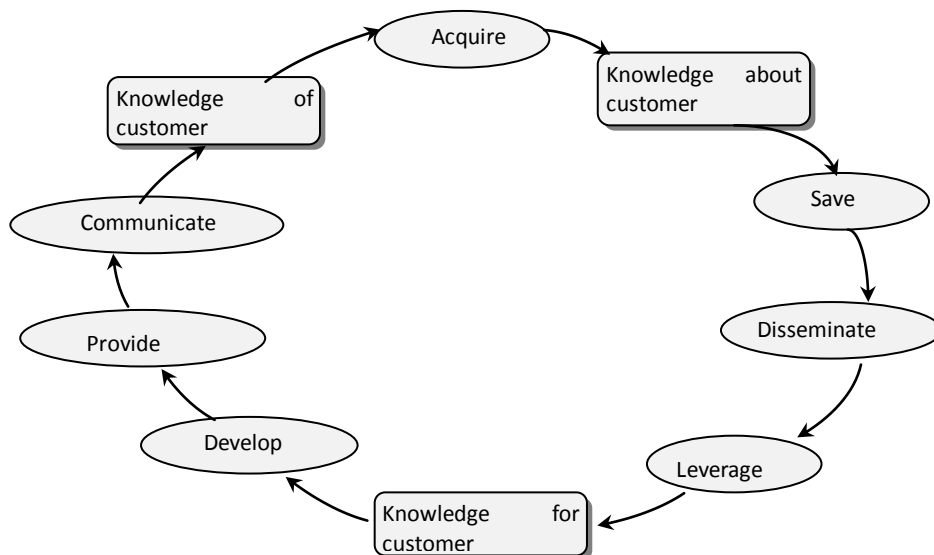


Figure 17 Customer Knowledge Management Cycle by Strauss

Source: Stauss (2002), pp. 281.

As the preliminary result of the Customer Knowledge Management project by five

German institutes, Korell and Rüger (2004) depict a German CKM model with 2 dynamic cycles: one is the cycle with questions and tasks of customer knowledge development and the other is the cycle with deployment and utilization of knowledge. They argue that CKM is purposeful and systematic exploitation, development, deployment and utilization of customer knowledge.

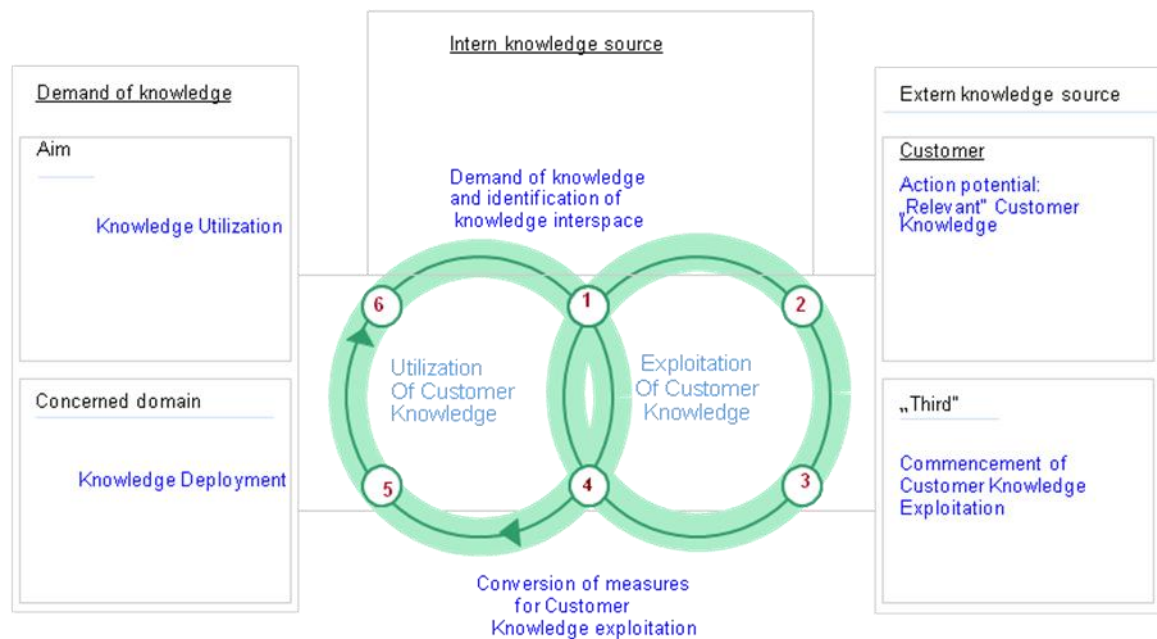


Figure 18 German Model of Customer Knowledge Management

Source: Korell and Rüger (2004)

Smith and McKeen (2005) examine the wide variety of ways organizations use KM in their customer relationships and suggest that CKM is not a tool like CRM but a process that is designed to dynamically capture, create and integrate knowledge about and for customers. Accordingly, they design their conceptual framework and state that CKM means that companies exploit and utilize knowledge of customers, knowledge from customers, knowledge for customers and knowledge co-created with customers through the communications with selected customers.

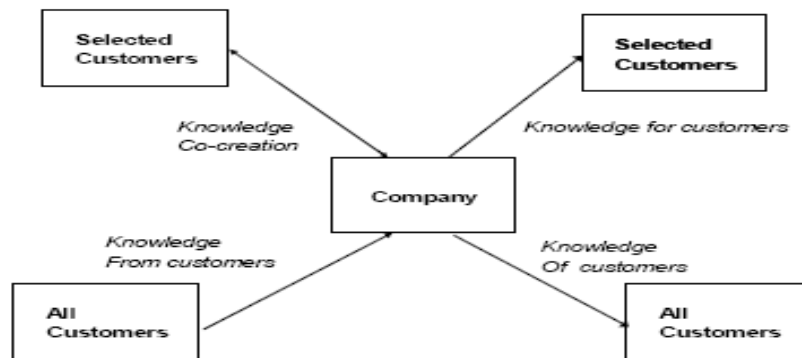


Figure 19 Conceptual Framework of CKM by Smith & McKeen

Source: Smith and McKeen (2005)

Su et al. (2006) propose a conceptual framework entitled the E-CKM model by incorporating IT into the CKM model, with a methodology for precisely delineating the process of customer knowledge management for innovative product development. In the E-CKM model, the CKM process comprises four stages which are supported by the applications of different methods in information technology: product features/benefit identification, customers' needs categorization, market segmentation for converting tacit customer knowledge into codified knowledge, customers' needs pattern extraction. Each stage integrates concerned customer knowledge and information technologies.

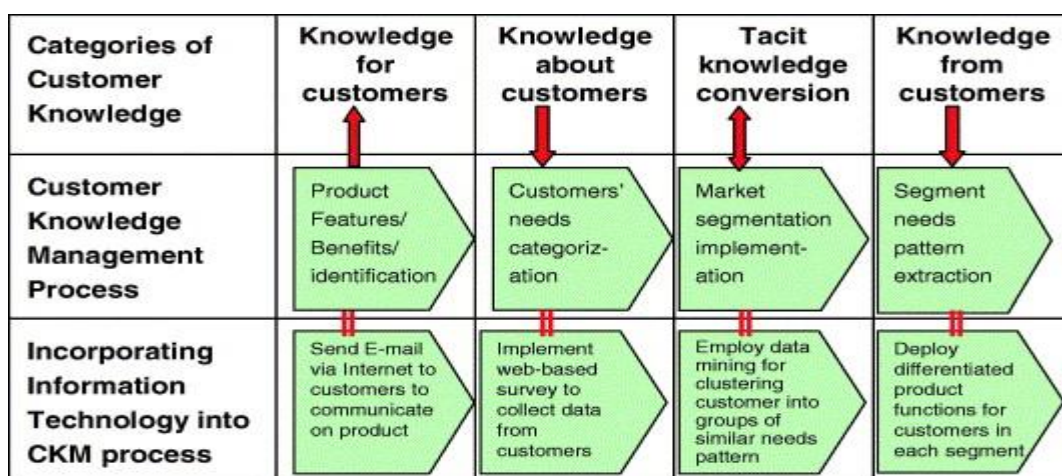


Figure 20 The E-CKM Model Applied in NPD

Source: Su et al. (2006)

2.4.4 Differences among CRM, KM and CKM

Some people just regard CKM as another name for CRM, or one part of KM. Although CKM is taken as improvement or complement of CRM to enhance effective management of customer relationship in this study, CKM has obvious distinctions from CRM and KM in many aspects.

Table 11 Comparison of CRM, KM and CKM

	CRM	KM	CKM
Disciplinary roots	Relationship marketing and management theories & approaches.	Fusion of organizational behavior theory, cognitive sciences and information sciences.	CRM and KM approaches.
Knowledge sought in	Customer database.	Employee, team, company, network of companies.	Customer experience, creativity, and (dis)satisfaction with products/services.
Perspective	In customer interface.	Inside the organization.	In customer interface and inside the organization.
Axioms	"Retention is cheaper than acquisition."	"If only we knew what we know."	"If only we knew what our customers know."
Key actors	Customers and employees	Employees	Employees and customers
Key communication context	Marketing communication: interaction between organization and its customers.	Organizational communication.	Interaction between organization and customers.
Rationale	Mining knowledge about the customers in company's databases.	Unlock and integrate employees' knowledge about customers, sale processes and R&D.	Gaining knowledge directly from the customer, as well as sharing and expanding this knowledge.
Objectives	Customer base nurturing, maintain company's customer base.	Efficiency gains, cost saving, and avoidance of re-inventing the wheel.	Collaboration with customers for joint value creation.
Metrics	Performance in terms of customer satisfaction and loyalty.	Performance against budget.	Performance against competitors in innovation and growth, contribution to customer success.
Conceptual foci	What is customer relationship? Different types of customer relationships of organization(B2B, B2C)	What is knowledge? How it is created?	What is customer knowledge? Different sources and types of customer knowledge.
Key processes	Creating loyal and stable customer base, improving customer service and maintaining customer	Knowledge creation, sharing, and exploitation.	Generating, disseminating and using customer knowledge within organization and between

	relationships.		organization and its customers.
The goal	To build and develop long-term customer relationships with profitable customers, managing interaction between an organization and its customers.	To fuel organizational learning, cost savings, and “avoid re-inventing the wheel”.	Learning about, from and with customers, in order to support CRM efforts.
Benefits	Customer retention.	Customer satisfaction.	Customer success, innovation, organizational learning.
Recipient of incentives	Customer.	Employee.	Customer.
Role of customer	Captive, tied to product/service by loyalty schemes.	Passive, recipient of product.	Active, partner in value-creation process.
Corporate role	Build lasting relationships with customers.	Encourage employees to share their knowledge with their colleagues.	Emancipate customers from passive recipients of products to active co-creators of value.

Source: adapted from Gibbert et al.(2002), Rowley (2002a), Rowley (2004) and Rollins and Halinen (2005)

From the above table, we can find out that the communication channel of CRM between companies and customers is unidirectional via the media of analytical data, where the objective is to identify separate groups of customers and to target them with differentiated measures and maintain them. CKM, on the contrary, emphasizes a bi-directional communication channel, interaction with customers, cooperation with customers and customer knowledge discovery, in order to set up strategies for developing attractive new products or service to win customers’ satisfaction (Gibbert, Leibold et al. 2002; Rollins and Halinen 2005; Chen and Su 2006).

2.5 Customer Knowledge Management Competence

Although CKM seems to be able to provide a significant competitive advantage for companies, Gibbert et al. (2002) identify two major possible stumbling blocks for CKM implementation: the cultural challenge (in terms of re-thinking the role of the

customer and the far-reaching implications this has for the mindset of the organization's employees), and the competency challenge (in terms of the skills and processes needed to take full advantage of participative techniques). CKM requires organizational competence to make full use of CK and to fulfill the promises of superior CK for company performance and competitive advantage (Rollins and Halinen 2005). Bang (2005) finds in his doctoral study that market knowledge competence has significant impact on CRM process. Therefore, customer knowledge management competence (CKMC) is intended to be discussed in this study.

2.5.1 Studies about CKMC

Owing to its important role, CKMC has emerged as a significant topic in product innovation research. However, until today, the concepts of "Customer Knowledge Management Competence" as well as Customer Knowledge Management are not clearly described. Some closely related terms can be found in the literature, such as market knowledge competence (Li and Calantone 1998), customer knowledge competence (Campbell 2003), and so on. Literature analysis and empirical studies reveal that this competence originates from the cross section of CRM, KM and customer competence, which is showed as follows.

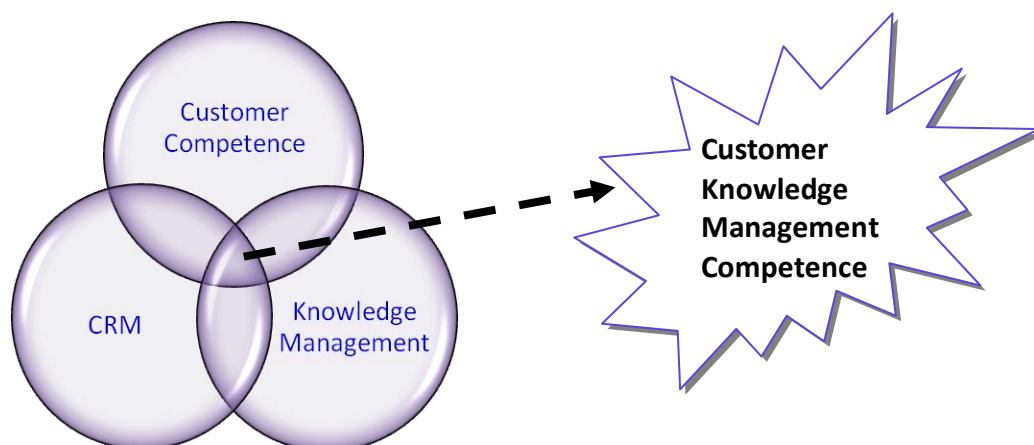


Figure 21 The Origin of Customer Knowledge Management Competence

Source: designed by this study

Reviewing from these three fields mentioned above, we can find out that all of them emphasize the importance of CK. Only CRM and KM are to emphasize the use of CK and synergies of both fields within organizations, and customer competence is the competitive capability from customers using their knowledge outside of organizations. Without customer competence, CKM will be trapped in “bricks without straw”. This is why this study is intent to combine customer competence with CRM and KM to deduce the concept of customer knowledge management competence.

Customer knowledge management competence (CKMC) is unique, because the processes that generate and integrate CK are embedded in organizations and not easily observed by outsiders, therefore, CKMC can’t be transferred easily or be bought on the market.

Li and Calantone (1998) define market knowledge competence as “the processes that generate and integrate market knowledge[®]”. Since the ability to create a market knowledge competence has only been enabled through technology recently, previous works on the impact of market knowledge competence on NPD is adapted and extended to conceptualize market knowledge competence. Li and Calantone (1998) suggest that market knowledge competence in NPD is composed of three organizational processes: (1) customer knowledge process; (2) competitor knowledge process; and (3) the marketing research and R&D interface.

Based on the perspective of organizational capabilities, Gold et al. (2001) suggest in their research that “a knowledge infrastructure consisting of technology, structure,

[®] Market knowledge is defined as “organized and structured information about the market as the result of systematic processing” by Li and Calantone (1998).

and culture along with a knowledge process architecture of acquisition, conversion, application, and protection are essential organizational capabilities or ‘preconditions’ for effective knowledge management.” They classify knowledge management competence as knowledge infrastructure capabilities, which encompass technological, structural and cultural knowledge management infrastructure, and knowledge process capabilities, which include capabilities of knowledge acquisition, conversion, application and protection (Gold, Malhotra et al. 2001).

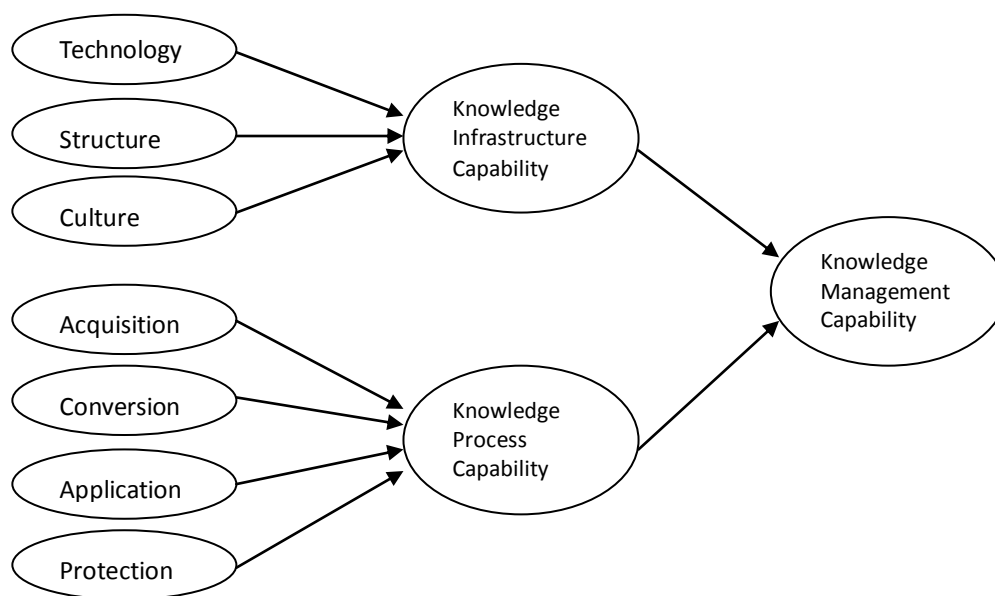


Figure 22 The Framework of Knowledge Management Capabilities

Source: adapted from Gold et al. (2001)

Campbell (2003) develops his study from Li and Calantone (1998) and conceptualizes customer knowledge competence as being composed of four organizational processes, which, together, generate and integrate customer knowledge with the organization: (1) customer information process; (2) marketing-IT interface; (3) senior management involvement; and (4) employee evaluation and reward systems.

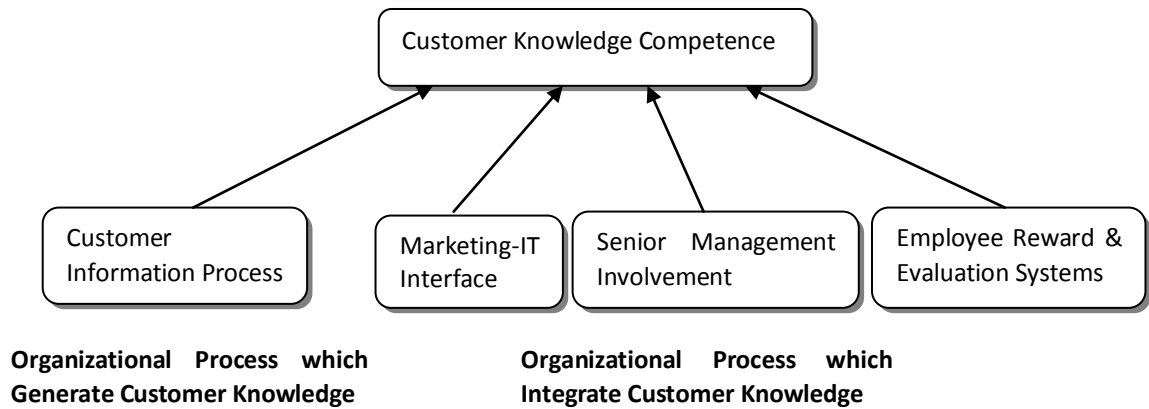


Figure 23 A conceptualization of customer knowledge competence

Source: Campbell (2003)

Rollins and Halinen (2005) propose a tentative framework for CKM competence, which should concern five aspects in particular: (1) inter-functional cooperation; (2) supportive organizational systems; (3) cooperation with customers; (4) supportive IT systems; and (5) organizational culture that supports organizational learning and customer orientation. They argue that these five areas should be managed so that generation, dissemination and use of customer knowledge are enhanced and become integral parts of customer management processes and operations (Rollins and Halinen 2005).

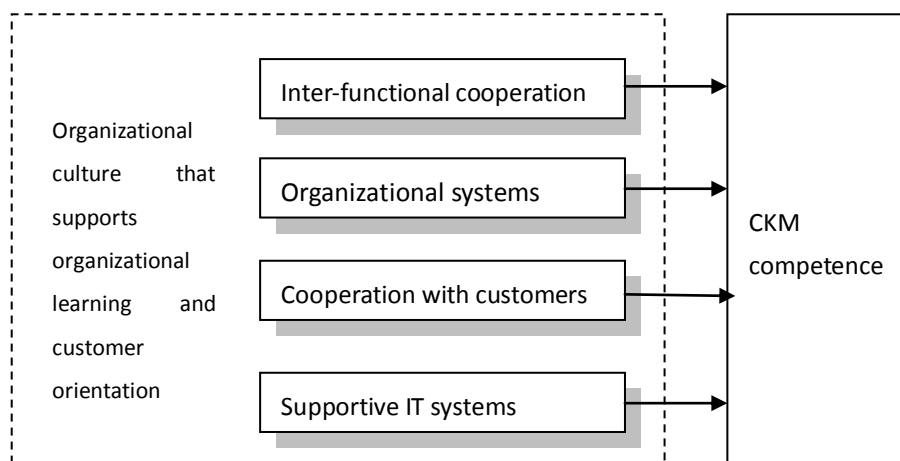


Figure 24 A Tentative Framework for CKMC

Source: Rollins and Halinen (2005)

2.5.2 Key Components of CKMC

Examination of dimensionality is essential in concept development and testing (Anderson and Gerbing 1988). The dimensions of CKMC in NPD are still not sufficiently understood. Identifying key elements of CKMC is not only the prerequisite and basis of research on CKMC, but also the fundament for cultivation and evaluation of CKMC, which can help companies improve their business performance against their weakness. This study intends to determine the key indicators of CKMC through literature review.

Davenport and Prusak (1998) identify nine causal factors which are common throughout successful projects and make knowledge projects successful: (1) a knowledge-oriented culture; (2) technical and organizational infrastructure; (3) senior management support; (4) a link to economics or industry value; (5) a modicum of process orientation; (6) clarity of vision and language; (7) nontrivial motivational aids; (8) some level of knowledge structure; and (9) multiple channels for knowledge transfer (Davenport and Prusak 1998 , p. 153).

The dominant benchmarking model - Knowledge Management Assessment Tool (KMAT), which was jointly developed by Arthur Andersen Company and the American Productivity and Quality Center (APQC), is designed to help organizations with making an initial high-level assessment of how well they manage knowledge (Raub and Sthapit 2001). KMAT model places the major KM activities and enablers together in a dynamic system, and illustrates how four so-called enablers (leadership, culture, technology and measurement) can be used to foster the development of organizational knowledge through a typical KM process, which can identify, collect, adapt, organize, apply, share and create knowledge. Each of the five sections in KMAT model – leadership, culture, technology, measurement and knowledge process –

encompasses a set of KM practices.

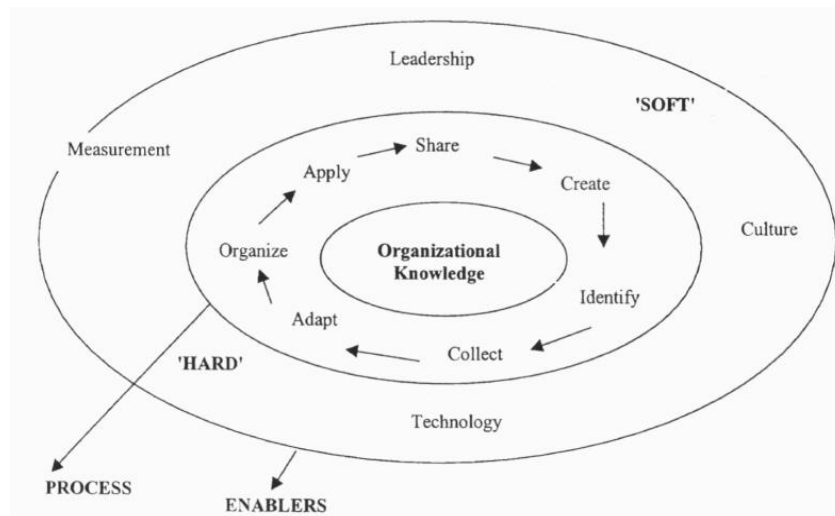


Figure 25 The KMAT – An example of the benchmarking focus

Source: Raub and Sthapit (2001)

Liu et al. (2002) discuss that knowledge management competence can be classified as knowledge management infrastructure, which encompasses leadership and management, IT application, organizational culture and human capital maintenance, and knowledge management processes, which include knowledge acquisition, innovation, protection and dissemination.

Based on the existing studies, we can summarize that CKMC is a conceptual framework that is multidimensional and composed of customer knowledge process capability and knowledge management infrastructure capability. This study draws on the results of Li and Calantone (1998), Gold et al. (2001), Campbell (2003), Rollins and Halinen (2005) and other studies to refine the key elements of CKMC. After reviewed by expert interview and group discussion and analyzed with Analytic Hierarchy Process (AHP) method, this study selects 12 elements as the key components of CKMC. They are structured into two second-orders, which are **customer knowledge infrastructure capability that integrates customer knowledge**

throughout the organization: (1) marketing-R&D interface, (2) supportive IT systems, (3) supportive organizational structure, (4) reward and evaluation system, (5) senior manager involvement, (6) customer friendly organizational culture; **and customer knowledge process capability that generates and uses customer knowledge:** (7) knowledge identification, (8) knowledge acquisition, (9) knowledge conversion, (10) knowledge application, (11) knowledge innovation, (12) knowledge protection. This conceptualization is complementary to the Gold et al. (2001) study on knowledge management capability and the Campbell (2003) study in several respects.

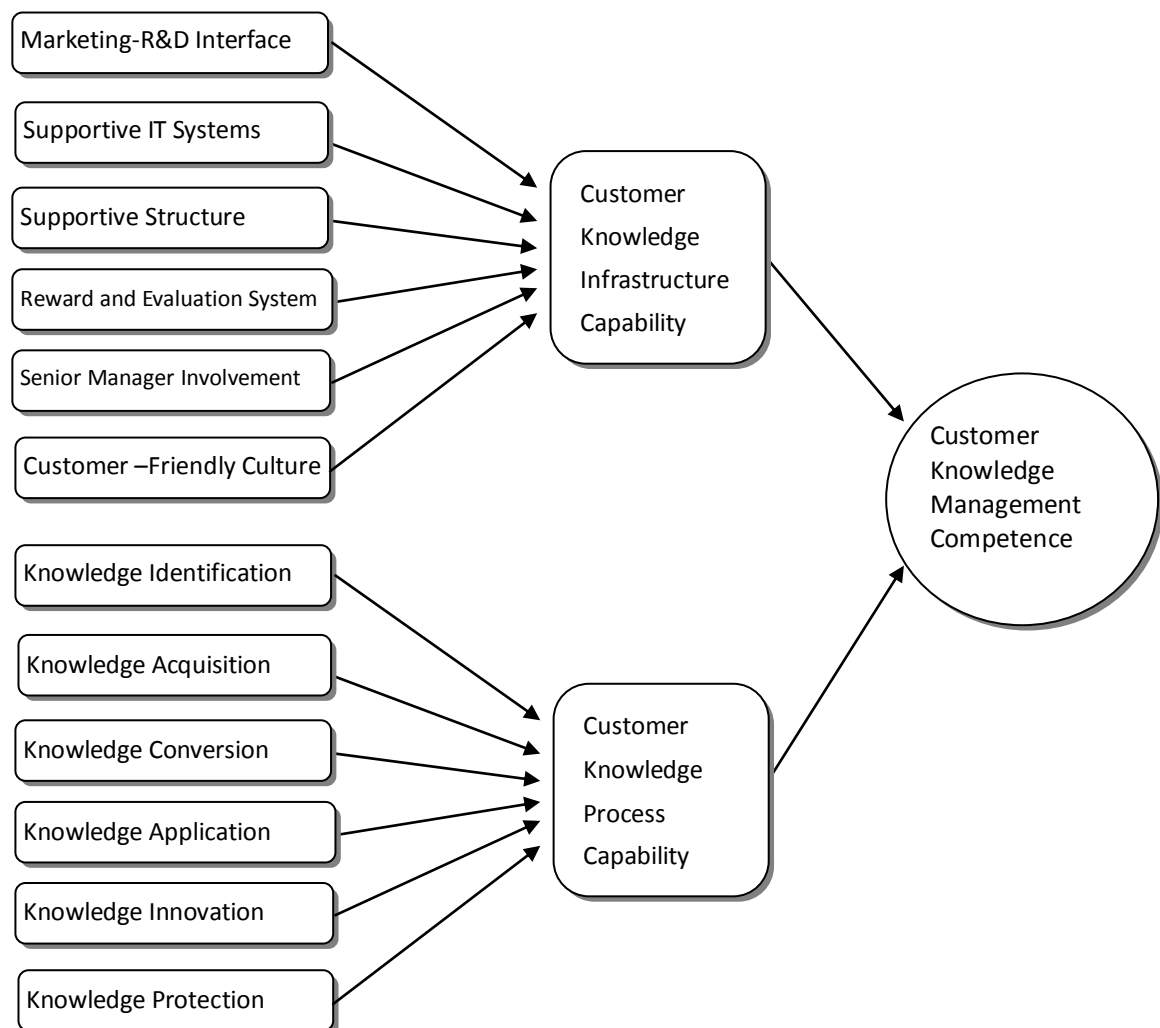


Figure 26 Key Elements of CKMC

Source: designed by this study

Customer knowledge management infrastructure capability is the ability of an organization to integrate customer knowledge to the whole organization. Marketing-R&D interface refers to the process by which marketing and R&D functions communicate and cooperate with each other. Supportive IT system refers to the information technology system which can support the user-friendly and interactive innovation toolkits and data mining from enormous data warehouse. Supportive organizational structure refers to organic structure which facilitates employees to communicate with customers in many contact node points. Reward and evaluation system refers to the process by which employee behavior is aligned to the company's goals of generating and integrating customer knowledge into company's marketing strategies. Senior management involvement refers to "the processes by which top management signals its support for the generation and integration of customer knowledge within the firm (Campbell 2003)". Customer-friendly culture refers to the customer oriented organization culture.

Customer knowledge process capability is the ability of organization to generate and use customer knowledge in and out of whole organization, and refers to the set of behavioral activities and processes that identify, acquire, convert, apply, innovate and protect customer knowledge pertaining to customers' current and potential needs for products and services.

Drawn on the ideas of Li and Calantone (1998), Campbell (2003) and Rollins and Halinen (2005), **this study defines customer knowledge management competence as a competitive organizational resource for implementing CKM in an organization, which composes the capability to exploit, integrate and utilize customer knowledge into an organization's CRM processes and operations with the support of knowledge management infrastructure capability to integrate customer knowledge throughout the organization.**

2.6 CKM-embedded Innovation Marketing Conceptual Framework

The goal of this study is to overcome the shortcomings of traditional CRM systems by proposing a process model consisting of innovation marketing processes relevant in the context of CRM. So the purpose of this chapter is to provide an understanding of CKM as an integrated management approach. After literature review, this study designs a conceptual framework of integration with CKM and the innovation marketing process as follows, which comprises three main parts: CKM system, interaction platform and innovation marketing system.

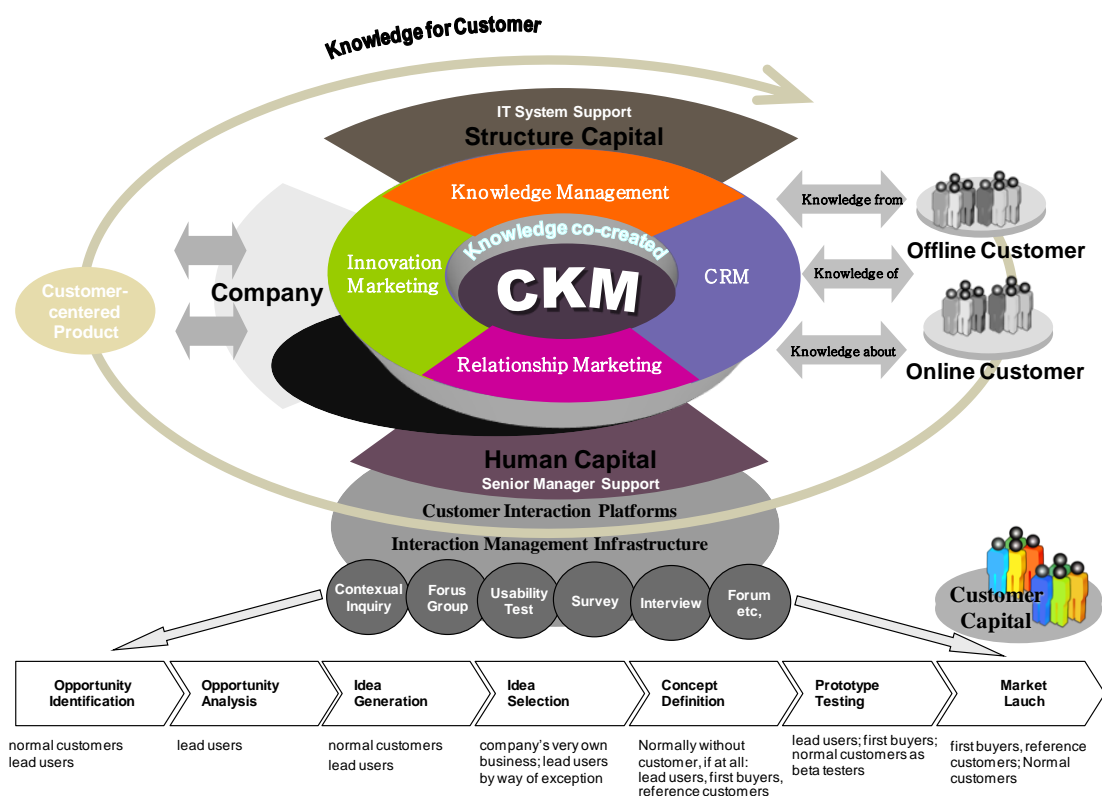


Figure 27 Conceptual Framework of CKM-embedded Innovation Marketing

Source: designed by this study

The principal aim of CKM-embedded innovation marketing is to establish a

co-creative environment for customers and companies to let all involved parties work together dynamically. Therefore, collaboration, cooperation and communication involving marketers and customer are the key points (Law, Lau et al. 2003).

This framework may be used as a starting point for the analysis of knowledge flows in CRM processes. Through CKM-embedded innovation marketing, marketers and managers can keep their finger on the customer's pulse and respond to customers' wants and needs in real time. Different CK, such as knowledge of customers, knowledge about customers and knowledge from customers, are acquired through interactive platform with appropriate methods and input into CKM systems in innovation processes. KM is supported by structural capital (i.e. infrastructure capability to some extent) and human capital (e.g. innovation team and senior manager). Innovation teams and customers work together and co-create new knowledge for solution – customer centered products, which comprise knowledge for customers. Thus, customer knowledge flow forms a dynamic cycle within innovation process.

The output of this integrated framework can be read as follows:

- **Two path dependences: information system dependence and human dependence.** While the value of customers' tacit knowledge is widely recognized as well as the explicit knowledge obtained by communicational CRM, the vast quantity of CK is too much for the processing capacity of human beings. Therefore, information system must be dependent for storage and analysis. Also because the importance of customers' tacit knowledge, which can't be operated by machines and must be acquired with interactive communication by marketers, human dependence is therefore necessary in CKM-embedded innovation marketing.
- **Two knowledge cycles: SECI knowledge cycle within organizations and between**

organizations and customers. When CK is input into CKM-embedded innovation marketing processes in organizations, customer knowledge, especially tacit knowledge, will be dealt with in the socialization process, externalization process, combination process and internalization process, which forms famous Nonaka's SECI knowledge transformation model (Nonaka and Takeuchi 1995). Meanwhile, involved customers will also benefit from this knowledge cooperation and learn new useful knowledge that can update their knowledge level and give more valuable contribution to innovation. A SECI knowledge cycle forms between organization and customers.

- **Two performance outputs: customer centered product and sustainable valuable customer relationship.** Through dynamic dialogue and communication, companies will understand the ideas and thoughts of customers. Much non-relevant information and knowledge will be abandoned immediately, while valuable information and knowledge will be put into deep processing till customer-satisfied solutions are generated. Through the CRM approaches and interactive communication during customer-integrated innovation processes, companies take advantage of this long-time interaction and supply professional knowledge service and relational service, which can improve customer value and lead to long-time customer relationship.

2.7 Summary

The purpose of this study is to understand the internal business processes necessary to execute CKM and cultivate the CKMC it requires. This exploratory research attempts to help understand the way that companies execute NPD with the customer integration approach and knowledge relationship perspective, redesigning their internal organizational networks and processes to meet the challenges of generating and integrating and co-creating specific customer knowledge. Therefore, this chapter

reflects the customer-integrated innovation processes from three aspects: customer, relationship, and management, which means “Customer” provides the direction, “Relationship” gives the focus, and “Management” represents the approach.

This conceptual chapter draws on relationship marketing theory, recent advances in knowledge management and dynamic capabilities theory, and the innovation management literature to offer an integrated framework for building a dynamic CKM system. This framework is intended to help managers take a more strategic approach in a new way for managing CRM systems in their companies, especially in innovation processes. Some synergy effects of utilizing innovation marketing with CKMC are highlighted. The CKMC, composed of knowledge management infrastructure capability and customer knowledge process capability, drive CKM systems rather than a process-based approach to nurturing successful innovation with not only customer-centered new products but also proactive valuable customer relationship. CKM-embedded innovation marketing can not only improve the successful performance of innovation, but also minimize the risks of innovation.

Chapter III Theoretical Model Development and Research Hypotheses

The purpose of this chapter is to construct a theoretical model. The model is to test the path correlations between CKMC, Intensity of Customer Interaction, Customer Relationship Quality, Knowledge Exchange Quality and New Product Advantage. Following the development of the model, a series of theoretically justified hypotheses are posited.

3.1 CKMC and New Product Advantage

3.1.1 New Product Advantage: Definition and Dimension

3.1.1.1 Definition of New Product Advantage

Reviewed from NPD literature we can find out that new product performance is more frequently used in empirical studies. New product advantage is regarded as one part of new product performance and there is positive effect between them (Utterback, Allen et al. 1976). In respect that this study is more concerned with customer-integrated innovation, new product advantage is taken as the key variable.

Customer-integrated innovation will help companies to understand customers' needs and wants better, so that they can develop more customer satisfied products. Therefore, new product advantage should be viewed from the customer's perspective. Calantone and di Benedetto (1988) argue that new product advantage is the benefit that customers get from a product. Song and Parry (1996) define new product advantage as "a product's perceived superiority relative to competitive products". Campbell and Cooper (1999) also agree that product advantage is defined

from the customers' perspective and "gained by offering new, important, and visible benefits to customers when compared to competitive solutions". Henard and Szymanski (2001) state that new product advantage is the superiority or differentiation of product which supplied to beyond competitive products.

As a summary, we can find out that new product advantage has three main characteristics: superiority to competitive products, high quality and benefits for customers. Based on Song and Parry (1996), **this study defines new product advantage as a new product's perceived superiority relative to competitive products, which can bring benefits to customers.**

3.1.1.2 Dimensions of New Product Advantage

Song and Parry (1997a) review measures of new product advantage from previous research and find out "a significant positive relationship between the level of new product success and measures of product competitive advantage, such as the presence of unique features, relatively high product quality, and the ability to reduce consumer costs or enable the consumer to perform a unique task".

Although quality and reliability are traditional measures of new product advantage, many researchers (Calantone and Cooper 1981; Griffin and Hauser 1991; Cooper 1992) argue that new product attributes, such as new product quality, reliability, newness, and uniqueness, provide a more concrete picture of a company's ability to meet customer needs, and differences between alternatives on the important attributes provide direct evidence of advantage (Li and Calantone 1998). Following this routine, more concrete new product attributes for measures of new product advantage are explored and validated by Li and Calantone (1998), such as newness, productivity, reliability, compatibility, uniqueness, ease of use, and functionality.

Song and Parry (1996) give their suggestions to measure new product advantage from following aspects: compared to competitive products, (1) this product offers some unique features or attributes to the customer; (2) this product is clearly superior to competing products in terms of meeting customers' needs; (3) this product permit the customer to reduce costs, when compared to what he was then using; (4) this product permits the customer to do a job or to do something he could not presently do with what was available before; (5) this product has higher quality than competing products: tighter specification, stronger, last longer, or more reliable; (6) this product provides a superior benefit to cost ratio than competing products; and (7) this product has superior technical performance than competing products.

Campbell and Cooper (1999) state some key indicators to measure new product advantage: product superiority in meeting customer needs vs. competition, superior product quality vs. competition, visible benefits to customers, and benefits easy to explain.

Summarized from existing studies we can find out that new product advantage is the benefit to customer as compared to competition. Therefore, this study adopts the suggestions of Song and Parry (1997a) and tries to measure new product advantage as compared to competitive products,

- (1) This product offer some unique features or attributes to the customer.
- (2) This product is clearly superior to competing products in terms of meeting customers' needs.
- (3) This product permits the customer to do a job or do something he/she could not presently do with what was available.
- (4) This product is of higher quality than competing products (tighter specifications, stronger, lasted longer, or more reliable).

(5) This product has superior technical performance relative to competing products.

3.1.2 Successful CKMC Cases in NPD from Practice

Many companies have been aware of the opportunities from customer integration and customer knowledge. In recent years, some organizations started to cultivate their customer knowledge management competence and tried to forge the bridge between customer/market orientation and new product development.

Boeing involved most of its customers (the airlines) for a close interactive cooperation to develop Boeing 777. Innovative processes were developed and implemented to meet the customers' preferences and to reduce program costs. In this way, Boeing developed new products faster than in the laboratory study alone, and has reduced the risk of market failure (Li and Calantone 1998).

Microsoft established beta sites to seek customer knowledge in all important phases of new software development, from generating product specifications to alpha and gamma testing. Microsoft attributes its continued market success to its vigorous pursuit of customer knowledge in new product development (Li and Calantone 1998).

Silicon Graphics Inc. (SGI) adopted a policy of cultivating customer knowledge in its product innovation process. When designing its new generation of graphics supercomputers, Onyx, SGI actively sought knowledge from heavy graphics users such as Walt Disney's Imagineering Group, the technical producer of Aladdin, and Coryphaeus Software, a developer of space shuttle simulation software (Li and Calantone 1998).

Symbian integrated most well-known cell phone companies, such as Nokia, Sony-Ericsson, Motorola and other companies, into the entire development process to develop the operating system for 3G mobile phone. Now Symbian operating system has achieved impressive results against Microsoft cell phone operating platforms (Ancarani and Shankar 2003).

3.1.3 Empirical CKMC Studies in NPD from Literature

In their study of 56 industrial organizations, Sanchez and Elola (1991) find that certain activities in the customer knowledge process are “the most frequent method of finding out whether or not there is a suitable market for the new product, which correlates with the preponderance of the market as a source of new ideas.”

Based on his research on NewProd projects involving companies in the United States, Canada and Europe, Cooper(1992) identifies a customer knowledge process, which will determine product performance requirements and confirm or refute that proposed features are indeed customer benefits and of value to customers, as a critical factor in enhancing new product characteristics.

Based on a study of 404 Japanese firms and 788 new product introductions, Song and Parry (1996) argue that the most important success factor for NPD success is product advantage, while other related important success factors include predevelopment proficiency[®] as well as marketing and technological synergy. The relatively greater importance of controllable variable such as senior management support is also emphasized.

[®] Predevelopment proficiency is, proficiency in the predevelopment planning process as well as in concept definition and evaluation (Song and Parry 1996)

Li and Calantone (1998) propose that a customer knowledge process (defined as acquiring, interpreting, and integrating customer information) significantly improves new product advantage, because it enables a company to explore innovation opportunities created by emerging market demand and reduce potential risks of misfitting buyer needs.

Lesser et al. (2000) have identified four approaches (customer knowledge development dialogues, customer knowledge communities, facilitating the capture of knowledge relevant data, and demonstrating enterprise leadership commitment to customer knowledge) in their study that can expand the availability and use of customer knowledge, to solve the problems of customer knowledge management when (1) collecting customer information is very complex, (2) collecting correct information is very difficult, and (3) customers can not be easily differentiated.

Garcia-Murillo and Annabi (2002) cite from Koenig and Srikantaiah (2000) and believe that good processes and systems to manage customer knowledge are important for the following reasons: (1) better and more timely design of new products and services; (2) early warning and competitive intelligence; (3) customer commitment and loyalty; and (4) the synergy of collaboration.

That is, emphasizing CKM and managing CK systematically can help firms to improve customer satisfaction, develop successful new products and enhance innovation capacity (Day 1994; Slater and Narver 1995), and moreover, to influence new product advantage and performance.

Hypothesis 1: Customer knowledge management competence has a positive impact on new product advantage.

3.2 CKM Competence and Intensity of Customer Interaction

From literature and practice we can find out, to reduce the uncertain influence of market and improve NPD performance, companies must jump out of the traditional marketing, sales and service autonomy to collect information of customers and try to focus on the interaction with customers during the front-end phases to manage customer knowledge effectively. Therefore, companies can listen to the voice of customers directly and touch the pulse of market. With the assistance of information technology, companies can also build up their interactive platform effectively at reasonable cost.

From the discussion of CKM, we know that tacit knowledge of customers is much more important for innovation than explicit knowledge, and tacit knowledge can only be acquired through interaction. From the discussion of differences among KM, CRM and CKM by Gibbert, Leibold et al.(2002), Rowley (2002a), Rowley (2004) and Rollins and Halinen (2005), we can learn that CKM emphasizes managing the knowledge from customers much more than knowledge about customers. CRM programs pay much attention to collect passive transactional data and analyse it with information technology. One revolution of CKM is to encourage employees to interact with customers in any touch node and involve innovative customers as innovation partners. The role of customers is turned from passive recipients of products or services in CRM to active innovation partners or knowledge partners in CKM. Following these trends, many companies just change their main target in pursuit of maximum profit to managing interactive customer relationship and exploiting customer competence. Within the framework of CKM, customer integration and interaction into the NPD process can not only develop market oriented new products using customer knowledge, but also act as a professional knowledge service and relationship service to customers during the interactive process, so that companies

can not only gain customer-satisfied new products, but also improve the customer trust and customer relationship quality.

Thus, interaction management is a basic feature of CKM, or, the framework of CKMC is built upon interaction management with customers.

Hypothesis 2: Customer knowledge management competence has a positive impact on intensity of customer interaction.

3.3 Intensity of Customer Interaction and New product advantage

Many proofs from literature and practice have revealed that companies and customers can achieve mutual benefit through a close partnership, especially, cooperation with customers is a reasonable way to understand customer needs and wants and to achieve valuable innovation (Biemans 1992; Gemuenden, Heydebreck et al. 1992; Håkansson and Senehota 1995). These studies point out that there is a good effect for customer integration in NPD to generate ideas, to improve development performance, to shorten launch time, etc., because (1) customers can enlarge the main knowledge input and real-time market information for innovative product quality; and (2) customer involvement can reduce the complexity challenge of NPD projects with their respective competitive advantage or knowledge and empower the whole NPD capacity (Athaide, Meyers et al. 1996).

Interaction with customers is also widely acknowledged to be a success driver for new product performance. Parkinson (1981; 1982; 1985) tries to measure customer interaction through customer perception, and finds out that higher lever customer

interaction and more customer needs and wants conveyed by innovative customers lead to the success of German mechanical engineering industry. Shaw (1985) analyses 34 project from the English medical instrument industry and reveal the relative relationship between customer integration and new product success. Karagozoglu and Brown (1993) argue that customer involvement has relative influence on NPD and will improve new product success, if companies can enhance the interaction with marketing skills and accept innovative customer ideas. Gruner and Homburg (2000) also indicate that the intensity of interaction with customer will positively influence new product performance in NPD processes.

There are also some scholars who argue that customer integration can't guarantee NPD success, the factors, such as the choice of partner, intensity of customer involvement, customer competence and knowledge sharing willingness, knowledge nature and quality etc. (Leonard-Barton 1995b), have the possibility to influence the effect of customer integration in NPD. Moreover, customer integration can bring some risks, e.g., cooperation failure may harm the relationship with key customers, too early market test may lead vital information exposure or unrepresentative feedback (Dolan and Matthews 1993). Schrader and Gopfert (1998) discover from their codified interview that the limitation of customers' professional knowledge may lead to inefficiency of NPD, when companies involve customers in partner innovation. Enkel et al. (2005) summarize the different kinds of risks and negative effects of customer integration in NPD.

Though there are such adverse opinions about customer integration in NPD, most studies from literature agree that market orientation and customer integration is one of the fundamental rules to improve new product performance. In order to keep a good relationship with customers and enable customer competence to improve innovation performance, communicating and interacting with involved customers in

a preferable way, or providing market offering that he or she likes are definitely a must (Chen and Su 2006). As interacting with customers is the kernel attribute of customer integration in NPD, this study tries to find out the impact of interaction intensity in innovation marketing phases to new product advantage.

Hypothesis 3: The intensity of customer interaction in innovation marketing phases has a positive impact on new product advantage.

3.4 Middle Outcomes in CKM-embedded Innovation Marketing

Some studies have explored the relative relationship among CKM competence, intensity of customer interaction and new product advantage from their respective views (Li and Calantone 1998; Gruner and Homburg 2000; Huang 2002; Chung 2007). This study will stand on the shoulder of these studies and try to explore the role of customer relationship and knowledge management in the CKM-embedded NPD process, moreover, the transmission path and mechanism of CKMC to new product advantage.

3.4.1 Relationship Quality

For a long time the research about relationship quality focuses on B2C area, and discusses the attribute, perception, measurement and improvement of service quality mainly from consumer aspect. The current studies under B2B context are mostly based on B2C analysis methods.

3.4.1.1 Definitions of Relationship Quality

To understand the quality construct of relationship quality, it is necessary to consider the definitions of the construct and the evaluations of the dimensions that constitute the construct. A review of the relevant literature provides us a lot of definitions of relationship quality.

Gummesson, one of the earliest scholars who researched relationship quality, defines relationship quality as “quality of the interaction between a company and their clients, it can be interpreted in terms of accumulated value” (Gummesson 1987). Crosby et al. (1990) argue that “when the client is capable of trusting in the integrity of the seller and he has confidence in the future job of the seller because the past level has been satisfactory”, that is relationship quality¹¹. In the context of business purchasing, Smith (1998) provides another definition of relationship quality as “an overall assessment of the strength of a relationship and the extent to which it meets the needs and expectations of the parties based on a history of successful or unsuccessful encounters or events”. Johson (1999) considers relationship quality to be “total depth and climate of the relation between companies”. Grönroos (2000) emphasizes the interaction of relationship quality and describes relationship quality as the dynamic perception of quality that formed in the long-term interaction between enterprise and customer.

Some studies emphasize the role of relationship quality in value creation, which contains important contributions to understand the nature of this concept better. Levitt (1983) considers that the good relationship with customers is “one of hard copy intangible assets of enterprise”, and relationship quality is the important

¹¹ To understand better the Crosby's definition, it is good to know his study is based in the insurance industry and he has used an approximation based in the persons.

indicator to evaluate this asset.

Based on literature, this study defines customer relationship quality as the dynamic perception and overall assessment of the strength of a relationship which formed in the long-term interaction between enterprise and customer and the extent to which it meets the needs and expectations of the parties based on a history of successful or unsuccessful encounters or events.

3.4.1.2 Dimensions of Relationship Quality

Although relationship quality is recognized as a central construct in the relationship marketing bibliography, relatively little attention has been paid to the issues of the dimensions of relationship quality, especially in the B2B context. There is, however, general agreement from the review of relative literature that relationship quality, like service quality and product quality, is multi-dimensional. Crosby et al. (1990) were probably the earliest researchers to identify and empirically examine dimension of relationship quality, which consists of at least two dimensions: trust and satisfaction. Nevertheless, some scholars have used these consumer-based dimensions for studying B2B relationship quality, while other researchers have explored related dimensions on the basis of the dual dimensions of relationship quality (Woo and Ennew 2004). For example, Hennig-Thurau et al.(2002) take customer satisfaction and customer commitment as two key determinants of relationship quality, whereas Smith (1998) conceptualizes relationship quality as being manifest in at least three related constructs: trust, satisfaction, and commitment.

Other studies have attempted to extend the two or three dimensional structure of relationship quality by including more dimensions. For example, Dorsch et al. (1998) emphasize the importance of trust, satisfaction, commitment, minimal opportunism,

customer satisfaction, and ethical profile. Lang and Colgate (2003) suggest commitment, trust, satisfaction, social bonds and conflict as dimensions of relationship quality. Nowadays relationship quality is generally recognized in the literature as a high-order construct.

However, there is a lack of consensus about the dimensions of relationship quality in B2B context as the precise meaning of the term and about the number and nature of the first-order constructs which it comprises (Woo and Ennew 2004), because business markets or industrial markets are characterized by a higher degree of stability instead of change, long lasting relationships instead of short transactions, and closeness instead of distance between buyer and sellers (Håkansson 1982). There is intensive and deep interaction among transaction parties in B2B context, and there are many differences with character, purpose, process, perception, etc. between B2B and B2C. Although the first-order constructs focused on consumer market from the literature are commonly used in B2B relationship quality studies, whether they represent the most appropriate conceptualization for the context remains open to debate, especially when this study focuses on the relationship quality in innovation marketing processes.

After review from literature in many fields, the IMP interaction model, that provides a well established and rigorous conceptualization of relational exchange within a B2B context, is considered as an ideal framework for the development of a B2B conceptualization of dimensions of relationship quality. The research on IMP model was just undertaken in response to the criticisms of the marketing mix paradigm and traditional industrial marketing theories, which were taken account to be inadequate in explaining the reality of business marketing. The rigor of the research and the empirically grounded conceptualization are two features which make the IMP model appropriate as a basis for defining the domain of relationship quality in a B2B context.

Firstly, the IMP model takes the relationship as the analysis unit. Empirical data about over 1000 relationships were collected and analyzed in order to generate the interaction model and make the variables in the interaction model represent robust indicators of relationship quality. Secondly, the IMP model is concerned with marketers and purchasers who are both active with relationships in business markets (Ford 1997), whereas consumer based studies place the customer in a more passive role, even in relationship marketing perspectives.

In the IMP interaction model, four groups of variables were identified that describe and influence the interaction: (1) the interaction process which embraces short-term exchange episodes and long-term relationship behaviors (e.g. institutionalization and adaptation), (2) the atmosphere affecting/affected by the interaction, (3) the participants in the interaction process, and (4) the environment in which the interaction takes place (Woo and Ennew 2004). Based on these views, this study agrees that the IMP model provides a more realistic representation of the nature the relationship between companies and customers in innovation marketing processes, thus the constructors of IMP model should be better to examine company-customer interaction and hence relationship quality.

Therefore, this study agrees with Woo and Ennew (2004) and accepts relationship quality as a high-order construct which represents cooperation, adaptation and atmosphere.

Cooperation

Cooperation, or the term “institutionalization”(Halinen 1997), is defined as all activities undertaken jointly or in collaboration with others which are directed towards common interests or achieving rewards, and contains sentiments and

expectations of future behavior as well as behavioral elements (Young and Wilkinson 1997). From a B2B relationship perspective, cooperative behavior includes the coordination tasks which are undertaken jointly and singly to pursue common and/or compatible goals and activities undertaken to develop and maintain the relationship (Woo and Ennew 2004).

Adaptation

Adaptations are “behavioral or structural modifications, at the individual, group or corporate level, carried out by one organization, which are initially designed to meet specific needs of one other organization (Brennan and Turnbull 1998)”. Adaptation is considered as the defining characteristics of relationship and the extent of adaptation being made in a buyer-seller relationship should reflect the degree of relationship quality, with high levels of adaptation being consistent with high levels of relationship quality (Woo and Ennew 2004).

Atmosphere

The original IMP model defines atmosphere in terms of the power-dependence relationship between buyers and sellers, the state of conflict or cooperation, overall closeness or distance of the relationship, and the mutual expectations between the parties (Håkansson 1982; Woo and Ennew 2004). Young and Wilkinson (1997) consider that a central aspect of atmosphere is the cooperative and competitive norms (e.g. trust and opportunism) of the firms involved.

3.4.1.3 CKM Competence, Customer Interaction and Relationship Quality

In customer involved innovation marketing processes, especially when the CKM system is embedded into these processes, the interaction in all directions and the whole process between company and customer is emphasized. Therefore, the business behaviour of a company, the attitude of customers and the atmosphere surrounding the transacting parties are considered to influence on relationship quality.

Relationship profitability is one vital determinant of relationship quality. A basic assumption is that customer satisfaction drives profitability (Grönroos 2000), and the current satisfaction paradigm is based on the assumption that customers' actions are based on their perception of quality and satisfaction, that they are free to act and choose (Storbacka, Strandvik et al. 1994). In this study, customer interaction is not only used as an integration tool, but also supplied as a professional knowledge and relational service to customers by company according to CKM philosophy. According to Gummesson (1978), one of the unique features of professional service is its focus on advisory and problem-solving activities. Accordingly, if interaction is taken as professional service by companies in innovation marketing processes, customers can enjoy the cooperation atmosphere, get integration benefits from interaction processes (e.g. experience, knowledge, expected products, etc.), and perceive trust and satisfaction. Meanwhile companies also get enhanced advantages: improved customer knowledge sharing willingness and customer knowledge quality.

Based on the characteristics of customer-integrated innovation marketing processes and the conceptualization of relationship quality adopted from IMP work, the following hypotheses are proposed:

Hypothesis 4: Customer knowledge management competence in innovation marketing phases has a positive impact on customer relationship quality.

Hypothesis 5: Intensity of customer interaction in innovation marketing processes has a positive impact on customer relationship quality.

3.4.2 Knowledge Exchange Quality

Knowledge quality has been portrayed in the literature as an integral part of knowledge management success. However, this construct has received relatively little theoretical and empirical examination compared to information quality or data quality. This is partly because knowledge is very difficult to articulate and capture, while the definition and dimension of knowledge are difficult to be described and hard to come to a consensus, as well as the measurement criteria are not accurate. Both theoretical research and empirical evidence suggest that knowledge quality is positively associated with knowledge use. Therefore, this study uses knowledge exchange quality instead of knowledge quality to describe the knowledge performance of customer knowledge management and interaction effort in NPD.

3.4.2.1 Knowledge Exchange Quality

This study focuses on CKM which emphasizes CK, especially tacit knowledge, as an important element for innovation, and is concerned with the capture, representation, sharing and use of knowledge involved in dealing with the problems of innovation. However, it is very difficult to measure knowledge (particularly tacit knowledge) using accurate scales, especially when knowledge and knowledge management keep the "Wave-Particle Duality", which illustrates knowledge keeps both object attribute

and process attribute. In fact, this study tries to measure the effectiveness of knowledge sharing and information quality. Thus, we adopt the term of knowledge exchange quality to test this effectiveness, which is influenced by CKMC and relationship quality, and define knowledge exchange quality as fit for the purpose or as fitness for knowledge sharing willingness and information requirements.

From literature we know that there are distinct differences between concepts of information and knowledge, the same is for information exchange and knowledge exchange. The construct of knowledge exchange quality originates from the term of information exchange from IMP literature (Woo and Ennew 2005). In the IMP work, the concept of information exchange takes a wider perspective than the dimension of communication (i.e., simply keeping customer informed and listening to them) in the original SERVQUAL scale. It consists of two main components which are contact pattern and contents. The contact pattern includes numbers of persons involved, frequency of exchange, scope and depth, and level of formality, whereas content relates to the type of information requested and provided (Håkansson 1982).

3.4.2.2 CKMC, Customer Interaction and Knowledge Exchange Quality

The CKM system starts by making experts' knowledge explicit, and then to use this knowledge to steer data analysis to support individual and organizational learning (Argyris and Schön 1996). On the one hand, knowledge should drive what data is collected, whilst data supports the confirmation of knowledge. On the other hand, knowledge is personalized information which means tacit knowledge only becomes information if it is expressed in a processed form that can be shared. Based on both perspectives, the CKM system should allow individuals to process information in order to gain knowledge and at the same time allow them to express their personal knowledge explicitly in a sharable form. That is, this study tries to exploit the routes

from knowledge to information and from information to knowledge. Considering that this study is based on CKM implementation in innovation marketing processes, and information exchange during customer interaction is advisory for business purposes and innovation problem-solving, this study supposes that the information exchange in innovation processes can also be regarded as knowledge exchange. Therefore, this study adopts the perspectives of the IMP model and modifies the construct of information exchange to knowledge exchange. As interaction is considered as a professional service in this study, knowledge exchange between a customer and a professional service provider is expected to be frequent and formal.

Summarizing the above discussion, the following hypotheses are proposed:

Hypothesis 6: Customer knowledge management competence has a positive impact on knowledge exchange quality.

Hypothesis 7: Intensity of customer interaction has a positive impact on knowledge exchange quality.

3.4.2.3 Relationship Quality, Knowledge Exchange Quality and New Product Advantage

An important component in CKM is knowledge creation, which is supported by two key factors: (1) converting tacit knowledge of customers into explicit knowledge, and (2) translating this tacit knowledge of customers into a comprehensible form (Nonaka and Konno 1998). While tacit knowledge is much more important to product innovation, Nonaka has used a SECI¹² model to depict knowledge creation as a spiral

¹² SECI: Socialization, Externalization, Combination and Internalization.

process of interaction between explicit knowledge and tacit knowledge.

However, despite the fact that knowledge sharing is very important, a big question for the transformation from tacit knowledge to explicit knowledge rises: Since tacit knowledge is embodied in the customers' brain and can only be exploited through interaction, do customers really want to share their valuable expertise experience and skills with a company, when they have no employee obligations to the company?

Empirical results confirm that customers are willing to share knowledge, if they consider reciprocity, centrality, and have longer tenure in their field, and enjoy helping (Sun, Ju et al. 2009). In the IMP literature, Woo and Ennew (2004) present "the importance of overall atmosphere surrounding buyers and sellers is also addressed in the way that it mediates the influence of the groups of exchange variables (i.e. product/service exchange, financial exchange, information exchange and social exchange)". Anderson et al. (1997) propose that several processes and constructs of the IMP model can be constructed as compatible with the concept of operation, including value-creating exchange, mutually pre-agreed activities, part of the initiation and expansion phases in the relationship development, joint action and specific investment. All these activities and actions are underpinned by a high degree of trust and commitment- and would not be possible in the absence of such trust and commitment - from both partners (Woo and Ennew 2004).

Thus, it can be proposed as follows:

Hypothesis 8: Customer relationship quality has a positive impact on knowledge exchange quality.

Literature supports that organizational innovation is facilitated by the continuous

sourcing and renewal of knowledge, and “knowledge asset underpins competence, and the competence in turn underpins the company’s products and services offering in the market” (Styre 2002). It is also reasonable to consider that more innovative and useful knowledge from customers will influence NPD performance. Yli-Renko et al. (2001) found a significant positive relationship between knowledge acquisition and new product development. In fact, “the success of a knowledge-conscious company relies on its efficiency in creating knowledge, and its effectiveness in applying that knowledge to products and services that offer a deliverable value to customers, thereby generating a profit for the company” (Su, Chen et al. 2006). Furthermore, the use of KM for reducing the risk in NPD by collecting data from internal and external sources and extracting relevant information in order to prevent product failure is also emphasized in literature. The need to overcome “information overload” and various forms of uncertainty arising from innovation has lead to the importance of sourcing valuable knowledge.

In summary, this study builds upon previous studies to investigate whether the source of useful and innovative knowledge and knowledge exchange willingness have an impact on the level of new product advantage.

Hypothesis 9: Knowledge exchange quality has a positive impact on new product advantage.

3.5 Summary: Research Model and Hypotheses

This chapter deduces the relative relationships among each construct of this study based on literature proofs. Summarizing from the discussion in this chapter, this study sets up a research model based on structure equation modeling (SEM) which

explores the impact of CKMC in innovation marketing phases on new product advantage as follow.

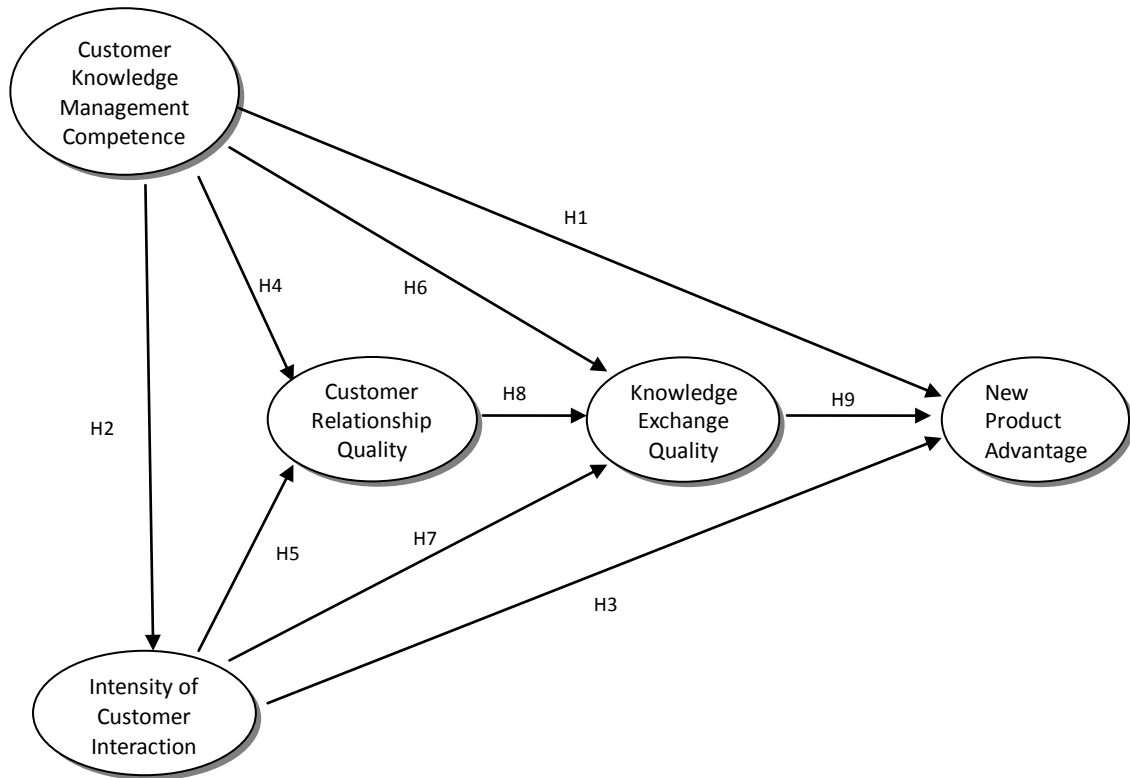


Figure 28 Theoretical Model of This Study

All hypotheses to this model are listed as following.

- Hypothesis 1:** Customer knowledge management competence has a positive impact on new product advantage.
- Hypothesis 2:** Customer knowledge management competence has a positive impact on the intensity of customer interaction.
- Hypothesis 3:** The intensity of customer interaction in innovation marketing phases has a positive impact on new product advantage.
- Hypothesis 4:** Customer knowledge management competence in innovation marketing phases has a positive impact on customer relationship quality.
- Hypothesis 5:** The intensity of customer interaction in innovation marketing processes has a positive impact on customer relationship quality.

- Hypothesis 6:** Customer knowledge management competence has a positive impact on knowledge exchange quality.
- Hypothesis 7:** The intensity of customer interaction has a positive impact on knowledge exchange quality.
- Hypothesis 8:** Customer relationship quality has a positive impact on knowledge exchange quality.
- Hypothesis 9:** Knowledge exchange quality has a positive impact on new product advantage.

Chapter IV Research Design and Methodology

The purpose of this chapter is to present the research design and the methodology used to test the theoretical model as well as proposed hypotheses. This chapter addresses the development of an appropriate research procedure including a description of the process used to perform the survey.

4.1 Research Design and Procedure

Firstly, a comprehensive literature review in concerned domains, such as CRM, KM, Customer Integration, NPD, Intellectual Capital, was performed to indentify and define research questions and objects. Case study and expert interview methods were used during preliminary research efforts to get a gross estimate of the research framework. The purposes of the case studies and interviews are: (1) to select appropriate research methodologies; (2) to develop sampling and survey administration techniques and procedures; (3) to establish the content validity of the concepts and the hypothesized relationship among the constructs; (4) to develop new appropriate measures; (5) to establish equivalence of the constructs, concepts, measures, and samples; and (6) to assess the possibility of cultural bias and response format bias (Douglas and Craig 1983; Song and Parry 1996). To this end, an interview instrument containing open-ended and semi-structured questions was prepared.

Secondly, based upon defined questions, a theoretical framework with proposed hypotheses and approaches was provided, with assistance from internal and external market research experts. Methodology selection, question measurement and scale selection, questionnaire design, sample design & size and the form of data analysis to

be used have been determined.

Third, after data collection with the finalized questionnaire, data analysis was performed. While the conceptual model is based on structural equation modeling, the main tools used for analysis are SPSS and PLS.

Finally, the findings of theoretical and empirical research were reported, followed by implications for theory and practice, as well as limitations and future research directions.

4.2 Sampling Frame and Data Collection

Sampling Frame

To test the empirical model, the companies from the supply chain of the Chinese automobile industry were selected. The sampling frame was mostly obtained from the Automobile Industry Affairs Office, a government unit managing automobile companies and their suppliers as well as distributors, in Xiangfan and Guangzhou; and partly from private contacts using the snowball sampling method. The company size in the sampling frame, measured in number of employees, ranged from 50 to more than 5000. The age of companies spanned from 5 to more than 30 years. The annual revenues of the companies varied from 10 million to 30 billion Chinese Yuan.

Sampling Methods

While the literature about CKM as well as CKMC in NPD is scarce and this study belongs partly to exploratory research, in order to get an inexpensive approximation of the truth, convenience sampling method is adopted in this study in consideration

of sample numbers and cost. Also because the desired sample characteristics are rare, and accordingly, it is extremely difficult and cost prohibitive to locate adequate respondents in these situations, snowball sampling, another nonprobability method which relies on referrals from initial subjects to generate additional subjects, is used as well, even though this comes to the expense of introducing bias, since the method itself reduces the likelihood that the sample will represent a good cross section of the population.

Key Informants

Project managers, marketing managers, R&D managers and CEOs were selected as key informants. The use of key organizational informants has been proven to be an effective approach in many research contexts (Huber and Power 1985). Typically, these respondents are seniors in their respective organizations. In this study, key informants were chosen following two established selection criteria: those in charge of some innovation projects and knowledgeable about the content of inquiry, and those who have access to, and make use of, the organization's knowledge. Therefore, the respondent profile considered ideal for this study is residing at project managers of NPD or above.

To avoid key informant bias and improve data validity (Phillips 1981), multi-informants within organizations are adopted in this study and expected to improve the quality of response data.

Sampling Process

Three waves of mails were sent to the informants in the sampling frame. The first consisted of the questionnaire of this study in paper form, while the second was the

email including greetings and a link to the online survey of this study. The informants could choose whether to fill out the document or the online questionnaire. The third was a reminder in the form of greeting card. In addition, a telephone follow-up was conducted in order to establish personal communication and to improve the response. After 6 months of sample collecting, 166 valid questionnaires in total were received for analysis¹³.

4.3 Measures and Variables

4.3.1 Constructs and Measure Development

In consideration of construct validity and the exception of top management, all variables were measured with multiple-item scales. In order to develop a research instrument with reliable and valid measures, this study adopted the Churchill's paradigm (Churchill 1979) for developing measures of the hypothesized constructs in the CKM-embedded innovation marketing model and tries to ensure the validity of measurement scales.

Measures of the constructs were developed at several stages. Firstly, based on the defined constructs, tentative measurement scales that are adequate for the purpose of this study were identified either to borrow or to develop, i.e. measurement of the constructs was accomplished via the use of both established and original scales. To maintain the integrity of the established scales, modifications were kept to the minimum necessary to address the constructs as they are conceptualized. Due to the scarcity of prior empirical research and the novelty of some constructs, new scales

¹³ More than 1000 questionnaires as well as links to online questionnaire were sent to informants. While the snowball sampling method was also used in this study considering scarce eligible samples and difficulty to reach them, the forwarded questionnaires and links could not be counted. Thus, an accurate response rate could not be calculated. An approximate rate would be proposed to be less than 15%.

had to be defined and developed. They were generated relying on the guidance obtained from the literature review and the content analysis.

Secondly, to establish content valid, a list of defined constructs and measures was submitted to a panel of six marketing, knowledge management and innovation management academicians in order to evaluate each item for clarity, specificity, and representativeness. To refine the items and get valuable suggestions, case study interviews in two selected companies were conducted.

Finally, a full survey questionnaire was finished in order to test proposed hypotheses with a list of constructs and corresponding measurement items. This was done after completing the first round of literature review, case studies and group discussions. A pretest was conducted by thirty MBA students who are managers in various companies and possess abundant project management experience. After the pretest, the questionnaire was modified according to the suggestions by the participants of the pretest, and finally, it was professionally drafted. Appendix A reports the sample items used in the questionnaire to measure each of the constructs, as well as the response format. All perceptual measures are conducted with the Likert seven-point scale with anchors 1= "fully disagree" and 7 = "fully agree".

Two types of measures are used in this study: reflective multi-item measures, i.e., observed indicators that are caused or formed by the latent constructs, and formative multi-item measures, i.e., observed indicators that cause or form the latent constructs (Bollen 1989). When observed variables are manifestations of underlying constructs, a reflective measurement is appropriate (Bagozzi and Baumgartener 1994). A formative measurement is employed in case a construct is a summary index of observed variables (Bollen and Lennox 1991; Diamantopoulos and Winklhofer 2001). Chin (1998b) gives a simple way to judge whether a construct is formative or

reflective: “Is it necessarily true that if one of the items (assuming all coded in the same direction) were to suddenly change in a particular direction, the other will change in a similar manner? If the answer is no and the items are in fact formative”.

4.3.2 Operative Definitions and Measures

4.3.2.1 Customer knowledge management competence

Customer knowledge management competence refers to the competitive organizational resources involved in implementing CKM in an organization, which composes customer knowledge process capability that generates and uses customer knowledge, and customer knowledge management infrastructure capability that integrate customer knowledge throughout the organization. This study adopts the statements of Li and Calantone (1998), Campbell (2003), Rollins and Halinen (2005) and combines the knowledge management capacity framework by Gold et al. (2001), structuring CKMC as both knowledge management infrastructure capability, which consists of Marketing-R&D interface, supportive IT system, supportive organizational structure, reward and evaluation system, senior management involvement and customer –friendly culture; and customer knowledge process capability, which consists of the capabilities of identifying, acquiring, converting, applying, innovating and protecting customer knowledge.

Table 12 Measurement of Customer Knowledge Management Competence

High-order Construct	Second Order Construct	Operational Definition	Indicators	References
Customer Knowledge Management Competence	Knowledge Management Infrastructure Capability	Internal organizational support capability for knowledge management by	Proper reward and evaluation system	Davenport(1998), Buren(1999), Campbell and Cooper(1999), Campbell (2003)
			Interaction supportive organizational structure	Gold et.al.(2001), Davenport and Klahr (1998), Rollins and Halinen(2005)

		infrastructure	senior management involvement	Campbell and Cooper(1999), Campbell (2003), Davenport (1998), Samuel (1998)
			customer –friendly organizational culture	Davenport and Prusak (1998), Gold et.al. (2001), Buren (1999), Samuel (1998), Duffy (2001), Greegard (1998), Arthur Andersen Business Consulting (1999), Sarvary (1999)
			Marketing-R&D interface	Davenport (1998), Gold et.al. (2001), Buren (1999), Campbell (2003), Duffy (2001) , Li and Calantone (1998) , Campbell (2003)
			supportive IT system	Davenport and Klahr (1998), Buren(1999), Gold et al.(2001), Greegard (1998), Arthur Andersen Business Consulting (1999), Sarvary (1999)
	Cusotmer Knowledge Process Capability	Organizational effectiveness and efficiency in customer knowledge processes	identify customer knowledge effectively within organization	Wayland and Cole (1997), Arthur Andersen Business Consulting(1999), Van Buren (1999), Bose and Sugumaran (2003)
			acquire customer knowledge from multiple channels	Buren(1999), Gold et al.(2001), Arthur Andersen Business Consulting (1999); Sarvary (1999), Wiig (1999), Gold et al. (2001)
			different units access knowledge base conveniently	Davenport(1998), Buren(1999), Arthur Andersen Business Consulting (1999), Gold et al. (2001)
			customer knowledge is widely applied	Hanley & Dawson(1999), Buren(1999), Arthur Andersen Business Consulting (1999), Tiwana (2000), Gold et al. (2001), Bose and Sugumaran (2003)
			numerous innovation project proposals	Nonaka & Takeuchi(1995), Leonard-Barton(1995), Nonaka and Takeuchi (1995), Buren(1999), Arthur Andersen Business Consulting (1999),
			Highlight customer knowledge protection	Gold et al.(2001)

4.3.2.2 Intensity of Customer Interaction

Intensity of customer interaction refers to the degree to which interactions between potential customers and the innovation team are frequent, participative, bidirectional, and involve joint problem solving (Bonner 1999). For each stage of the CKM-embedded innovation marketing model, six items chosen from Gruner and Homburg (2000) are used to measure the intensity of customer interaction, which are shown as following.

- (1) We interacted with customer beyond the standards of market research
- (2) The duration of joint work was long
- (3) Frequency of meeting with customers was high
- (4) A high number of persons were involved from customer companies
- (5) The (perceived) intensity of customer interaction was high
- (6) The number of involved companies was high.

Considering the preliminary implementation level of innovation marketing and customer integration in China, as well as the feedback from expert interviews and pretest, items (3) and (6) were taken as purposeless questions fit for cancellation. The questioned respondents also argued that item (1) was difficult to understand without a general standard and suggested to modify it. Based on this argument and repeated literature analysis, this item was reformulated as “we depended on customers’ assistance to define or refine customers’ demand frequently”. Moreover, interaction management is supposed as a professional service in innovation marketing processes, which implies that an organization actively applies relationship service and knowledge service during customer integration to enhance the relationship quality and knowledge exchange willingness. Thus, two more indicators about relational service and knowledge service were developed to reflect this purpose. The final items to measure intensity of customer interaction were

formulated as following.

Table 13 Measurement of Intensity of Customer Interaction

Construct	Operational Definition	Indicators	References
Intensity of Customer Interaction	the degree to which interactions between potential customers and innovation team are frequent, participative, bidirectional, and involve joint problem solving.	We depended on customers' assistance to define or refine customers' demand frequently	Booz, Allen & Hamilton (1981), Veryzer (1998), Gupta (1998), Song & Parry (1992), Gruner & Homburg (2000)
		Frequency of meeting with customers was high	Gruner & Homburg (2000), Veryzer (1998), Samli, Palda & Barker (1987)
		The duration of joint work was long	Gruner & Homburg (2000), Souder, Sherman & Cooper (1998)
		The (perceived) intensity of customer interaction was high	Gruner & Homburg (2000), Veryzer (1998), Samli, Palda & Barker (1997)
		We performed relational activities to care for customers frequently	Developed by his study
		We supplies knowledge support to customers frequently	Developed by his study

4.3.2.3 Innovation Marketing Phases

While NPD is usually divided into different stages, customer interaction is measured at different stages of innovation marketing. Kuczmarski (1992) argues that the partitioning of NPD stages can occur on demand, e.g. 2 stages, 4 stages, 7 stages, 10 stages, and more stages, more details for decision-makers and managers to control and supervise NPD. Based on Gruner and Homburg (2000) and Kausch et al. (2005), eight sub-phases are preferred to be adopted to distinguish the innovation marketing process in this study, which include: (1) Opportunity identification and Idea generation; (2) Idea selection; (3) Concept definition; (4) Business evaluation and selection; (5) Prototype development; (6) Prototype testing; (7) Market launch, and (8)

Market review. However, account should be taken of the preliminary development stage of innovation marketing activities in most Chinese companies. In regard of the responses¹⁴ received from the pretest, four stages were adopted in the final questionnaire:

- (1) Ideas generation and selection stage
- (2) Concept developments and evaluation stage
- (3) Prototype development and test stage
- (4) Market launch and review stage

4.3.2.4 Customer Relationship Quality

Customer relationship quality refers to the dynamic perception and overall assessment of the strength of a relationship which formed during the long-term interaction between enterprise and customer and the extent to which it meets the needs and expectations of the parties based on a history of successful or unsuccessful encounters or events. This study agrees that customer relationship quality is a high-order construct which represents cooperation, adaptation and atmosphere (Woo and Ennew 2004).

Table 14 Measurement of Customer Relationship Quality

High-order Construct	Second order Construct	Operational Definition	Indicators	References
Customer Relationship Quality	Atmosphere	The cooperative and competitive norms (e.g. trust and opportunism)	I consider the general atmosphere surrounding the working relationship with the customers as very harmonious.	Håkansson (1982), Woo and Ennew (2004)

¹⁴ Some respondents argued that they could not distinguish these so detailed sub-phases of innovation marketing, since they had even seldom become aware of the differences between these stages in practice. In addition, they complained that there were too many questions and it lasted too long to answer in the questionnaire if the innovation marketing process was separate into eight sub-phases. Therefore, sub-stages of innovation marketing process must be combined and lessened according to the characteristics of innovation activities.

		of the firms involved.	I regard the overall relationship with the customers as very close.	
			I believe mutual expectation for the project has been established with the customers.	
	Cooperation	All activity undertaken jointly or in collaboration with others which is directed towards common interests or achieving rewards	The customers cooperate closely with us in project.	Frear and Metcalf (1988), Metcalf et al.(1992), Woo and Ennew (2004)
			The customers are able to handle our requirements.	
			The customers are collaborative in resolving conflicts with us.	
	Adaptation	Behavioral or structural modifications carried out by one organization, which are initially designed to meet specific needs of one other organization	The customers constantly improve knowledge capabilities to keep abreast with new developments in the project.	Frear and Metcalf (1988), Metcalf et al. (1992), Woo and Ennew (2004)
			The customers make operational changes to project management when required by our project team.	
			The customers proactively offer us new technical solutions when conditions change.	
			The customers are able to coordinate the various knowledge disciplines when required by our project team.	

4.3.2.5 Knowledge Exchange Quality

Knowledge exchange quality refers to the fit for the purpose or fitness for knowledge sharing willingness and information requirements. This study borrows the construct of information exchange in the IMP model from Woo and Ennew (2005) and develops the construct of knowledge exchange quality. The original indicators includes: (1) The customers submit technical documentation that is easily understood by our project team; (2) The customers submit technical documentation that meets our needs; and (3) The technical information supplied by the customers is adequate. These indicators measure the explicit knowledge such as technical documentation. However, tacit knowledge from customers is much more important for CKM-embedded innovation marketing. Davenport and Prusak (1998) define knowledge as "a fluid mix of framed experience, contextual information, values and expert insight that provides a

framework for evaluating and incorporating new experiences and information." Accord with this knowledge perspective, this study attempts to view customer experience as representation of tacit customer knowledge and develops the measurement of knowledge exchange quality.

Table 15 Measurements of Knowledge Exchange Quality

Construct	Operational Definition	Indicators	References
Knowledge Exchange Quality	Fit for the purpose or fitness for knowledge sharing willingness and information requirements.	The customers submit technical documentation that is easily understood by our project team.	Woo and Ennew (2005)
		The customers submit technical documentation that meets our needs.	Woo and Ennew (2005)
		The technical information supplied by the customers is adequate.	Woo and Ennew (2005)
		The customers are willing to share their personal cognition and experience that is easily understood by our team.	Revised from Woo and Ennew (2005)
		The customers are willing to share their personal cognition and experience that meets our needs.	Revised from Woo and Ennew (2005)
		The personal cognition and experience supplied by the customers is adequate.	Revised from Woo and Ennew (2005)

4.3.2.6 New Product Advantage

New product advantage refers to a product's perceived superiority relative to competitive products (Song and Parry 1996). This study agrees with this definition from the customer perspective and adopts the scales from Song and Parry (1997a). They measured this construct with five items drawn from previous authoritative studies. These items, which are listed below, have been used in many other studies and assess the product's relative performance, quality, cost, as well as the presence of unique features and capabilities.

Table 16 Measurement of New Product Advantage

Construct	Operational Definition	Indicators	References
New product advantage	a product's perceived superiority relative to competitive products	Compared to competitive products, this product offered some unique features or attributes to customers.	Song and Parry (1996) ; Song and Parry (1997a)
		This product was clearly superior to competing products in terms of meeting customers' needs.	Song and Parry (1996) ; Song and Parry (1997a)
		This product permitted the customer to do a job or do something he could not presently do with was available.	Song and Parry (1996) ; Song and Parry (1997a)
		This product was higher quality than competing products: tighter specification, stronger, lasted longer, or more reliable.	Song and Parry (1996) ; Song and Parry (1997a)
		This product has superior technical performance than competing products.	Song and Parry (1996) ; Song and Parry (1997a)

4.4 Data Analysis Technique

Partial Least Squares (PLS) analysis was conducted to test the theoretical model and proposed hypotheses. PLS is a second-generation multivariate statistical method (Fornell and Bookstein 1982) using a principal-component-based approach for the analysis of indirectly measured causes and effects in complex behavioral systems. The reason for the use of PLS is that PLS is a powerful method of analysis that holds certain advantages: (1) it does not suffer from indeterminacy problems like other causal modeling techniques like LISREL; (2) it is a nonparametric technique and does not assume normality of the data; (3) it does not require a large sample size as other causal modeling techniques; and (4) it can be used to estimate models that use both formative and reflective indicators (Vinzi, Chin et al. 2010). Moreover, PLS can be used not only for theory confirmation, but also to suggest where relationships might or might not exist and to suggest propositions for later testing (Chin 1998a).

Like LISREL and related structural equations approaches, PLS is superior to traditional regression and factor analysis in that it offers the advantage of allowing the entire research to be tested at once. PLS estimates all paths, loadings, and Average Variance Extracted (AVE) of principal constructs and construct reliability, whilst convergent validity and discriminant validity are shown “when each item loads much higher on its assigned factor than on any other factor and when the square root of the AVE of each construct is much larger than the correlation of that construct with all other constructs” (Geri and Naor-Elaiza 2008).

The software employed for the data analysis and model testing of this study is SmartPLS 2.0 (M3) Beta developed by Ringle, Wende & Will (2005).

Chapter V Analysis and Discussions

This chapter describes the data analysis of the survey and discusses the general findings including background statistics, reliability, validity, factor loading, and measurement models. The purpose of this chapter is to explain the empirical results of the main study to test the proposed conceptual model and research hypotheses.

5.1 Descriptive Data Analysis

With the convenient sampling as well as snowball sampling and six months data collecting from August 2008 to February 2009, 166 valid questionnaires were finally received for analysis. Background information was collected as part of the survey questionnaire including firm characteristics, firm size, customer types, job characteristics and NPD projects numbers in the respective company over the last 3 years, etc.. A primary concern was whether the key respondents had enough knowledge to answer questions concerning the CKM in NPD or not.

Table 17 General Characteristics of the Sample

	category	samples	percentage
New products launch in the past 3 years	Less than 5	21	12.7%
	6 to 10	79	47.6%
	More than 10	66	39.7%
Company history	Less than 10 years	16	9.6%
	10 to 30 years	83	50.0%
	More than 30 years	67	40.4%
Company size (employee number)	Less than 500	22	13.3%
	500 to 1000	85	51.2%
	More than 1000	59	35.5%
Informant status	Vice president and above	38	22.9%
	Marketing manager (including sale manager)	56	33.7%
	R&D manager	43	25.9%
	others	29	17.5%

From the descriptive data, we can see that most respondents are managers of

marketing, R&D, or above. Most companies are state-owned enterprises, or reformed enterprises and joint ventures from state-owned enterprises. The informants should hold enough experience about product innovation and have enough recognition as well as knowledge of CRM and KM.

5.2 Reliability and Validity

The use of valid and reliable measures is a major concern prior to testing hypotheses in any empirical study. Key measures were purified one construct at a time through a process that examined their internal consistency by means of Cronbach's alpha and their convergent validity as well as discriminant validity by means of a series of confirmatory factor analysis (Churchill 1979; Anderson and Gerbing 1988).

5.2.1 Reliability

Construct reliability tests the degree to which individual items used in a construct are consistent with their measurement (Nunnally 1978). Each multi-item measure was checked by using SPSS 15.0 for reliability and unidimensionality with the final sample. Cronbach's alpha is used to test the reliability of the constructs, and a widely agreed minimum threshold for the Cronbach alpha is 0.70 (Nunnally 1978).

The following table reports the coefficient alphas for these measures, which shows that all the measures in this study are above the traditional Cronbach's alpha cutoff of 0.7 indicating acceptable inter-item consistency. These measures undergo a uni-dimensionality test using exploratory factor analysis.

Table 18 Construct Reliability of Constructs

Variables		Cronbach's α	Factor Loading	High-order Cronbach's α
Knowledge Management	idea generation and selection stage	0.835	0.9195	0.9395

Infrastructure Capability in	concept development and evaluation stage	0.829	0.9152	
	prototype development and testing stage	0.839	0.9268	
	market launch and review stage	0.820	0.9184	
Customer Knowledge Process Capability in	idea generation and selection stage	0.828	0.9196	0.9309
	concept development and evaluation stage	0.766	0.9252	
	prototype development and testing stage	0.739	0.8973	
	market launch and review stage	0.771	0.8981	
Intensity of Customer Interaction in	idea generation and selection stage	0.873	0.8939	0.9088
	concept development and evaluation stage	0.839	0.9019	
	prototype development and testing stage	0.817	0.8880	
	market launch and review stage	0.822	0.8595	
Customer Relationship Quality	Atmosphere	0.798	0.8312	0.7715
	Cooperation	0.853	0.8468	
	Adaptation	0.862	0.8070	
Knowledge Exchange Quality				0.900
New Product Advantage				0.783

Moreover, the Kaiser-Meyer-Olkin (KMO) and Bartlett's Test was performed with factor analysis using SPSS 15.0. Cronbach's α and Item-Total Correlations were used for consistency checking. Generally, KMO value should be greater than 0.5 and Bartlett's Test of Sphericity should be significant (Hair, Anderson et al. 2002) to proceed with factor analysis. If item-total correlation is too far below 0.3, this item should be cancelled. From the tables below, we can find out that all KMO values are over 0.5 as well as most KMO values over 0.7, and all the Bartlett's Tests of Sphericity are significant. All corrected item-total correlation coefficients are over 0.3 as well most of them are over 0.5. Therefore, the reliability of the constructs in this survey questionnaire is confirmed.

Table 19 Reliability and Factor Analysis of CKMC

	Item	Loading	KMO Value Bartlett's Test Significance	Corrected Item-Total Correlation	Inter-Item Correlation	Cronbach's α
Idea generation and selection stage	CKM1	.760	.836 343.224 .000	.634	0.460	0.835
	CKM2	.702		.566		
	CKM3	.792		.670		
	CKM4	.704		.561		
	CKM5	.778		.657		
	CKM6	.713		.574		
	CKM7	.705	.850 311.002 .000	.565	0.447	0.828
	CKM8	.732		.596		
	CKM9	.750		.621		
	CKM10	.694		.552		
	CKM11	.756		.624		
	CKM12	.766		.634		
Concept development and evaluation stage	CKM1	.689	.827 327.075 .000	.554	0.448	0.829
	CKM2	.684		.547		
	CKM3	.792		.665		
	CKM4	.759		.626		
	CKM5	.787		.658		
	CKM6	.698		.550		
	CKM7	.673	.805 212.275 .000	.504	0.358	0.766
	CKM8	.698		.526		
	CKM9	.676		.499		
	CKM10	.675		.511		
	CKM11	.631		.462		
	CKM12	.738		.573		
Prototype development and testing stage	CKM1	.739	.857 332.124 .000	.609	0.463	0.839
	CKM2	.681		.545		
	CKM3	.769		.644		
	CKM4	.764		.637		
	CKM5	.757		.627		
	CKM6	.751		.622		
	CKM7	.692	.787 188.631 .000	.508	0.325	0.739
	CKM8	.716		.534		
	CKM9	.572		.401		
	CKM10	.740		.556		
	CKM11	.651		.455		
	CKM12	.590		.417		
Market launch and review stage	CKM1	.708	.828 310.668 .000	.577	0.436	0.820
	CKM2	.694		.556		
	CKM3	.795		.662		
	CKM4	.754		.611		
	CKM5	.689		.540		
	CKM6	.725		.581		
	CKM7	.705	.819 217.532 .000	.539	0.361	0.771
	CKM8	.621		.449		
	CKM9	.714		.544		
	CKM10	.768		.616		
	CKM11	.693		.526		
	CKM12	.597		.428		

Table 20 Reliability and Factor Analysis of Intensity of Customer Interaction

	Item	Loading	KMO Value Bartlett's Test Significance	Corrected Item-Total Correlation	Inter-Item Correlation	Cronbach's α
Idea generation and selection stage	IIC1	.876	.854 494.484 .000	.790	.539	0.873
	IIC2	.845		.747		
	IIC3	.820		.723		
	IIC4	.748		.628		
	IIC5	.704		.587		
	IIC6	.714		.600		
Concept development and evaluation stage	IIC1	.793	.843 366.788 .000	.674	.472	0.839
	IIC2	.809		.691		
	IIC3	.711		.581		
	IIC4	.698		.561		
	IIC5	.704		.564		
	IIC6	.774		.650		
Prototype development and testing stage	IIC1	.750	.809 347.629 .000	.597	.422	0.817
	IIC2	.804		.665		
	IIC3	.838		.713		
	IIC4	.689		.545		
	IIC5	.555		.420		
	IIC6	.675		.540		
Market launch and review stage	IIC1	.790	.800 378.532 .000	.652	.431	0.822
	IIC2	.852		.736		
	IIC3	.771		.622		
	IIC4	.762		.627		
	IIC5	.648		.518		
	IIC6	.509		.380		

Table 21 Reliability and Factor Analysis of Customer Relationship Quality

	Item	Loading	KMO Value Bartlett's Test Significance	Corrected Item-Total Correlation	Inter-Item Correlation	Cronbach's α
Atmosphere	RQ1	.882	.691	.707	.571	0.798
	RQ2	.823	158.159	.608		
	RQ3	.829	.000	.619		
Cooperation	RQ4	.890	.730	.742	.662	0.853
	RQ5	.864	218.103	.698		
	RQ6	.887	.000	.738		
Adaptation	RQ7	.845	.807	.715	.609	0.862
	RQ8	.776	309.88	.623		
	RQ9	.888	.000	.781		
	RQ10	.853		.729		

Table 22 Reliability and Factor Analysis of Knowledge Exchange Quality

	Item	Loading	KMO Value Bartlett's Test Significance	Corrected Item-Total Correlation	Inter-Item Correlation	Cronbach's α
Knowledge Exchange Quality	KQ1	.807	.830 625.498 .000	.706	.606	0.900
	KQ2	.822		.731		
	KQ3	.803		.723		
	KQ4	.807		.712		
	KQ5	.867		.789		
	KQ6	.811		.728		

Table 23 Reliability and Factor Analysis of New Product Advantage

	Item	Loading	KMO Value Bartlett's Test Significance	Corrected Item-Total Correlation	Inter-Item Correlation	Cronbach's α
New Product Advantage	PA1	.792	.768 229.068 .000	.641	.423	0.783
	PA2	.717		.533		
	PA3	.703		.525		
	PA4	.744		.570		
	PA5	.713		.538		

5.2.2 Validity

Content validity, convergent validity and discriminant validity are discussed in this study.

5.2.2.1 Content Validity

Content validity refers to the extent to which a measure represents all facets of a given construct. All the constructs of this study were borrowed or developed from existing literature, and modified after expert feedback and case interview. Therefore, the constructs of this study retains content validity.

5.2.2.2 Convergent Validity

When multiple measures are used for an individual construct, the researcher should

be concerned not only with individual measurement item reliability, but also with the extent to which the measures demonstrate convergent validity. Convergent validity refers to the extent to which the same trait is measured by different methods (Carmines and Zeller 1979).

Carmines and Zeller (1979) suggest that factor analysis provides a suitable means to examine convergent validity, in which loading is used to detect whether an item appropriately loads on its predicted construct or not. Generally, loading of 0.5 or greater is considered to be significant (Hair, Anderson et al. 2002), Chin (1998a) suggests that the explanatory ability of a construct is strong when loading is over 0.7. From Table 19 to Table 23, we can see that all construct items meet or exceed the 0.5 significance-loading threshold and most loadings of items are over 0.7.

To verify this validity, this study conducts PLS analysis and gets similar results. An example report of factor analysis in idea generation and selection stage from PLS is given as follows, which shows that all construct items exceed the threshold of 0.5 significance-loading and manifests the uni-dimensionality of the constructs.

Table 24 Factor Analysis of First-order Constructs in Idea Generation and Selection Stage

	Item	Loading	t value	p value
Knowledge Management Infrastructure Capability	CKM11	0.7781	12.301	p<0.001
	CKM21	0.6979	10.424	p<0.001
	CKM31	0.7906	10.589	p<0.001
	CKM41	0.7020	8.948	p<0.001
	CKM51	0.7788	12.281	p<0.001
	CKM61	0.6974	9.312	p<0.001
Customer Knowledge Process Capability	CKM71	0.6940	9.328	p<0.001
	CKM81	0.7252	11.571	p<0.001
	CKM91	0.7609	11.307	p<0.001
	CKM101	0.6922	9.516	p<0.001
	CKM111	0.7587	9.828	p<0.001
	CKM121	0.7707	11.994	p<0.001

Intensity of Customer Interaction	IIC11	0.8660	18.773	p<0.001
	IIC21	0.8277	14.957	p<0.001
	IIC31	0.8268	12.768	p<0.001
	IIC41	0.7414	14.043	p<0.001
	IIC51	0.7245	14.554	p<0.001
	IIC61	0.7208	12.551	p<0.001
Atmosphere of Customer Relationship Quality	RQ1	0.8759	17.310	p<0.001
	RQ2	0.8239	14.831	p<0.001
	RQ3	0.8349	18.119	p<0.001
Cooperation of Customer Relationship Quality	RQ4	0.8994	16.297	p<0.001
	RQ5	0.8511	16.817	p<0.001
	RQ6	0.8882	19.847	p<0.001
Adaptation of Customer Relationship Quality	RQ7	0.8479	18.984	p<0.001
	RQ8	0.7859	16.414	p<0.001
	RQ9	0.8853	19.653	p<0.001
	RQ10	0.8431	20.574	p<0.001
Knowledge Exchange Quality	KQ1	0.7984	16.450	p<0.001
	KQ2	0.8208	19.217	p<0.001
	KQ3	0.8116	13.778	p<0.001
	KQ4	0.7997	17.736	p<0.001
	KQ5	0.8602	21.006	p<0.001
	KQ6	0.8247	18.322	p<0.001
New Product Advantage	PA1	0.7959	12.440	p<0.001
	PA2	0.7107	9.926	p<0.001
	PA3	0.7121	9.267	p<0.001
	PA4	0.7513	10.939	p<0.001
	PA5	0.6968	5.456	p<0.001

Traditionally, studies using PLS have generally reported one or both of two measures of convergent validity (also referred to as composite reliability): Cronbach's α and the internal consistency measure developed by Fornell and Larcker (1981). In addition, Average Variance Extracted (AVE) and Composite Reliability (CR) are also reported in PLS to indicate the convergent validity of constructs (Fornell and Larcker 1981). AVE is a measure of the shared or common variance in a latent variable (LV), the amount of variance that is captured by the LV in relation to the amount of variance due to its measurement error (Dillon and Goldstein 1984).

Table 25 PLS Analysis of First-order Constructs in Idea Generation and Selection Stage

	AVE	Composite Reliability	R²	Cronbach's α	Communality
Adaptation	0.7078	0.9063	0.3215	0.8616	0.7078
Atmosphere	0.7144	0.8823	0.3343	0.7996	0.7144
CKMI	0.5505	0.8799	0	0.8363	0.5505
CKMP	0.5392	0.8751	0	0.8289	0.5392
Cooperation	0.7741	0.9113	0.1705	0.8543	0.7741
IIC	0.6188	0.9064	0.6786	0.8753	0.6188
KEQ	0.6716	0.9246	0.715	0.9022	0.6716
NPA	0.5392	0.8537	0.5974	0.7858	0.5392

From the overview of the above table, we can view those AVE values of first-order constructs range from 0.539 to 0.774, which mean that they meet or exceed 0.5 - the requirement of standard value threshold. CR range from 0.853 to 0.925, thus they meet or exceed the threshold requirements of 0.7 (Fornell and Larcker 1981; Chin 1998a). Therefore, the convergent validity of the instrument is confirmed.

Second-order constructs can be approximated using various procedures. One of the easiest to implement is the approach of repeated indicators known as the hierarchical component model which is adopted in this study. In essence, a second-order factor is directly measured by observed variables for all first-order factors. This study takes the mean of first-order items as the value of items of second-order constructs¹⁵.

¹⁵ How to measure the high-order constructs with SmartPLS in a standard way has not come to a consensus in literature, even not in the online SmartPLS forum developed by Ringle, Wende & Will (2005). That means, explorations and discussions are still continuing. Here adopting the mean of first-order indicators as the value of second-order indicators still should be observed, for the analysis results showed relative high loadings of high-orders' indicators and also the correlation coefficients. In addition, most path coefficients of SEM model analyzed by SamrtPLS appear relative higher than the results using other SEM approaches, such as AMOS. More methods are recommended to process the high-order constructs of this study in the future in order to verify the results.

Table 26 Loadings of Second-order Constructs

	Item	Loading	t value	p value
Customer Knowledge Management Competence	Knowledge Management Infrastructure Capability (CKMI)	0.9532	40.366	p<0.001
	Customer Knowledge Process Capability (CKMP)	0.9505	42.692	p<0.001
Intensity of Customer Interaction	Customer Interaction Intensity in Idea Generation and Selection stage	0.8939	24.392	p<0.001
	Customer Interaction Intensity in Concept Development and Evaluation stage	0.9020	27.016	p<0.001
	Customer Interaction Intensity in Prototype Development and Testing stage	0.8879	23.458	p<0.001
	Customer Interaction Intensity in Market Launch and Review stage	0.8595	21.574	p<0.001
Customer Relationship Quality	Atmosphere	0.8294	22.092	p<0.001
	Cooperation	0.8465	26.061	p<0.001
	Adaptation	0.8091	21.884	p<0.001
Knowledge Exchange Quality	KQ1	0.7990	16.747	p<0.001
	KQ2	0.8214	18.805	p<0.001
	KQ3	0.8109	14.587	p<0.001
	KQ4	0.7997	17.079	p<0.001
	KQ5	0.8607	20.881	p<0.001
	KQ6	0.8238	20.195	p<0.001
New Product Advantage	PA1	0.7924	11.739	p<0.001
	PA2	0.7121	11.207	p<0.001
	PA3	0.7126	9.606	p<0.001
	PA4	0.7548	11.231	p<0.001
	PA5	0.6949	5.385	p<0.001

Still, all construct items exceed the threshold with 0.5 significance-loading and most of them are over 0.7. This result manifests the uni-dimensionality of second-order constructs.

Table 27 PLS Analysis of Second-order Constructs

	AVE	CR	R ²	Cronbach's α	Communality
CKM	0.0000	0.0000	0.0000	0.0000	0.9046

IIC	0.7849	0.9359	0.7065	0.9088	0.7849
KEQ	0.6716	0.9246	0.7121	0.9022	0.6716
NPA	0.5391	0.8537	0.6062	0.7858	0.5391
CRQ	0.6864	0.8678	0.4770	0.7715	0.6864

In this table we can view that all AVE values of first-order constructs range from 0.539 to 0.785, and they meet or exceed the requirements of 0.5 standard value threshold.¹⁶ Whilst CR values range from 0.853 to 0.935, which meet or exceed the threshold requirements of 0.7 (Fornell and Larcker 1981; Chin 1998a). Therefore, the convergent validity of the second-order construct is confirmed.

5.2.2.3 Discriminant Validity

Discriminant validity is defined as the extent to which measures traits of a given construct are distinct from measures of other constructs in the same model (Carmines and Zeller 1979). One way to test discriminant validity is to assess whether the items that measure a construct do not correlate too highly with measures from other constructs from which they are supposed to differ (Churchill 1979). In a PLS context, one criterion for adequate discriminant validity is that a construct should share more variance with its measures than it shares with other constructs in a given model (Hulland 1999).

SmartPLS supplies cross loadings of items as one of the methods to judge the discriminant validity of constructs. From the tables below, we can see that the respective item-loadings of each first-order construct are greater than other item-loadings correlated to this factor. The same goes for the second-order constructs.

¹⁶ Because customer knowledge management competence is proposed as formative construct in this study, there is no AVE and CR value reported in the PLS analysis.

Table 28 Cross Loadings of First-order Constructs in Idea Generation and Selection Stage

	CKMI	CKMP	IIC	Atmosphere	Cooperation	Adaptation	KQ	NPA
CKM11	0.7781	0.6166	0.5271	0.4495	0.3566	0.5730	0.4924	0.5836
CKM21	0.6979	0.5739	0.5086	0.2311	0.1960	0.4711	0.2927	0.4375
CKM31	0.7906	0.6594	0.6060	0.3479	0.3252	0.3855	0.4099	0.5439
CKM41	0.7020	0.5170	0.5554	0.4887	0.2879	0.2616	0.3182	0.4205
CKM51	0.7788	0.6586	0.5984	0.4477	0.2756	0.4300	0.3738	0.4548
CKM61	0.6974	0.5777	0.5720	0.3752	0.2300	0.1913	0.3112	0.4058
CKM71	0.5141	0.6940	0.5091	0.1843	0.1780	0.4347	0.2496	0.4337
CKM81	0.5995	0.7252	0.5716	0.2994	0.1899	0.3854	0.3224	0.4722
CKM91	0.6281	0.7609	0.6389	0.4122	0.2636	0.4228	0.4054	0.5208
CKM101	0.6076	0.6922	0.5634	0.4716	0.2334	0.2322	0.3330	0.3800
CKM111	0.6228	0.7587	0.6493	0.4008	0.3027	0.3109	0.3072	0.4629
CKM121	0.5950	0.7707	0.6035	0.3027	0.3285	0.4554	0.3918	0.5346
IIC11	0.6036	0.6603	0.8660	0.4703	0.2828	0.4238	0.4510	0.5690
IIC21	0.5640	0.6108	0.8277	0.3936	0.1965	0.3431	0.3277	0.4945
IIC31	0.5936	0.6666	0.8268	0.4538	0.3525	0.5312	0.4494	0.5850
IIC41	0.5858	0.5651	0.7414	0.5133	0.3236	0.3102	0.3932	0.4593
IIC51	0.6232	0.6579	0.7245	0.3796	0.3841	0.4925	0.4420	0.5174
IIC61	0.5796	0.6247	0.7208	0.3706	0.2813	0.3548	0.3278	0.5084
RQ1	0.4312	0.3739	0.4784	0.8759	0.5779	0.4127	0.5762	0.5192
RQ2	0.4684	0.4334	0.4837	0.8239	0.4430	0.4833	0.5508	0.4903
RQ3	0.4431	0.3925	0.4296	0.8349	0.4837	0.2943	0.6202	0.4634
RQ4	0.3718	0.3244	0.3718	0.5623	0.8994	0.4943	0.6628	0.5301
RQ5	0.2768	0.2707	0.3094	0.4890	0.8511	0.4616	0.5529	0.4436
RQ6	0.3501	0.3089	0.3447	0.5115	0.8882	0.4597	0.6158	0.4480
RQ7	0.4620	0.4430	0.4348	0.3999	0.4598	0.8479	0.6278	0.5167
RQ8	0.4475	0.3870	0.4057	0.4526	0.4547	0.7859	0.5988	0.4828
RQ9	0.4425	0.4328	0.4557	0.4148	0.5039	0.8853	0.6408	0.5533
RQ10	0.4329	0.4542	0.4828	0.3029	0.3801	0.8431	0.5237	0.4714
KQ1	0.4366	0.4283	0.5022	0.6167	0.5232	0.4847	0.7984	0.4864
KQ2	0.4323	0.3786	0.4238	0.5946	0.5671	0.5177	0.8208	0.5779
KQ3	0.3087	0.2894	0.3153	0.4881	0.5845	0.6582	0.8116	0.5165
KQ4	0.5113	0.4696	0.5402	0.5281	0.5215	0.5459	0.7997	0.4938
KQ5	0.4066	0.3134	0.3810	0.6539	0.6051	0.5145	0.8602	0.4769
KQ6	0.3844	0.3897	0.3742	0.5187	0.6147	0.7536	0.8247	0.6024
PA1	0.5036	0.5241	0.5102	0.4840	0.4759	0.4853	0.5471	0.7959
PA2	0.4491	0.4430	0.4983	0.4236	0.3101	0.2859	0.4062	0.7107
PA3	0.4299	0.4714	0.4739	0.3000	0.4102	0.6315	0.5025	0.7121
PA4	0.5525	0.4933	0.5321	0.5223	0.4264	0.4447	0.4869	0.7513
PA5	0.4255	0.4061	0.4327	0.3909	0.3449	0.3441	0.4087	0.6968

Table 29 Cross Loadings of Second-order Constructs

	CKM	IIC	RQ	KQ	NPA
CKMI_A	0.9642	0.7912	0.6391	0.5456	0.6827
CKMP_A	0.9378	0.8092	0.6045	0.4983	0.6582
IIC_A1	0.7973	0.8939	0.5911	0.5081	0.6664
IIC_A2	0.7619	0.9021	0.6510	0.5877	0.6622
IIC_A3	0.6870	0.8879	0.5884	0.5098	0.5875
IIC_A4	0.7202	0.8595	0.5372	0.3869	0.5346
RQ_A1	0.5921	0.5906	0.8297	0.6911	0.5804
RQ_A2	0.4735	0.4719	0.8466	0.6950	0.5402
RQ_A3	0.5554	0.5953	0.8087	0.7091	0.6021
kq1	0.5091	0.4973	0.6540	0.7991	0.4864
kq2	0.4909	0.4576	0.6749	0.8215	0.5781
kq3	0.3525	0.3916	0.6966	0.8108	0.5158
kq4	0.5116	0.5576	0.6407	0.7997	0.4943
kq5	0.4255	0.4149	0.7115	0.8607	0.4765
kq6	0.4298	0.4752	0.7592	0.8238	0.6020
pa1	0.5409	0.5176	0.5794	0.5469	0.7921
pa2	0.4976	0.5059	0.4118	0.4065	0.7126
pa3	0.4824	0.5305	0.5423	0.5017	0.7116
pa4	0.6070	0.5430	0.5610	0.4869	0.7553
pa5	0.4474	0.4489	0.4359	0.4087	0.6952

In addition, another possible way to roughly assess discriminant validity is by using the estimated path coefficients, which means the root AVE values should be all larger than the path coefficients they estimate (Cool, Dierickx et al. 1989; Fornell, Lorange et al. 1990). We can use the table below to check whether the square root of AVE of each factor is greater than the correlation coefficients between constructs.

Table 30 Correlation Matrix and Descriptive Statistics of Variables

	AVE	CR	R ²	Cronbach's α	CKM	IIC	KQ	NPA	RQ
CKM	0.0000	0.0000	0.0000	0.0000	1.0000	0	0	0	0
IIC	0.7849	0.9359	0.7065	0.9088	0.8405	0.8859	0	0	0
KQ	0.6716	0.9246	0.7121	0.9022	0.5487	0.5668	0.8195	0	0
NPA	0.5391	0.8537	0.6062	0.7858	0.7045	0.6952	0.6444	0.7342	0
RQ	0.6864	0.8678	0.4770	0.7715	0.6535	0.6704	0.8438	0.6950	0.8285

Numbers in bold are square roots of AVE.

As shown in the table above, the bold values at cater-corner right side are square root of AVE values. We can find out the square root of AVE of knowledge exchange quality is less than the correlation coefficient between knowledge exchange quality and customer relationship quality. There are some significant inter-correlations between variables and two correlation coefficients are over the level which is considered to be serious, which is generally accepted as 0.80 or higher (Licht 1995). It indicates that some problems exists in the discriminant validity of second-order constructs and should be discussed to check whether the components of second-order constructs are valid or not.

5.3 Structural Equation Modeling Analysis

The model is tested using the Partial Least Squares (PLS) method in SmartPLS. Given the sample size and data distribution of this study, PLS, which has less stringent requirements for sample sizes and residual distributions as well as compatibility of both formative and reflective indicators, is the proper choice for this study.

LISREL and other covariance structure analysis modeling approaches involve parameter estimation procedures which seek to reproduce as closely as possible the observed covariance matrix. In contrast, PLS has as its primary objective the minimization of error (or, equivalently, the maximization of variance explained) in all endogenous constructs (Hulland 1999). R^2 values can be examined for the endogenous constructs to determine the degree to which any particular PLS model accomplishes this objective, while no proper overall goodness-of-fit measures exist for models estimated using PLS. In bootstrapping, Chin (1998a) suggests 500 random samples generated from the original dataset by sampling with replacement.

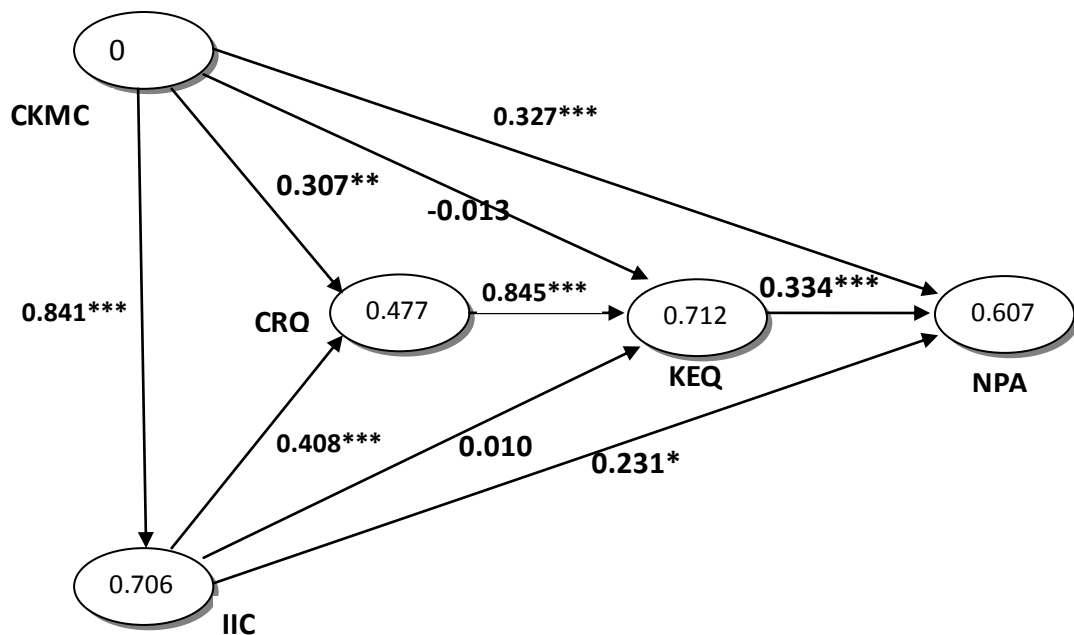


Figure 29 Standardized PLS Path Coefficients Model

Notes: CKMC represents customer knowledge management competence
 IIC represents intensity of interaction with customers (customer interaction intensity)
 CRQ represents customer relationship quality
 KEQ represents knowledge exchange quality
 NPA represents new product advantage
 *** Correlation is significant at the 0.001 level
 ** Correlation is significant at the 0.01 level
 * Correlation is significant at the 0.05 level
 n=166

The above figure shows the standardized PLS path coefficients model. The coefficients and significance are shown next to the arrows. The R^2 values are shown inside the box of the relevant constructs. Generally, when in a model AVE values are greater than 0.5, Cronbach's α are greater than 0.7, and CRs are greater than 0.7, the model is acceptable (Rossiter 2002). Table 30 describes that the AVE values are all over 0.5, all Cronbach's α of constructs are over 0.7 and CRs are over 0.8, therefore, this model is satisfied.

As expected by literature and discussion, CKMC influences customer interaction

intensity and customer relationship quality, as well as new product advantage, while customer interaction intensity also positively influences customer relationship quality and new product advantage. Hence, hypotheses H1, H2, H3, H4, H5, H8, H9, which are based on CKM-embedded innovation marketing, are supported. However, two paths between CKMC and knowledge exchange quality as well customer interaction intensity and knowledge exchange are insignificant. It seems that CKMC and customer interaction intensity does not have a direct significant effect on knowledge exchange quality. Hence, H6, H7 are rejected. Nevertheless, CKMC and customer interaction intensity have strong indirect effect on knowledge exchange quality via customer relationship quality. Furthermore, customer relationship quality strongly affects knowledge exchange quality directly and new product advantage indirectly.

Table 31 Overview of Hypotheses Test

	Hypotheses	Path coefficient	T Value	Result
H1	Customer knowledge management competence has a positive impact on new product advantage.	0.327	3.228***	supported
H2	Customer knowledge management competence has a positive impact on intensity of customer interaction.	0.841	38.865***	supported
H3	The intensity of customer interaction in innovation marketing phases has a positive impact on new product advantage.	0.231	2.264*	supported
H4	Customer knowledge management competence in innovation marketing phases has a positive impact on customer relationship quality.	0.307	2.946**	supported
H5	Intensity of customer interaction in innovation marketing processes has a positive impact on customer relationship quality.	0.408	3.931***	supported
H6	Customer knowledge management competence has a positive impact on knowledge exchange quality.	-0.013	0.176	rejected
H7	Intensity of customer interaction has a positive impact on knowledge exchange quality.	0.010	0.131	rejected
H8	Customer relationship quality has a positive impact on knowledge exchange quality.	0.845	15.048***	supported
H9	Knowledge exchange quality has a positive impact on new product advantage.	0.334	4.652***	supported

5.4 Discussion and Model Adjustment

5.4.1 Discussion and Model Modification

As mentioned in 5.2.2.3, there is one problem with discriminant validity regarding the constructs of customer relationship quality and knowledge exchange quality: the square root value of AVE for knowledge exchange quality is lower than the correlation coefficients between knowledge exchange quality and customer relationship quality. Moreover, the correlation coefficient between these two constructs is too high to exceed the serious threshold with 0.8 (Licht 1995). Hereby we must reflect whether these two constructors describe the same thing or not.

Reviewing the research procedure, this study developed CKMC in NPD from knowledge perspective and relationship perspective, while constructs of customer relationship quality as well as knowledge exchange quality was developed respectively to assess the degree of relationship quality as well as knowledge quality. In fact, these two constructs were both borrowed from IMP literature (Woo and Ennew 2004; Woo and Ennew 2005). In line with Woo and Ennew (2005), six interaction dimensions, such as product/service exchange, financial exchange, information exchange, social exchange, cooperation and adaptation, were chosen to measure the construct of professional service quality and represent a broad spectrum of activities that are performed by the representatives of both buyer and seller in business market. The first four dimensions represent the essentials of encounter-specific interaction while the final two incorporate elements reflecting the development and evolution of those interactions (Woo and Ennew 2005). Therefore, the constructs of customer relationship quality and knowledge exchange quality in this study, in essential, account for the same thing and need to be combined. This

study adopts the term of knowledge relationship (Athanasopoulou 2006; Gummesson 2008) to define this focal type of relationship for new product and service development, which is used to create knowledge, and develops a new construct named knowledge relationship quality to measure this relationship.

Moreover, from data analysis we can view that there is a high correlation (over 0.8) between constructs of CKMC and intensity of customer interaction, while the value of their cross loading is also great. This is probably because the interaction management is considered as the core characteristic of CKM in this study and this ideology penetrates concept development as well as measurement development, which means that some limitations might exist because of scale representation.

Theoretically, these two constructs should also be combined into one construct. However, CKMC is a kind of internal organization competence, which we can view it mostly from technology perspective, while customer interaction is a business approach which is viewed mostly from people perspective. Therefore, despite of probable scale deviation, this study still takes CKMC and customer interaction intensity as two separate constructs in the modified model shown below in order to observe the role of customer interaction in the theoretical model.

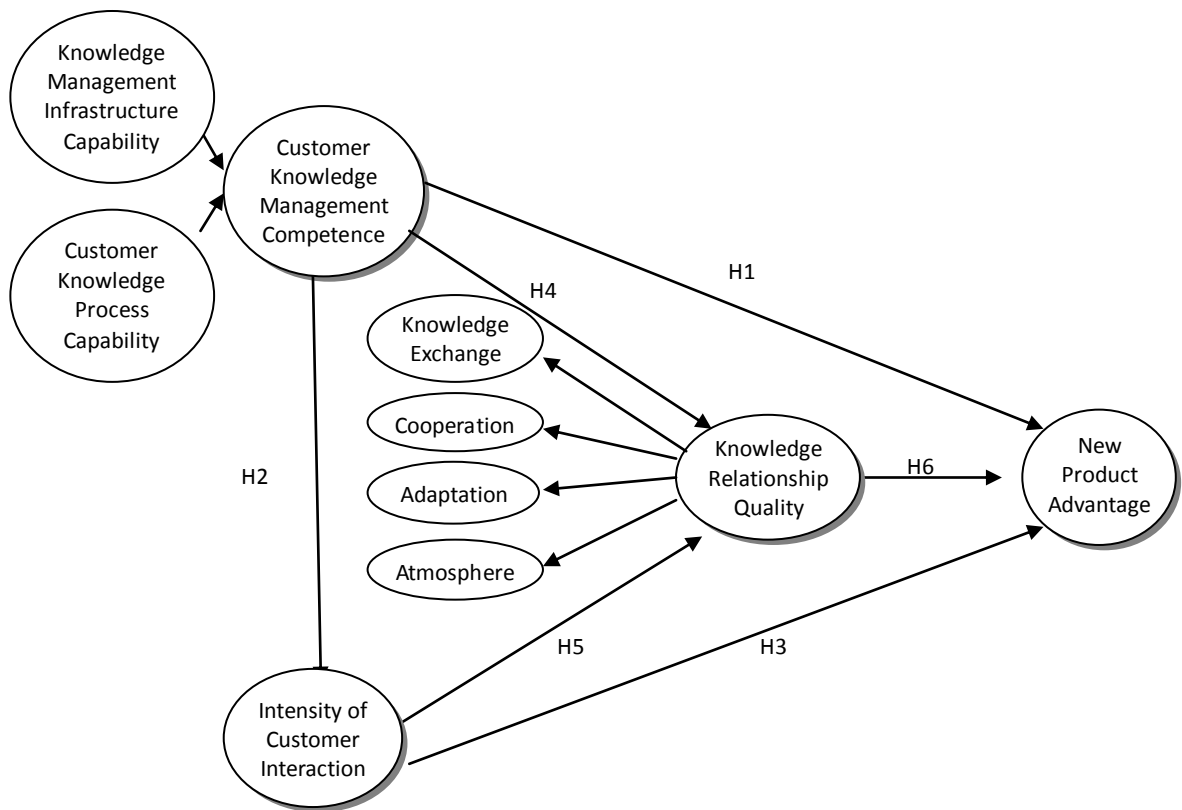


Figure 30 Modified Theoretical Model

Accordingly, the proposed hypotheses are:

- Hypothesis 1:** Customer knowledge management competence has a positive impact on new product advantage.
- Hypothesis 2:** Customer knowledge management competence has a positive impact on intensity of customer interaction.
- Hypothesis 3:** The intensity of customer interaction in innovation marketing phases has a positive impact on new product advantage.
- Hypothesis 4:** Customer knowledge management competence in innovation marketing phases has a positive impact on knowledge relationship quality.
- Hypothesis 5:** Intensity of customer interaction in innovation marketing processes has a positive impact on knowledge relationship quality.
- Hypothesis 6:** Knowledge relationship quality has a positive impact on new product advantage.

5.4.2 Data Analysis of Modified Model

We run SmartPLS again to test the modified model. Some parameters are reported as following.

Table 32 Cross Loadings of Constructs for Modified Model

	CKM	IIC	KRQ	NPA
CKMI_A	0.9527	0.7913	0.6322	0.6827
CKMP_A	0.9510	0.8095	0.5935	0.6588
IIC_A1	0.8009	0.8946	0.5869	0.6663
IIC_A2	0.7610	0.9007	0.6540	0.6623
IIC_A3	0.6895	0.8871	0.5864	0.5878
IIC_A4	0.7220	0.8610	0.5097	0.5345
KQ_A	0.5472	0.5656	0.9225	0.6455
RQ_A1	0.5860	0.5904	0.8156	0.5802
RQ_A2	0.4716	0.4713	0.8236	0.5410
RQ_A3	0.5592	0.5951	0.8096	0.6041
pa1	0.5406	0.5172	0.5898	0.7935
pa2	0.4951	0.5059	0.4240	0.7078
pa3	0.4888	0.5301	0.5508	0.7148
pa4	0.6032	0.5430	0.5573	0.7557
pa5	0.4437	0.4488	0.4427	0.6942

Table 33 Correlation Matrix and Descriptive Statistics of Variables for Modified Model

	AVE	CR	R ²	Cronbach's α	CKM	IIC	KR	PA
CKM	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000
IIC	0.7850	0.9359	0.7052	0.9088	0.8408 ^{***}	0.8860	0.0000	0.0000
KRQ	0.7187	0.9271	0.4653	0.9009	0.6440 ^{**}	0.6620 ^{***}	0.8441	0.0000
NPA	0.5390	0.8536	0.6141	0.7858	0.7048 ^{**}	0.6950 [*]	0.7049 ^{***}	0.7342

*** Correlation is significant at the 0.001 level

** Correlation is significant at the 0.01 level

* Correlation is significant at the 0.05 level

N=166

Reliability and validity are observed firstly. From the tables above, we can see that :

(1) the AVE values of constructs range from 0.5390 to 0.7850 and all over the

threshold value of 0.5 (Hair, Anderson et al. 2002); (2) the CR values range from 0.8536 to 0.9359 and all exceed the 0.7 threshold value (Chin 1998a); (3) all the Cronbach's α values are over 0.7; (4) loadings on other constructs are less than the loadings on the assigned construct, and (5) Square root of AVEs of constructs are greater than the correlations coefficients. With these results, the reliability, convergent validity and discriminant validity of the modified model are qualified.

5.4.3 Hypotheses Testing of Modified Model

The following Figure represents the hypothesized relationships embedded in the modified theoretical model, while Table 34 summarized the hypotheses testing results are shown with standardized path coefficients and t-value for each parameter.

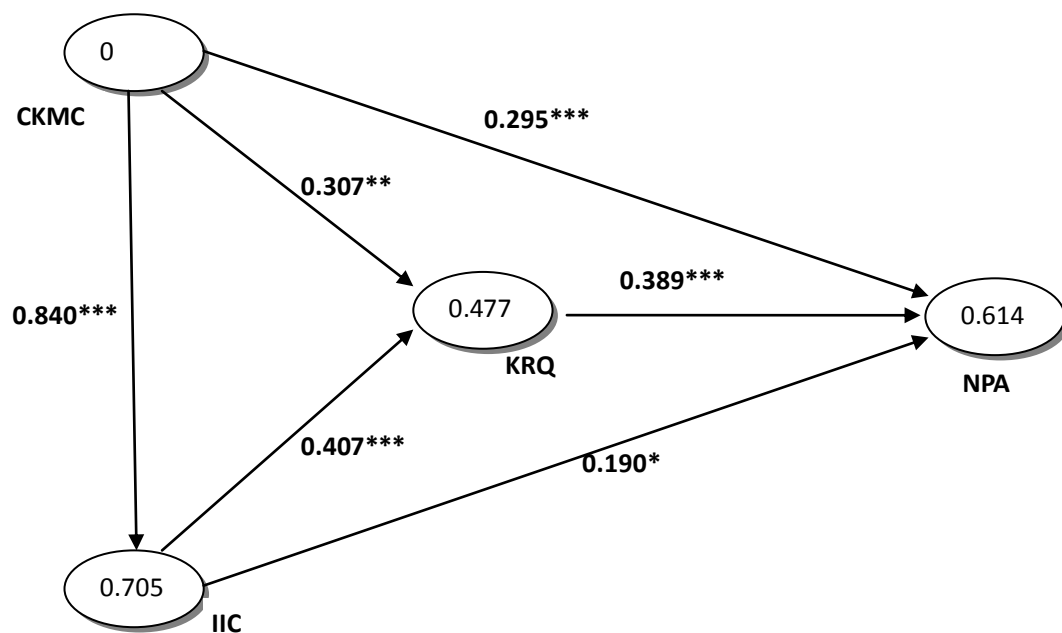


Figure 31 Standardized PLS Path Coefficients of Modified Model

- Notes: CKMC represents customer knowledge management competence
 IIC represents intensity of interaction with customers (customer interaction intensity)
 KRQ represents knowledge relationship quality
 NPA represents new product advantage
 *** Correlation is significant at the 0.001 level
 ** Correlation is significant at the 0.01 level
 * Correlation is significant at the 0.05 level

n=166

According to the standardized PLS path coefficients of modified model, we can view that all related hypotheses are proven. Still, the indirect influence of CKMC on new product advantage via knowledge relationship quality is greater than the direct influence.

Table 34 Overview of Hypotheses Testing

	Hypotheses	Path Coefficient	T Value	Result
H1	Customer knowledge management competence has a positive impact on new product advantage.	0.295	2.896**	supported
H2	Customer knowledge management competence has a positive impact on intensity of customer interaction.	0.840	36.431***	supported
H3	The intensity of customer interaction in innovation marketing phases has a positive impact on new product advantage.	0.190	1.906*	supported
H4	Customer knowledge management competence in innovation marketing phases has a positive impact on knowledge relationship quality.	0.307	2.812**	supported
H5	Intensity of customer interaction in innovation marketing processes has a positive impact on knowledge relationship quality.	0.407	3.591***	supported
H6	Knowledge relationship quality has a positive impact on new product advantage.	0.389	4.059***	supported

Chapter VI Contributions to Theory and Management

“Although every organization has its own definition of its customers and how they would like to use knowledge to enhance their customer relationships, all organizations seek to do one of four things in CKM: develop knowledge about customer; use knowledge to support customer and enhance their experience with the firm, learn from customers; and co-create new knowledge. CKM is not a tool (like CRM), but a process that is designed to capture, create and integrate knowledge about and for customers on a dynamic basis.”(Smith and McKeen 2005)

The purpose of this final chapter is to summarize the results and present contributions of this study. Firstly, the findings of empirical research are discussed. Following, this chapter presents the implications for research and practice. Furthermore, discussions toward some of the research limitations and possible directions for future research are addressed. Last, an overall conclusion is given.

6.1 Discussion of the Findings

This study began with the arguments that: (1) product innovation should be linked with customer knowledge by customer integration, (2) customer knowledge and customer relationship should be managed well, and (3) in order to address the importance of customer knowledge in innovative product development, this study tries to conceptualize CKM and CKMC and propose a CKM-embedded innovation marketing framework by presenting a taxonomy of customer knowledge, as well as an infrastructure and processes of how to generate and use customer knowledge in each innovation stage.

Based on literature review and empirical research, this study tries to summarize the high synergy potential between CRM and KM, and to provide an integrated framework of CKM as well as the competence it requires, which can not only improve the innovation performance, but also enhance long-term valuable customer relationship quality. Also, the findings strongly support that companies may possess a predisposition for successful product innovation through the development of CKM systems and the cultivation of CKMC.

6.1.1 CKMC and New Product Advantage

As predicted, CKMC is found to have a significant effect on new product advantage (path coefficient of initial model: $\gamma=0.327$, $t=3.228$, $p<0.001$; path coefficient of modified model: $\gamma=0.295$, $t=2.896$, $p<0.01$). Moreover, it could be shown that CKMC influences new product advantage not only directly, but also, and even more strongly in an indirect way. The data report shows that CKMC impacts customer interaction intensity and customer relationship quality much more significantly, just as customer interaction intensity also influences customer relationship quality distinctly, and customer relationship quality (or knowledge relationship quality in modified model) affects new product advantage prominently.

These findings emphasize the strategic significance of CKMC in NPD projects. Since the added value and quality of a product is perceived by customers, it is paramount that a company has a thorough understanding of customers' needs and expectations. CKM is such a system that listens to the voice of customers with interactive approaches and allows companies not only to effectively identify customer needs and preferences, but also compares performance against customer expectation and perception (Al-Shammari 2009). Thus, CKMC helps companies with delivering high

quality products which meet customers' needs and expectations, and moreover, with identifying patterns and trends that can guide future strategies.

6.1.2 CKMC, Customer Interaction and New Product Advantage

From the PLS analysis, we can observe that CKMC affects customer interaction intensity prominently (path coefficient of initial model: $\gamma=0.841$, $t=38.865$, $p<0.001$; path coefficient of modified model: $\gamma=0.840$, $t=36.431$, $p<0.001$), and customer interaction influences new product advantage positively but not so strongly (path coefficient of initial model: $\gamma=0.231$, $t=2.264$, $p<0.05$; path coefficient of modified model: $\gamma=0.190$, $t=1.906$, $p<0.05$).

According to the high correlation coefficient of CKMC and customer interaction intensity, CKMC does almost not differ from the construct of customer interaction intensity. This is probably because this study emphasizes interaction management as the core characteristic of CKM and there are great synergies between them, and maybe it also suffers from the small sample size. By considering CKMC mostly from the technology (or organization) perspective and customer interaction from the people perspective, this study neglects the multicollinearity temporarily and puts them together in the structural equation model, in order to test their effects to other factors respectively.

The more companies know about their customers, the better they can serve them. Meanwhile, the more customers know about and experience companies' business, the more attention and involvement is likely to be provided by these customers. Therefore, customer interaction intensity is expected to have a positive impact on new product advantage. Interestingly, this impact is not as strong as the other paths,

especially when compared to the prominent effect of relationship quality no new product advantage. It implies that customer integration can't guarantee the certain success of innovations, while customer interaction brings both chances and challenges to companies. Thus, one important mission for CKM and interaction management is to manage customers and knowledge systematically to minimize the risk of customer integration while improving innovation success.

To achieve the competitive advantage comparing to competitors and work with quality, it is not only necessary to continually observe the expectations and perceptions that customers have about the delivered products, but also essential to continually interact with customer in order to exploit and use their tacit knowledge for product innovation.

6.1.3 Middle Outcomes

CKMC has a positive influence on customer relationship quality (path coefficient of initial model: $\gamma=0.307$, $t=2.946$, $p<0.01$) as well as knowledge relationship quality (path coefficient of modified model: $\gamma=0.307$, $t=2.812$, $p<0.01$). It manifests that the adoption of customer-focused strategies and CKM practices significantly increase an organization's capability to satisfy customers during integration.

Customer interaction intensity impacts customer relationship quality significantly (path coefficient: $\gamma=0.408$, $t=3.931$, $p<0.001$) and knowledge relationship quality in the modified model positively as well (path coefficient: $\gamma=0.407$, $t=3.591$, $p<0.001$). It confirms that the new perspective of customer interaction as a professional service plays a role in fostering enhanced customer relationship and encouraging customers' involvement and cooperation.

However, there is no significance relationship between CKMC and knowledge exchange quality (path coefficient: $\gamma = -0.013$, $t = 0.176$, $p > 0.05$), as well as customer interaction intensity and knowledge exchange quality (path coefficient: $\gamma = 0.010$, $t = 0.131$, $p > 0.05$). Meanwhile, customer relationship quality has a strong effect on knowledge exchange quality (path coefficient: $\gamma = 0.845$, $t = 15.048$, $p < 0.001$).

The lack of direct effect of CKMC and customer interaction intensity on knowledge exchange quality was surprising but not unexplainable. From this finding, it can be speculated that customer knowledge about new product advantage is less directly acquirable by company's traditional business process. In consideration that CKMC and customer interaction intensity all have significant influence on customer relationship quality, this study proposes that in the Chinese business environment customers share their knowledge mostly after customer commitment and satisfaction. It is also logical to deduce that enhanced customer relationship quality will improve the customers' knowledge exchange willingness and accordingly the knowledge quality devoted to product innovation.

Moreover, while the indirect impact of CKMC on customer relationship quality via customer interaction intensity is stronger than the direct impact, it implies that customer interaction plays an important role in customer relationship cultivation and knowledge exchange willingness. It indicates that the extended knowledge network needs relational investments and management commitment, for the customers should not have the feeling they are working for free¹⁷, because in that situation they can be more committed and active. That is, the customers must have the motivation for working in such an integrated knowledge network, at least from relational reward and knowledge benefit aspects.

¹⁷ Financial or nonmaterial rewards are proposed to be expected by customers.

6.2 Implications for Research

This study contributes to our understanding of the CKMC in innovation marketing process or in NPD in several important ways.

First, this study reflects CRM and the customer-integrated innovation processes from three aspects: customer, relationship, and management. This study acknowledges the importance of CRM to business despite of its high failure rate, and finds out that the key myth of CRM is interpreted by each word of CRM itself, that is, each of the three words from Customer Relationship Management has a particular indication: “Customer” provides the direction, “Relationship” gives the focus, and “Management” represents the approach. Passive product consumers vs. active innovation partners, short-term transactional relationship vs. long-term knowledge relationship, still data mining vs. dynamic customer knowledge management are discussed following these hints in this study. These indications give us a new perspective to review CRM in customer-integrated innovation processes, which lead to a trigger pulse for an integrated knowledge-enabled CRM framework and a relationship-centered KM approach.

Second, this study develops a conceptual framework to interpret the concepts of CKM and CKMC. This study observes that knowledge as well as knowledge management has the “wave-particle duality”, that is, KM is not simply a form of object management but also a form of people-oriented process management. Working along with this perspective, this study has demonstrated the utility of a CKMC framework with infrastructure and process capabilities for operationalizing salient aspects of key variables. This study takes CKM as the complement and improvement to CRM, but not denial and replacement of CRM. The “wave-particle duality” or “object-process duality” of CKM will help companies reflect traditional

CRM programs and cultivate dynamic capacities to achieve the customer satisfied solutions and serve customers better.

Third, this study validates the conceptualization of CKMC and tests its impact on new product advantage as well as other factors in the theoretical model using data collected from managers of companies from the Chinese automobile industry. The results indicate that CKMC influences new product advantage not only directly but also in indirect ways via customer interaction and customer relationship quality (or knowledge relationship quality). This finding is significant to reflect the role of relationship activities and reveal more operational paths to implement CKM.

Fourth, this study reflects the role of customer relationship in customer-integrated innovation to help understand synergy of CRM and KM. While some studies have stated CKM's positive impact on business performance and some studies have examined innovation improvements in NPD, not so many studies have explored relationship activities and relationship quality improvements in customer-integrated NPD. In particular, this study focuses attention on the relational transmission path from customer integration to new product advantage. That is, instead of the short-time transactional relationship in CRM, long-term interactional partnership relationship is focused upon in CKM in order to improve innovation performance.

Fifth, this study reflects the characteristics of customer knowledge important to innovation and tries to exploit and use of tacit customer knowledge that can only be acquired in an interactive way. CRM helps organizations with collecting enormous amounts of transactional information from customers, but this silent, passive data can't help organizations truly understand customers and cultivate profitable long-term relationship. Therefore, emphasizing tacit knowledge from customers based on effective interactive communication gives CRM new impetus to build

valuable customer relationship through customer knowledge.

6.3 Implications for Practice

In terms of managerial implications, the results of this study hold several indications.

Firstly, managers need to reflect the role of customers who keep increasing customer competence, and recognize the importance of customers' tacit knowledge that is most important for innovation and can only be exploited by interactive communication. Companies need to truly take customers as active innovation partners instead of passive product recipients through customer integration, and thereby need to invest more on relationship service and knowledge service to customers instead of pure exploitation from customers. Leveraging the customer base, competitive advantage will be created through customer knowledge management. In this standpoint, it is recommended to identify customer characteristics in order to improve innovation success, for not all customer knowledge is important to innovations and companies can purify information through key customers identification and selection.

Secondly, managers need to recognize that long-term interactive relationships really cost time and effort to establish, so that managers will gain a better understanding about where the excess profit comes from customer-integrated innovation and how value gets shared between a company and its customers before committing to innovation partnerships. Moreover, while using customer knowledge to improve innovation success, managers need to recognize the various risks of customer-integrated innovation and get ideas on how to minimize them. Along this line, managers should take account of the effectiveness and efficiency of interaction management and implement customer integration in an effective way, in order to

improve the innovation performance while minimizing the innovation risks. Stage-Gate System is recommended to be embedded into customer-integrated innovation, in order to hold the equilibrium of innovation force and control force. Through customer-integrated innovation and CKM-embedded innovation marketing companies will get not only innovative product but also long-term interactive customer relationships.

Thirdly, for NPD managers, the findings of this study emphasize the importance of relationship quality in customer-integrated innovation and accordingly the importance of designing incentive systems that reward innovation-related activities, especially for nonmaterial incentives, such as knowledge needs, relationship needs, experience needs and so on. Thus, a new perspective on customer integration as professional service to customers is recommended to effective interaction management implementation, especially in China context. The form of customer interaction processes is an important determinant of outcomes either directly or through mediating processes. The results from this study suggest that emphasis should be given to an intensive, more interactive and more experiential form of acquiring customer knowledge in the innovation marketing processes.

Fourth, the findings of this study about measurement of CKMC suggest a number of key elements cited as success factors in the managerial bibliography, which are likely to be necessary but may be not sufficient conditions for CKM to result in customer knowledge that can be leveraged strategically. These factors were categorized as the technology-oriented customer knowledge process capability which generates and uses customer knowledge, and the people-oriented knowledge management infrastructure capability which integrates customer knowledge throughout the organization. This structure implicates the “Wave-Particle Duality” of CKM with the compatibility of both objective management and process management. Along these

lines, this result will help managers operate targeted activities in order to foster CKMC and make their organizations more effective and efficient, especially in the context of innovation management and relationship management.

6.4 Limitations and Future Research Directions

6.4.1 Limitations

No research is without limitation and this study is no exception. Although this study presents strong evidences conceptualizing the term of CKM and regarding the impact of CKMC on innovation effectiveness, the results should be interpreted in light of some limitations.

First, this study suffers from potential response bias associated with the sampling frame and sampling methods. In consideration of construct novelty and sample scarcity (especially since this study was conducted in China, where academic research is not paid much attention and cooperation by companies), this study uses convenience sampling and snowball sampling to choose samples from supply chain companies of the Chinese automobile industry. Still, it is by no means an ideal method of data collection, and that only 166 valid sample questionnaires collected for data analysis is acceptable but not overwhelming or sufficient. While the small sample size does not necessarily detract much from the findings that were statistically significant, the smallness of the sample does mean that the results which were not statistically significant can't be dismissed easily and the large standard errors related to multicollinearity may be reduced. Therefore, if possible, research using other sampling methods and larger sampling frames is recommended for other industries or regions.

Second, this study suffers from resource restriction and the personal capability of the

researcher as well as respondents. This study conceptualizes CKMC as a high order construct comprised of knowledge management infrastructure capability and customer knowledge process capability with 12 key elements based on own exploratory work, and tests it in the theoretical model. However, with the restricted literature and samples, this result may not include all the important factors of CKMC, and whether the selected elements represent the most appropriate conceptualization for the context remains open to debate, especially when this study focuses on the CKMC in innovation marketing processes. The results may be also limited by the honesty and capability of the respondents to survey questions that may have been influenced by extraneous factor that can't solely be controlled. More empirical approaches are needed to determine what key elements CKMC indeed includes and what additional processes or indicators the construct of CKMC may encompass.

Third, there is a lack of discussion about customer characteristics. Not all customers are equally significant because their needs and preferences are different, their customer competence is different and their value to the organization is also different. Identifying target customers for innovation will improve the quality of customer knowledge and the performance of knowledge management.

Fourth, this study emphasizes interaction in innovation and the framework of CKMC, however, one might speculate that some new revolutionary products may involve much less customer interaction due to the inability of customers to provide useful information. Therefore, this study did not include radical innovations. The intent is to target innovation projects that have the potential to benefit from customer interaction. Thus, the results of this study can't be simply generalized to any innovation projects or industries.

Finally, this study focuses on the company perspective and was conducted in the business market, but not the consumer market. Clearly a future research effort is recommended to test the current theoretical framework from the customers' perspective and the perception of CKMC in a consumer environment.

6.4.2 Future Research Directions

The research undertaken in this study can only be regarded as a start for understanding and further in-depth analyses of CKM in the innovation marketing process. Generally speaking, it is recommendable to conduct further studies with a far bigger sample size to make solid statements concerning the research questions, while it would be valuable to analyze other industries or regions and compare the results. As such, further research is also recommended in several other directions:

(1) Since this study was conducted from the company perspective, it would be necessary and meaningful to examine the viewpoints of customers concerning which organizational processes create CKMC. In this context, further research could examine the effects of differences in the types of customers as well as the effects of industry and company characteristics on new product success with CKM initiatives.

(2) Other types of mediating variables may be important to understand and examine as well. Insofar as CKM-embedded innovation marketing is a success driver for product innovation with the perspectives of relationship quality and knowledge quality, it could be hypothesized that there are some other mediating factors that can help us understand CKMC and would be interesting to examine more transmission paths of CKMC to innovation success.

(3) Identifying the factors that foster customers' effective participation in the process

of CKM and examining other dimensions of knowledge exchange quality, or knowledge quality, would be useful as well. Understanding how the customer network, may lead to better creative/conceptual information versus better instrumental information seems particularly interesting (Moorman 1995), and further more tacit forms of customer knowledge may be more easily acquired. It should also prove valuable to set up effective tacit/knowledge transformation models or processes.

(4) Sufficient discussions about principles and steps of CKM implementation are required. Many CRM and KM initiatives fail during implementation, therefore, it is essential that time and effort be spent to explore prerequisite conditions of implementation and ensure that a CKM venture is successfully executed from both the customer and the company perspectives. Poorly conceived and executed CKM initiatives could be problematic for organizations in many highly visible ways and the organizational challenges involved in becoming customer-centric are significant (Smith and McKeen 2005).

(5) A logical extension of the research is recommended to examine in-depth how structural dimensions of CKMC might influence the customer interaction process, and accordingly, to develop an effective interaction platform. The number and types of functional areas involved in customer interactions may have interesting effects. In business markets, the structural dimensions of the customer-centric organization might provide useful insights into effective interaction processes and knowledge management infrastructure capabilities. Identifying effective interactive approaches in proper situations is also recommendatory.

(6) Developing customer knowledge management (CKM) to customer knowledge relationship management (CKRM) is implicated by the survey of this study. Two

constructs, which are customer relationship quality and knowledge exchange quality in the primary theoretical model, are manifested by data analysis to describe the same thing, which is the focal type of relationship used to create knowledge for new product and service development. Athanassopoulou (2006) absorbs the idea of Gummesson (2002) and defines this relationship as knowledge relationship, which can emphasize the particular relationship related to knowledge compared with traditional customer relationship. In consideration of the possible misapprehension taking CKM as one kind of knowledge management and intimating CKM as complementary approach to CRM, it is recommended to conceptualized the term of customer knowledge relationship management for further research.

6.5 Overall Conclusions

This study aims to develop a better understanding of CKM as an integrated management approach and CKM-embedded innovation marketing as a success driver for product innovation, as well as CKMC as a competitive organizational resource in implementing CKM in an organization, which enable the organization to exploit and use knowledge to develop new products that make customer satisfied in an interactive way and “to manage knowledge for high quality relationships in a cost effective way” (Gebert, Geib et al. 2003).

Beginning with multidisciplinary literature review, an integrated framework for CKM-embedded innovation marketing based on customer integration has been drawn to provide a blueprint for better CRM and innovation practice. Based on this framework, critical factors for CKMC were identified to develop related measurement and a theoretical model was proposed to examine the relationships of variables among CKMC, customer interaction intensity, customer relationship quality, knowledge exchange quality and new product advantage. Data were collected from

166 managers of companies from the Chinese automobile industry and analyzed using the PLS method. The results confirm the positive impacts of CKMC on customer interaction intensity, customer relationship quality as well as new product advantage, and especially, reveal the strong indirect effect of CKMC on new product advantage via customer interaction intensity and customer relationship quality, which implicate the significant role of relationship investments in interactive innovation processes.

The view of CKM-embedded innovation marketing introduces a new dimension on how companies become more market-oriented and realize customer orientation into their daily business processes in order to foster competitive advantage. This view is particularly instructive in illuminating the tradeoff between product innovation and customer relationship by developing long-term interactive relationship through CK in innovation marketing processes. In this context, CKM is not just a tool like traditional technology-based CRM about data nor just about customer relationships with transactional attribute; rather, CKM is a "multiple-paradigms one-solution" holistic business framework and a customer-oriented as well as knowledge-based business strategy enabled by a holistic organizational reinvention manifested by changes in people, structure, processes and technology. Accordingly, CKMC can be seen as an enable for the development of organizational capabilities that allow the adoption of business approaches to support knowledge creation and sharing mechanisms (Al-Shammari 2009) and long-term valuable relationship cultivating mechanisms.

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Appendix A Measurements

Scales of Constructs

Customer Knowledge Management Competence

- CKM1 Our organization uses information technology widely to facilitate knowledge acquisition, distribution and utilization.
- CKM2 Marketing and R&D cooperate fully in sharing customer knowledge and communicating for new product development.
- CKM3 Our organization's structure and system facilitate interaction and sharing of knowledge.
- CKM4 Our organization's evaluation and reward systems encourage employees to share knowledge.
- CKM5 Senior management was involved in customer-integrated new product development.
- CKM6 The customer friendly culture in our organization encourages employees to reach customers and acquire knowledge.
- CKM7 Project team can effectively identify existing knowledge and potential needs of customer knowledge.
- CKM8 Project team can effectively acquire customer knowledge from customers through various channels.
- CKM9 Different departments in our organization can easily access general knowledge database and communicate with each other.
- CKM10 Our organization use customer knowledge in new product development abundantly.
- CKM11 Employees in our organization submit many innovative proposals every year.
- CKM12 Our organization pays great importance to protects knowledge (from inappropriate use, illegal use, theft etc.).

Intensity of Customer Interaction

- IIC1 The Duration of joint work was long.
- IIC2 Frequency of meetings with customers was high. (Including supplying knowledge for customers .)
- IIC3 The (perceived) intensity of customer interaction was high.
- IIC4 Customers were frequently depended to help to define and understand the needs of customers.
- IIC5 We performed relational activities to care for customers frequently.
- IIC6 We supplies knowledge support to customers frequently.

Customer Relationship Quality

- RQ1 I consider the general atmosphere surrounding the working relationship with the customers as very harmonious.
- RQ2 I regard the overall relationship with the customers as very close.
- RQ3 I believe mutual expectation for the project has been established with the customers.
- RQ4 The customers cooperate closely with us in project.
- RQ5 The customers are able to handle our requirements.
- RQ6 The customers are collaborative in resolving conflicts with us.
- RQ7 The customers constantly improve knowledge capabilities to keep abreast with new developments in the project.
- RQ8 The customers make operational changes to project management when required by our project team.
- RQ9 The customers proactively offer us new technical solutions when conditions change.

- RQ10 The customers are able to coordinate the various knowledge disciplines communication when required by our project team.

Knowledge Exchange Quality

- KQ1 The customers submit technical documentation that is easily understood by our project team.
- KQ2 The customers submit technical documentation that meets our needs.
- KQ3 The technical information supplied by the customers is adequate.
- KQ4 The customers are willing to share their personal cognition and experience that is easily understood by our team.
- KQ5 The customers are willing to share their personal cognition and experience that meets our needs.
- KQ6 The personal cognition and experience that supplied by the customers is adequate.

New Product Advantage

Compared to competitive products,

- PA1 our products offered some unique features or attributes to customers.
- PA2 our products were clearly superior to competing products in terms of meeting customers' needs.
- PA3 our products permitted the customer to do a job or do something he could not presently do with was available.
- PA4 our products were higher quality than competing products: tighter specification, stronger, lasted longer, or more reliable.
- PA5 our products have superior technical performance than competing products.

Appendix B Final Questionnaire

Final Questionnaire (conducted in Chinese)

柏林工业大学经济管理学院

顾客知识管理能力研究之调查问卷

尊敬的女士/先生:

您好!

这是一份关于顾客知识管理能力影响新产品优势的调查问卷。

在顾客能力日益提升及市场竞争日益激烈的背景下，整合顾客的新产品开发能力是塑造企业核心竞争能力极其重要的课题。本份问卷主要目的是了解在新产品发展阶段顾客知识管理能力、与顾客互动强度对新产品优势的影响之研究。恳请您能在百忙之中，惠赐宝贵意见。

大多数公司或多或少都有在进行顾客关系管理或知识管理的相关活动，差别只是正式化的程度和系统性而已，因此，您可以不必拘泥于贵公司是否有名义上正式推行CRM还是顾客知识管理，请依据贵公司实际情况或者以您熟悉的相关公司新产品开发情况填答即可。

由于本问卷需要由产品研发和市场研究等相关管理经验的管理人员作答，因而所发问卷不多，您的协助与支持，将对本研究有非常大的贡献。由于本问卷的选题是企业管理中的新课题，因而并无标准答案，也无所谓对错，您只要依照您自己的经验和感受，依题填答即可。对于您填答的任何资料，将全部作为学术研究的统计分析之用，绝对不作其他用途，也不对外发表，敬请放心填答。

非常感谢您的帮助和您的智慧!

敬祝身体健康、家庭美满、宏图大展、万事如意!

德国柏林工业大学经济管理学院
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调查问卷

附录： 基于顾客知识的新产品开发之问卷调查

备注：

- 1、本研究所指的顾客既包括企业顾客，也包括创新型的消费者；既包括上游供应厂商，也包括下游购买厂商或消费者。
- 2、本研究所指的顾客知识包括关于顾客的知识（如对顾客购买及使用习惯及潜在需求的了解等），顾客需要的知识（顾客感兴趣的产品知识或方法等），以及顾客自身的知识（如顾客自身的认知和经验等）。
- 3、本研究将新产品开发阶段分为四个分阶段：创意产生与筛选阶段、概念发展与评估阶段、原型设计与测试阶段、市场测试与推广阶段。

第一部分 新产品开发阶段之顾客知识管理能力

以下的问题是为了了解贵公司在新产品开发阶段的顾客知识管理能力。请您根据贵公司的实际情况，在适当的□内填入您的判断数值，其中：1 代表非常不同意；……；7 代表非常同意。

1=非常不同意 2=不同意 3=有点不同意 4=无意见 5=有点同意 6=同意 7=非常同意

示例：

因为这一阶段需要大量借助 IT 技术及网络技术收集顾客知识并分析，

因为这一阶段需要借助计算机模拟、分析软件等技术分析创意，但程度较创意阶段低一点

因为这一阶段需要运用计算机在企业内部进行设计，测试时需要与顾客进行实时联系与沟通

因为这一阶段需要实时收集市场反应情况并反馈、调整

	在我公司的新产品开发项目中：	创意产生与 筛选阶段	概念发展与 评估阶段	原型设计与 测试阶段	市场测试与 推广阶段
CKM1	我公司能有效运用 IT 技术促进顾客知识开发、流通和利用。	6	6	7	6
CKM2	我公司营销团队和技术团队能有效配合，共同使用顾客知识开发产品。	5	7	6	7

仅作参考！

	在我公司的新产品开发项目中：	创意产生与 筛选阶段	概念发展与 评估阶段	原型设计与 测试阶段	市场测试与 推广阶段
CKM1	我公司能有效运用计算机技术等信息技术，以促进顾客知识的管理和利用。				
CKM2	我公司营销团队和技术团队能有效配合，以共同使用顾客知识开发产品。				
CKM3	因为我公司的组织结构和制度，各部门利用顾客知识时能容易地进行交流沟通。				
CKM4	因为我公司的评价体系和薪酬奖励制度，员工愿意与他人分享顾客知识。				
CKM5	我公司高层管理人员高度支持并参与到新产品开发项目。				
CKM6	因为顾客友好的企业文化，我公司员工愿意接触并获取顾客知识。				
CKM7	创新团队能有效识别公司的存量知识及确认所需要的顾客知识类型。				

CKM8	在新产品开发阶段，创新团队从外部多个渠道获取顾客知识。				
CKM9	我公司不同部门都能够容易地获取知识库中的顾客知识。				
CKM10	我公司将顾客知识应用到在新产品开发活动中的程度高。				
CKM11	我公司员工每年利用顾客知识提出的创新提案的数量多。				
CKM12	我公司对顾客知识保护的重视程度高（防止非法使用、不当使用、失窃等）。				

第二部分 新产品开发阶段之顾客互动强度

本部分是为了解贵公司在新产品开发的阶段与顾客互动的情形。本研究将新产品开发分为四个阶段，请您根据贵公司整合顾客进行合作开发时的实际情况，配合题意填入相应的判断数值，其中：1 代表非常不同意；2 代表不同意；3 代表有点不同意；4 代表无意见；5 代表有点同意；6 代表同意；7 代表非常同意。填答方法同第一部分。

	在整合顾客进行新产品开发时，	创意产生与 筛选阶段	概念发展与 评估阶段	原型设计与 测试阶段	市场测试与 推广阶段
IIC1	我们长时间与顾客共同工作。				
IIC2	我们经常与顾客会面进行沟通、研讨。				
IIC3	我们感觉与顾客互动的程度高。				
IIC4	我们经常依靠顾客来协助界定与理解顾客的需求。				
IIC5	我们经常通过各种活动关心顾客，以使顾客感觉更好（如：礼品赠送、致谢等）。				
IIC6	我们经常提供顾客需要的知识（如产品知识或者共同工作所需要的方法等）。				

第三部分 新产品开发阶段之顾客关系质量

本部分是为了解贵公司在新产品开发阶段与顾客互动时的顾客关系情况。请您根据贵公司在整合顾客进行新产品开发的实际情况，并配合题意在适当的□内打勾。每题选择唯一！

示例：

	在整合顾客进行新产品开发时，	非常不同意	不同意	有点不同意	无意见	有点同意	同意	非常同意
RQ1	我们与顾客一起工作的整体关系氛围很和谐。						✓	
RQ2	我们与顾客的关系总体而言很亲近。					✓		

仅作参考！

调查问卷

	在整合顾客进行新产品开发时，	非常不同意	不同意	有点不同意	无意见	有点同意	同意	非常同意
RQ1	我们与顾客一起工作的总体关系氛围很和谐。							
RQ2	我们与顾客的关系总体而言很亲近。							
RQ3	我们与顾客在很大程度上对项目有共同的期望。							
RQ4	顾客能与我们密切配合。							
RQ5	顾客能接受并处理我们的要求。							
RQ6	顾客能配合处理与我们的冲突。							
RQ7	顾客能不断提高知识水平以紧跟创新项目的新发展。							
RQ8	顾客能按照我们的要求在项目中进行操作。							
RQ9	当情况发生变化时，顾客能主动提供解决问题的新方案。							
RQ10	根据我们的要求，顾客能进行跨学科的协作和交流。							

第四部分 新产品开发阶段之知识交换质量

本部分是为了了解贵公司在新产品开发阶段与顾客互动时的顾客交换知识的意愿情况。请您根据贵公司在整合顾客进行新产品开发的实际情况，配合题意在适当的□内打勾。填答方法同第三部分。每题选择唯一！

	在整合顾客进行新产品开发时	非常不同意	不同意	有点不同意	无意见	有点同意	同意	非常同意
KQ1	顾客愿意提供给我们易于理解的技术资料。							
KQ2	顾客愿意提供给我们开发项目所需要的技术资料。							
KQ3	顾客愿意提供给我们足够的技术资料。							
KQ4	顾客愿意与我们交流易于理解的个人经验。							
KQ5	顾客愿意与我们交流开发项目所需要的个人经验。							
KQ6	顾客愿意与我们交流足够的个人经验。							

第五部分 新产品优势

本部分是为了了解贵公司与顾客合作进行新产品开发后新产品优势情况。请您根据贵公司在整合顾客进行新产品开发时的实际情况，并配合题意在适当的□内打勾。填答方法同第三部分。

		非常不同意	不同意	有点不同意	无意见	有点同意	同意	非常同意
PA1	和竞争产品相比，我们的产品特征对于顾客而言与众不同。							
PA2	和竞争产品相比，我们的产品在满足顾客需求方面表现得更好。							
PA3	我们的产品可以让顾客做到之前以其它产品无法做到的工作或事情。							
PA4	和竞争产品相比，我们的产品质量更好。（规范更严格、更结实、更耐用、更稳定等）							
PA5	和竞争产品相比，我们的产品有更好的技术性能。							

第六部分 基本背景资料

以下几个问题是为了了解贵公司与填答者的基本背景资料，以帮助了解研究背景。请根据贵公司的概况和实际情况，在适当的□内打勾。**每题选择唯一！**

贵公司名称	选填
贵公司所属产业是	<input type="checkbox"/> 机械制造业 <input type="checkbox"/> 汽车业 <input type="checkbox"/> 纺织业 <input type="checkbox"/> 消费电子业 <input type="checkbox"/> 信息业 <input type="checkbox"/> 化工业 <input type="checkbox"/> 医药业 <input type="checkbox"/> 其它工业：_____ <input type="checkbox"/> 服务业：_____
您在贵公司的职位是	<input type="checkbox"/> 总经理 <input type="checkbox"/> 副总经理 <input type="checkbox"/> 研发主管 <input type="checkbox"/> 项目经理 <input type="checkbox"/> 产品经理 <input type="checkbox"/> 营销经理 <input type="checkbox"/> 研发人员 <input type="checkbox"/> 其他
贵公司成立历史为	<input type="checkbox"/> 3年以下 <input type="checkbox"/> 3~5年 <input type="checkbox"/> 6~10年 <input type="checkbox"/> 11~15年 <input type="checkbox"/> 16~30年 <input type="checkbox"/> 30年以上
贵公司 2007 年的资本额是	<input type="checkbox"/> 1 千万以下 <input type="checkbox"/> 1~5 千万 <input type="checkbox"/> 5 千万~2 亿 <input type="checkbox"/> 2 亿~5 亿 <input type="checkbox"/> 5 亿以上 (币种：人民币)
贵公司 2007 年的营业额是	<input type="checkbox"/> 1 亿以下 <input type="checkbox"/> 1 亿~5 亿 <input type="checkbox"/> 5 亿~10 亿 <input type="checkbox"/> 10 亿~20 亿 <input type="checkbox"/> 20 亿以上 (币种：人民币)
贵公司研发经费占营业额比例平均为	<input type="checkbox"/> 1%以下 <input type="checkbox"/> 1%~3% <input type="checkbox"/> 3%~5% <input type="checkbox"/> 5%~10% <input type="checkbox"/> 10%以上
贵公司 2007 年的平均员工人数是	<input type="checkbox"/> 1 百人以下 <input type="checkbox"/> 1 百~5 百人 <input type="checkbox"/> 5 百~1 千人 <input type="checkbox"/> 1 千~5 千人 <input type="checkbox"/> 5 千人以上
贵公司过去 3 年开发的新产品数量为	<input type="checkbox"/> 1~5 件 <input type="checkbox"/> 5~10 件 <input type="checkbox"/> 10~20 件 <input type="checkbox"/> 20 件以上
贵公司的主要顾客类型是	<input type="checkbox"/> 企业用户 <input type="checkbox"/> 一般消费者 <input type="checkbox"/> 两者皆是
贵公司目前 CRM 系统建设情况是	<input type="checkbox"/> 已建立且效果很好 <input type="checkbox"/> 已建立但效果一般 <input type="checkbox"/> 正着手建立 <input type="checkbox"/> 进行规划评估中 <input type="checkbox"/> 没有立项
如果您对本研究感兴趣，需要最终的论文作为参考，请您与本人联络。如您希望与我就相关问题进行探讨，也欢迎您的电子邮件。 Email: _____	

本问卷到此结束，最后请您再浏览一下有无遗漏的地方，确认后请将问卷寄回联络人或者通过电邮、传真发给本人。再次感谢您对本研究的大力支持和帮助！

Appendix C Online Questionnaire

**Online Questionnaire
(performed in www.unipark.de)**

Online Questionnaire performed in www.unipark.de



尊敬的女士/先生：

您好！

这是一份关于顾客知识管理能力影响新产品开发的博士论文的调查问卷。

在顾客能力日益提升及市场竞争日益激烈的背景下，整合顾客的新产品开发能力是塑造企业核心竞争能力极其重要的课题。本份问卷主要目的是了解在新产品发展阶段顾客知识管理能力、与顾客互动强度对新产品优势的影响之研究。恳请您能在百忙之中，惠赐宝贵意见。

所谓顾客知识管理能力，是顾客关系管理（CRM）和知识管理能力的协同，通过创新团队与顾客的互动交流及企业基础建设的支持，对顾客知识进行识别、获取、转换、利用、创新和保护，在利用顾客知识进行适应顾客需求的产品创新的同时，也积极培养顾客关系。大多数公司或多或少都有在进行顾客关系管理或知识管理的相关活动，差别只是正式化的程度和系统性而已，因此，您可以不必拘泥于贵公司是否有名义上正式推行CRM还是顾客知识管理，请依据贵公司实际情况填答即可。

由于本问卷需要由有产品研发和市场研究等相关管理经验的管理者作答，因而所发问卷不多，您的协助与支持，将对本研究有非常大的贡献。由于本问卷的选题是企业管理中的新课题，因而并无标准答案，也无所谓对错，您只要依照您自己的经验和感受，依题填答即可。对于您填答的任何资料，将全部作为学术研究的统计分析之用，绝对不作其他用途，也不对外发表，敬请放心填答。

非常感谢您的帮助和您的智慧！

敬祝身体健康、家庭美满、宏图大展、万事如意！

德国柏林理工大学经济管理学院

博士指导教师：Prof. Dr. Trommsdorff

博士研究生：孙洪庆

联系电话：(0049) 30 314 23969

传真号码：(0049) 30 314 22664

电子邮箱：h.sun@live.com

继续



第一部分 新产品开发阶段之顾客知识管理能力

以下的问题是为了了解贵公司在新产品开发阶段的顾客知识管理能力。本研究所指的顾客既包括企业顾客，也包括创新型的消费者；所指的顾客知识包括关于顾客的知识（如对顾客购买与使用习惯及潜在需求的了解等），顾客需要的知识（顾客感兴趣的产品知识），以及顾客的知识（如顾客自身的认知和经验等）。本研究将新产品开发分为五个分阶段，请您根据贵公司的实际情况，在适当的0内填入您的判断数值，其中：1 代表非常不同意；……；7代表非常同意。 1=非常不同意 2=不同意 3=有点不同意 4=无意见 5=有点同意 6=同意 7=非常同意

	创意产生与选择阶段	概念发展与评估阶段	原型设计与测试阶段	市场测试与推广阶段
我公司能有效运用计算机技术等信息技术，以促进顾客知识的管理和利用。	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>
我公司营销团队和技术团队能有效配合，以共同使用顾客知识开发产品。	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>
因为我公司的组织结构和制度，各部门利用顾客知识时能容易地进行交流沟通	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>
因为我公司的评价体系和薪酬奖励制度，员工愿意与他人分享顾客知识。	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>
我公司高层管理人员高度支持顾客整合创新并参与到新产品开发项目。	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>
因为顾客友好的企业文化，我公司员工愿意接触并获取顾客知识。	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>
创新团队能有效识别公司的存量知识及确认所需要的顾客知识类型。	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>
在新产品开发阶段，创新团队从多个渠道获取顾客知识。	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>
我公司不同部门能够容易地获取知识库中顾客知识并互相交流。	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>
我公司将顾客知识应用到在新产品开发活动中的程度高。	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>
我公司员工每年利用顾客知识提出的创新提案的数量多。	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>
我公司对顾客知识保护的重视程度高（防止非法使用、不当使用、失窃等）。	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>



第二部分 新产品开发阶段之顾客互动强度

本部分是为了解贵公司在新产品开发的不同阶段与顾客互动的情形。本研究将新产品开发分为五个分阶段，请您根据贵公司整合顾客进行合作开发时的实际情况，配合题意填入相应的判断数值，其中：1 代表非常不同意；2代表不同意；3代表有点不同意；4代表无意见；5代表有点同意；6代表同意；7代表非常同意。

	创意产生与筛选阶段	概念发展与评估阶段	原型设计与测试阶段	市场测试与推广阶段
在新产品开发时，创新团队长时间与顾客共同工作。	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>
创新团队经常与顾客会面沟通、研讨	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>
在新产品开发时，创新团队感知与顾客互动的程度（较竞争者）高。	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>
创新团队经常依靠顾客来协助界定与理解顾客的需求。	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>
在与顾客互动时，创新团队经常通过各种可以让顾客感觉更好的活动关照顾客（如赠送礼品、微笑服务等）。	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>
创新团队会在允许范围内主动提供顾客需要的知识（如产品背景知识和共同工作需要的方法等）	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>	<input type="text" value="请点选"/>



第三部分 新产品开发阶段之顾客关系质量

本部分是为了解贵公司在新产品开发阶段与顾客互动时的顾客关系情况。请您根据贵公司在整合顾客进行新产品开发的实际情况，并配合题意在适当的框内点选。

在整合顾客合作进行新产品开发时，

	1 非常不同意	2 不同意	3 有点不同意	4 无意见	5 有点同意	6 同意	7 非常同意
我们与顾客一起工作的大致关系氛围很和谐。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
我们与顾客的关系总体而言很亲近。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
我们与顾客在很大程度上对项目有共同的期望。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
顾客能与我们密切配合。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
顾客能接受并处理我们的要求。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
顾客能配合处理与我们的冲突。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
顾客能不断提高知识水平以紧跟创新项目的新发展。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
顾客能按照创新团队的要求在项目中进行操作。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
当情况发生变化时，顾客能主动提供解决问题的新方案。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
根据创新团队的要求，顾客能进行跨学科的协作和交流。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Previewmo



第四部分 新产品开发阶段之知识交换质量

本部分是为了了解贵公司在新产品开发阶段与顾客互动时的顾客交换知识的意愿情况。请您根据贵公司在整合顾客进行新产品开发的实际情况，并配合题意在适当的框内点选。
在整合顾客进行新产品开发时，.....

	1 非常不同意	2 不同意	3 有点不同意	4 无意见	5 有点同意	6 同意	7 非常同意
顾客愿意提供创新团队易于理解的技术资料。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
顾客愿意提供项目需要的技术资料。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
顾客愿意提供足够的技术资料。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
顾客愿意与创新团队交流易于理解的个人经验。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
顾客愿意与创新团队交流项目需要的个人经验。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
顾客愿意与创新团队交流足够的个人经验。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

返回 继续



Preview

第五部分 新产品优势

本部分是为了了解贵公司与顾客合作进行新产品开发后新产品优势情况。请您根据贵公司在整合顾客进行新产品开发时的实际情况，并配合题意在适当的框内点选。

	1 非常不同意	2 不同意	3 有点不同意	4 无意见	5 有点同意	6 同意	7 非常同意
和竞争产品相比，我们的产品特征对于顾客而言与众不同。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
和竞争产品相比，我们的产品在满足顾客需求方面表现得更好。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
我们的产品可以让顾客做到之前以其它产品无法做到的工作或事情。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
和竞争产品相比，我们的产品质量更好。（规范更严格、更结实、更耐用、更稳定等）	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
和竞争产品相比，我们的产品有更好的技术性能。	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

返回 继续

您在贵公司的职位是

☐ 总经理 ☐ 副总经理 ☐ 研发主管 ☐ 项目经理 ☐ 产品经理 ☐ 营销经理 ☐ 工程师 ☐ 其他

贵公司成立历史为

☐ 3年以下 ☐ 3~5年 ☐ 6~10年 ☐ 11~15年 ☐ 16~30年 ☐ 30年以上

贵公司2007年的资本额是：(币种：人民币)

☐ 1千万以下 ☐ 1~5千万 ☐ 5千万~2亿 ☐ 2亿~5亿 ☐ 5亿以上

贵公司2007年的营业额是：(币种：人民币)

☐ 1亿以下 ☐ 1亿~5亿 ☐ 5亿~10亿 ☐ 10亿~20亿 ☐ 20亿以上

贵公司研发经费占营业额比例平均为

☐ 1%以下 ☐ 1%~3% ☐ 3%~5% ☐ 5%~10% ☐ 10%以上

贵公司2007年的平均员工人数是

☐ 100人以下 ☐ 100~500人 ☐ 500~1000人 ☐ 1000~5000人 ☐ 5000人以上

贵公司过去3年开发的新产品数量为

☐ 1~5件 ☐ 5~10件 ☐ 10~20件 ☐ 20件以上

贵公司的主要顾客类型是

☐ 企业用户 ☐ 一般消费者 ☐ 两者皆是

贵公司目前CRM系统建设情况是

☐ 已建立且效果很好 ☐ 已建立但效果一般 ☐ 正着手建立 ☐ 进行规划评估中 ☐ 没有立项

如果您对本研究感兴趣，需要最终的论文作为参考，请您与本人联络或者留下您的电子邮箱。如您希望与我就相关问题进行探讨，请在下面填写，也欢迎您的电子邮件。