Impact of Customer Relationship Management on Product Innovation Process

Supervisor
Dr. Ossi Pesämaa

Authors
Yelin Li and Nguyen Thi Thu Sang

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Abstracts

In marketing, the common view is that customer relationships enhance innovativeness. Regularly it involves doing something new or different in response to market conditions. However, previous studies have not addressed how customer relationship management (CRM) plays its role in product innovation process.

This thesis proposes and tests how key CRM activities influence and relate to each stage in product innovation process. The objective of this study is to test how customer relations management activities influence four basic stages of product innovation process. Five practices of CRM is found in the literature (i.e., information sharing, customer involvement, long-term partnership, joint problem-solving and technology-based CRM). Furthermore, our literature review suggests four stages of innovation process (i.e., innovation initiation, input, throughput and output). The one-to-one relationship between CRM activities and innovation stages are established in four models. These associations are tested and some are verified in a survey-based study.

Specifically data from 83 respondents were collected. All respondents represent a strategic business unit and work closely with R&D, product development or marketing. Regression analysis is conducted to examine the impacts of CRM on innovation process. The statistical results indicate that not all CRM activities make contributions to each stage within innovation process. It is found that 1) information sharing effectively enhances both innovation throughput and innovation output. 2) Customer involvement and joint problem-solving exert positive influence on innovation throughput stage, while long-term partnership has significant effects on innovation output. 3) CRM activities have no impact on innovation initiation and input. 4) Technology-based CRM is the least effective mechanism during the innovation process.

The findings suggest the need for more research in this area and the statistical results provide corporate management with useful reference to align their CRM activities with a certain stage of innovation process.
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1. Introduction

The core of any business activity is the customer. Without customers there is no business. Companies at various levels therefore invest time and resources to satisfy new customers, satisfy old customers even more and make sure this leads to loyal customers (Pesämaa, Hair, Fredman, 2008). One core activity in such research is replacing old products with new ones and as such contributing to better products. To this end, the aim of this research is to investigate the effects of various dimensions of customer relationship management (CRM) on product innovation process. Five dimensions of CRM (i.e., information sharing, customer involvement, long-term partnership, joint problem-solving and technology-based CRM) and four stages of innovation process (i.e., innovation initiation, innovation input, innovation throughput, and innovation output) are identified. The one-to-one associations between the two constructs will be developed and verified.

Peter F. Drucker once described “Every organization, not just businesses, needs one core competence: innovation.” Innovation is not a new term for the organizations in the world today. The recognition of innovation as the critical discipline which will bring sustainable growth and be one of the most important core competences of the business has been wildly accepted.

In marketing, the common view is that customer orientation enhances innovativeness because it involves doing something new or different in response to market conditions. Customer-oriented companies emphasize information use and learning, and uncover latent customer needs, thus enhancing innovativeness (Narver et al. 2004).

Furthermore, knowledge of customer’s role in process of product innovation is central for firm’s growth and competitive advantage. Yet, we find that this knowledge is still limited and not systematically conducted. The authors believe that studying the relationship of the two constructs CRM and innovation process will contribute new additional values in the research field.
1.1 **Background and research problem**

According to Kusiak, innovation is an interactive process aimed at the creation of new products, processes, knowledge or services by the use of new or even existing knowledge. He points out that market relevance and market acceptance distinguish innovation from invention and creation. The market determines whether a creation or an invention becomes an innovation (Kusiak, 2009). Nowadays the ultimate goal of most companies is believed to build up long-term customer brand loyalty by enhancing customer value from their products or services. In an era of rapidly changing technology and highly unpredictable markets, manufacturers must enhance their innovation capabilities to satisfy market demands and customer preferences in order to maintain a long-term competitive advantage (Panayides, 2006). Tidd et al. (1997) indicated that manufacturers possessing higher product and service innovation capabilities can earn twice the profits of those manufacturers without innovation. Specific examples of this show that companies such as HP and Gillette earn 40-50% of their sales from new products (Steenkamp, Hofstede and Wedel, 1999). Yet, some research also indicates innovative processes involve high risks and at a very high cost given that these are conducted improperly (Pesämaa, Shoham and Ruvio, 2011). For instance, Girardi, Soutar and Ward (2005) argue that 66% of all innovations fail at the cost of 15 million US dollars per product. Given the high potential rewards and high risks some products and services are also time demanding (Pesämaa, Shoham and Ruvio, 2011). Taking these perspectives into account, both positive and negative, effective development of innovation capabilities to meet the demands of highly unpredictable competitive markets has become an important issue for manufacturing firms (Shane and Ulrich, 2004).

CRM thus develops how the firm relates to consumers. Ramani and Kumar (2008) argue good customer relationship management between manufacturing firms and industrial customers not only retains customers but also encourages them to provide important suggestions for improving products and service. CRM helps firms refine their knowledge about customers’ tastes and preferences. The effectiveness and efficiency of CRM are increasingly recognized as means for developing innovation capability and providing a lasting competitive advantage (Sahay and Ranjan, 2008).
However, previous studies have not addressed how CRM plays its role in product innovation process. This research aims at illustrate how key CRM activities influence and relate to each stage in product innovation process. The objective of this study is to empirically verify the relationship between these two important constructs. Accordingly, several research hypotheses are established to examine the one-to-one relationships. We believe this approach of studying the relationship between customer relations management activities and innovation process provides a meaningful and pragmatic perspective to corporate management.

1.2 Problem formulation and research question and purpose

As there is positive and negative effects of innovation processes and more knowledge is needed in this area we find it relevant to study following. What CRM processes leads to innovative outcomes?

Purpose is to study customer relations management and innovation process and to formulate and test a theoretical relationship between these customer relation management components and innovation process.

1.3 Thesis Structure

The structure of the thesis is as follows: the first chapter provides the background and formulates the problem and objectives for the research.

The theoretical concepts of innovation and customer relationship management (CRM) are presented in Chapter 2. This chapter aims to break down the two concepts into key elements and to form a theoretical foundation for further researches on how CRM activities influence each innovation stage.

In Chapter 3, the research model and hypotheses are presented. The goal of this chapter is to justify the hypothetical relationship between the five CRM activities and each innovation stage.
In Chapter 4, methodology of this study is illustrated. Chapter 5 presents the results of the survey, including the factor analysis and the regression analysis. Each hypothesis is measured and explained. Finally, Chapter 6 concludes the thesis, summarizes main finding and implications for corporate management and scholars.

2. Literature Review

2.1 Innovation

Practically innovation is a novel idea, which is useful and relevant to someone. Typically this someone is a customer ready to pay given someone offer this idea to price reflecting the value of it. Conceptually innovation is thus interpreted as an idea, practice, or object that is perceived as new to an individual or another unit of adoption (Fruhling and Siau, 2007; Hsu, 2006). To achieve such innovative ideas, practices or object, innovation capability is a necessary component. Innovation capability refers to the implementation or creation of technology as applied to systems, policies, programs, products, processes, devices, or services that are new to an organization (Chang and Lee, 2008). Innovation capability is also the ability of firms to assimilate and utilize external information for transfer into new knowledge (Cohen and Levinthal, 1990). Thus, it is considered important “not to treat primarily innovations as single events but, on the contrary, using terms such as ‘the process of innovation’ or ‘innovative activities’” (Lundval, 1988: 350). Innovation will be treated from the process point of view in this research, which covers the transformation of “ideas” into new products and production processes. This process is often also referred to as innovativeness (Pesämaa, Shoham and Ruvio, 2011). Innovation is thus the outcome whereas innovativeness is the process that leads to this outcome (Nybakk, Crespell, Hansen and Lunnan, 2009). Yet, as we refer to this process we will from this point we use the term innovative process instead of innovativeness.

The scope of innovation capability consists of technical innovation and administrative innovation (Damanpour, 1991). As it is a capability it is not a temporal but a sustained process. Such technical innovations include products, marketing, services, and the technology used to produce products, product sales, or render services directly related to the basic work activity of an organization (Damanpour and Evan, 1984; Daft, 1982).
The scope of this research is to focus on product innovation. Product innovation refers to the development and introduction of a new product to the market or the modification of existing products in terms of function, quality consistency, or appearance (Liao et al., 2007).

### 2.2 Innovation Process

Innovation process has a nature of complexity and interaction. The first model analyzes the process of technological change as a process is the “linear model of innovation” (Rosegger, 1986: 9). Afterwards Kline and Rosenberg (1986) developed “chain-linked model”, which highlight the interactive nature of the innovation process. By reviewing the literature on innovation process, we can conclude that product innovation process usually consist of:

- **a.** First phase: initiatives—idea generation and deciding upon the continuation of innovating.
- **b.** Second phase: input—establishing the level of inputs. With the decision to innovate, the level of innovation effort and resources is decided.
- **c.** Third phase: throughput—transformation of innovation input into innovation output.
- **d.** Fourth phase: output—obtaining the direct innovation outputs. In this phase, the innovation output is analyzed. (Kemp, Folkeringa, Jong, & Wubben, 2003; Klomp & van Leeuwen, 1999; Lööf, Heshmati, Asplund, & Naas, 2001). Later on, the firm’s economic and financial performance is analyzed, representing an immediate result of the innovation output.

### 2.3 Customer Relationship Management

Customer relation is the process by which companies promote customer satisfaction and customer loyalty. Obtaining satisfied customer is a goal oriented process (Pesämaa, Hair, Fredman, 2008). The goal is specifically that most customer relation programs build long-term relationships. The program is typically two folded: in which one identify those in which the customer keeps buying the product or service and secondly those recommend it to others (Reference for Business, Encyclopaedia of Business, and 2nd edition). CRM thus refers to utilizing extensive strategies and engineering to find, obtain, and cultivate advantaged customers, and hence maintain
long-term partnerships (Sin et al., 2005). Aggarwal (1997) and Claycomb et al. (1999) defined CRM as activities that manufacturers practice for understanding customer demands and improving customer satisfaction. Joo (2007) heed customer-centred approach is a critical success factor for businesses and furthermore Ranjan and Bhatnagar (2008) argue CRM guides organizations to focus on their customers. A good CRM strategy can increase sales by improving relationships with customers, thus enhancing customer loyalty (Huang and Lin, 2005).

The acceleration of R&D efforts and the development of internal innovative capabilities are no longer sufficient to cope with the increasing cost, speed, and complexity of technological developments. In recent decades, there has been unprecedented growth in corporate partnering and an increasing reliance on various forms of external collaboration (Hagedoorn and Schakenraad, 1992; Gulati, 1995). Empirical studies have established that customer integration increases a company’s potential for innovation (Urban and von Hippel, 1988).

Customer relationship management (CRM) has generally been assumed to enhance competitiveness for an organization, as well as to have a positive impact on corporate innovations. Among its many advantages are: early customer integration leads to a stronger relationship with the partner, a better understanding of market needs, fewer errors in the early development process, and a better product quality. Customers can provide first-hand information regarding their needs, can help create innovative ideas for new products, and provide feedback regarding concepts and prototypes (Bruce and Biemans, 1995). Customers are no-longer playing the mere role of end users. Their role in the whole value chain has become more and more prominent.

However, there is still much debate over exactly what constitutes CRM. In fact, many scholars have claimed that the precise meaning of CRM is not always clear in the literature (Nevin, 1995; Parvatiyar and Sheth, 2001). For example, at a tactical level, CRM may mean database marketing (Peppers and Rogers, 1995) or electronic marketing (Blattberg and Deighton, 1991). At a strategic level, CRM may mean customer retention or customer partnering (Peppers and Rogers, 1993; Vavra, 1992). At a theoretical level, CRM may mean an emerging research paradigm in marketing (Parvatiyar and Sheth, 2001).
This study focuses on the five most popular CRM activities listed by Lin et al. (2010): information sharing, customer involvement, long-term partnership, joint problem solving, and technology-based CRM.

### 2.3.1 Information Sharing

Information sharing refers to the sharing and exchange of essential and exclusive information through interactive activities between manufacturers and their customers (McEvily and Marcus, 2005; Mentzer et al., 2000). The commonly shared information includes market demand, customer preferences, sales promotion, and new product introduction (Mentzer et al., 2000).

Studies show that customer participation affects the value of new products. Moreover such participation affects efficiency of the new product development process... Information sharing thus contributes in the extent that the two partners to effectively exchange important information about product ideas, market, competition, among other issues. Proper information sharing between customers and manufacturers will support to explore better their unique capability and value creation opportunities (Fang et al, 2007). Therefore, sharing information between manufacturers and customers should increase the value of new products.

As organizations today have been continually invested in CRM programmes, they designed new forms of relationships with their customers. Customers use internet-related technologies to interact with suppliers. Co-creation throughout technology based approaches is becoming a more important component of innovation and any organization’s growth strategies. In this context, the traditional market research approaches has been forced to be looked outdated by the new technology methods which deliver more convenience for customers to involve. Therefore, it showed the need to study the information sharing process from customers in the context of co-creation of value, rather than innovation mainly generated by company. (Roberts, Baker and Walker, 2005)
2.3.2 Customer Involvement

Customer involvement is related to customer participation in new product development activities, technical meetings, supply chain annual conference, and market evaluation conferences. Customers normally provide market trend/direction and technical support in the process, which should lead to better understanding of future demands (Sin et al., 2005).

CRM is a comprehensive and an approach of customer-centric to dealing with the customers of an organization. Effective CRM is not only a practice of products and services, when interacting with valuable customers, the company must consider the needs of valuable customers, services and communications of the products. When a customer tells the company about his “needs or wants”, the company and the customers are collaborating on the sales of the products. (Peppers and Roger, 2004) Customers normally provide market trend and technical support in the process, which should lead to better understanding of future demands (Sin et al., 2005).

Organizations therefore recognize the need to communicate with customers in addition to learning about loyalty, satisfaction or their complaints. An organisation is emerging to focus on customer participation, listen to capture customer’s responses, and ideas in order to perform better with innovative ideas as well as developing products and services in a competitive market environment (Singh, 2002).

It is further assumed customers participating in new product and service development value factors affecting customer satisfaction (Lagrosen, 2005). Higher levels of customer value will ensure customer satisfaction and long term loyalty. It will further enhance the brand, corporate image, and help to the organisation to compete in domestic as well as in the world market. (Gungor, 2008)

This is a new role for clients can be referred and mentioned to as "customer advice". In this context, customers will help the organization to adapt itself to continually changes taking place in a competitive environment in two key capabilities which are to capture and respond using customer services provided by organizations. (Gungor, 2008)
2.3.3 Long-term Partnership

Long-term partnership is a business relationship with trust and commitment between two firms. Both companies must share similar goals and pursue mutual profits on a reliable and dependable basis (Mohr and Spekman, 1994). Numerous studies have proven that a long-term partnership entails high degrees of commitment and mutual trust, thus both parties are willing to provide resources, in a fair and dependable manner, in order to maintain and reach the goals of both parties (Handfield and Bechtel, 2002). If a business aims to maximize its long-term performance in terms of customer satisfaction, it must build, maintain, and enhance long-term and mutually beneficial relationships with its target buyers (Sin et al., 2005).

The concept of customer lifetime value is defined by Jain and Singh (2002) as “the net of the revenues obtained from that customer over the lifetime of transactions with that customer minus the cost of attracting, selling, and servicing that customer, taking into account the time value of money.” In CRM, marketers assess the lifetime value of each customer individually to decide whether to build a relationship with him/her and provide customized offerings. Thereby company can become more profitable by focusing on profitable customers and reduce the subsidization of unprofitable customers in the long-run.

Moreover, based on mutual trust and understanding, manufacturers are able to maintain close partnerships with their customers and are more likely to precisely identify customer demands and thus provide an acceptable pricing scheme, promotion activities, and retailing and marketing strategies (Lin and Germain, 2004).

Therefore, we propose a long-term partnership has a positive effect on product innovations.

2.3.4 Joint Problem Solving

Joint problem solving refers to collaboration between manufacturers and customers in solving problems together and sharing responsibilities when they encounter difficult or unexpected situations (McEvily and Marcus, 2005).
Joint problem solving exerts positive influence over the success of product and market development. Ritter and Walter (2003) believed that it would be easier for manufacturers to improve product quality and technical process ability. Practically this means customers voluntarily provide assistance to solve product design or technical process problems. Joint problem solving influences innovation in that it generally introduces ongoing improvements to existing products, processes, or services (Huang and Chang, 2008). Specifically this involves everything from established designs, processes, and markets. According to Ahire et al. (1996) and Lin and Germain (2004), manufacturers equipped with sound joint problem-solving mechanisms are in a better position to provide after-sale services, resolve customer claims, and offer warranty and maintenance services.

By involving customers into the co-creation process, companies can enhance the value customers get when buying and using goods and services. It enables companies to understand and respond to deeper and more valuable customer needs and reduces the inherent risks of innovation (Maklan, et al., 2008). The participatory approach of co-developing solutions increases customer value and yields far greater returns than do traditional methods based upon researching customer needs and responding sequentially with new products (Lilien, et al., 2002). For instance, auto industry suppliers have improved their capabilities in quality management, just-in-time production and delivery, and also in product and process innovation, by working closely with lead customers (Helper, 1991).

Therefore, we propose joint problem solving has a positive effect on product innovations.

2.3.5 Technology-based CRM

Technology-based CRM involves manufacturers using computer technologies to facilitate various CRM activities and actively offer technology assistance to customers, including data storage, data mining, and CRM software systems (Sin et al., 2005).

It is well-recognized that information systems and technology support product innovation. Dyche (2001) suggested that manufacturers should apply information
Technology enhances the intelligence competence of CRM greatly. Accurate customer data is essential to successful CRM performance (Abbott et al. 2001). Companies grow the capability to collect, store, analyze, and share customer information in ways that greatly enhance their ability to respond to the needs of individual customers and thus to attract and retain customers (Butler, 2000). CRM technologies can help companies to understand the customers more coherently and comprehensively, and to better organize internal data to reduce service costs, help salespeople close deals more efficiently and improve the targeting of marketing programs.

With the assistance of technology, companies are also interacting more directly with customers through social media, using them to collect and assess ideas and evaluate offers. By capturing massive amount of market intelligence, manufacturers are able to provide quick responses to customer requests for new product innovation. On the other hand, as customers use internet-related technologies to manage their relationships with suppliers, it is more likely for them to participate in the product innovation process.

Moreover, CRM software systems enable companies to provide greater customization with better quality at lower cost. It also helps staff at all contact points serve customers better. Many customer-centric activities would be impossible without appropriate technology (Sin, et al., 2005).

Therefore, we propose technology-based CRM has a positive effect on product innovations.

3. Research Model and Hypotheses

The Figure 1 below shows the combination of the two above-mentioned constructs, which serves as the conceptual framework of this research.
3.1 **Innovation Initiation and CRM Activities Hypotheses:**

Innovation initiatives represent the initial impulse for further innovation activities. The significance of initiation is reflected in the following aspects:

a) Initiation is prerequisite for innovation emergence. Hence, as performance needs innovation (Foster & Kaplan, 2001), initiatives become a precondition for sustainable corporate performance.

b) Deficiencies in idea development and idea selection are dominant factors explaining innovation failure (Khurana & Rosenthal, 1998). When deficient ideas serve as basis for the R&D process there is little chance of the outcome leading to technical or commercial success (Rubenstein, 1994).

c) Initiatives determine to a large extent the characteristics of innovations (Salomo & Mensel, 2001). Ground-breaking ideas will presumably lead to radical innovations (Reid & de Brentani, 2004), ideas brought up by lead users or other market parties will probably lead to more market-driven innovations compared to ideas developed by scientific research partners (Mensel, 2004, p. 110).

d) Initiatives create the input to the innovation portfolio of companies and determine the whole flow. Without a sufficient number of different initiatives, no adequate risk-return spread in innovation portfolios becomes possible (Cooper, Edgett & Kleinschmidt, 1999).

e) Because of the increasing innovation speed, an effective and efficient initiative phase is gaining importance for corporate success (Gupta, Brockhoff & Weisefeld, 1992).
All in all, the success of innovation to a large extent is determined during the initiative phase, both in terms of its development within the companies and its market acceptance. Hauschildt (2004) listed out five criteria as the requirements for the emergent of initiatives:

a) Initiative is highly dependent on an individual, especially for radical innovation. According to O’Connor & Rice, opportunity recognition for (radical) innovation is highly dependent on individual initiative and capacity, rather than routine practices and procedures of the company (O’Connor & Rice, 2001). This implies that the initiator’s curiosity, sensitivity, attention, power of observation and perception determines whether or not an initiative is taken, correctly evaluated and announced in a suitable manner (Hauschildt, 2004, p. 292).

b) Initiatives emerge when a discrepancy between expectation and reality is recognized. Generally, it is assumed that crises, discontentment, tensions or other forms of external pressure resulting from an actual situation or an anticipated development stimulate individuals to come up with new ideas (Van De Ven, 1986). When a problem is observed in a given situation, a course of action is triggered aimed at finding a solution in order to eliminate the experienced discrepancy or to take advantage of it. As soon as the problem is resolved and the situation is perceived as satisfactory, the process ends (Baker et al., 1980).

c) The third criterion is linked to the initiator’s will to take action. An initiative is started only if the perceived discrepancy between an actual and a desired situation stimulates the initiator’s will to commence activities aiming at closing the gap (Nijhof et al., 2002). A feeling of responsibility is prerequisite for the initiator’s will to take action. In a narrow sense, the responsibility for starting an initiative is bound to the individual job description or mandate. A broader understanding of responsibility for initiatives allows employees to propose ideas that do not immediately fall under their sphere of competence (Hauschildt, 1969, p. 737).

d) A fourth criterion represents the official announcement of the idea. Therefore, the idea has to be made known to an organizational unit with competences to allocate resources for further pursuing the new project. Thereby, the idea is taken from the individual to the organizational level (Hauschildt 2004).
e) The fifth element concerns the end of the initiative process, which is manifested in a decision about the continuation of the initiative. Again, this decision is made by an organizational unit with competences to assign resources for further pursuing the new project (Hauschildt, 2004, p. 225). In a selection process alternative initiatives are evaluated and the one that matches the given criteria best is singled out. Carefully filtering the existing initiatives is of central importance, as not every initiative represents a valid alternative for the respective organization (Rice et al., 2001). Only initiatives matching the company’s strategy and resources should then be pursued (Cooper & Kleinschmidt, 1995). Therefore, initiatives are always linked with an evaluation and selection process, where the ‘raw material’ becomes an opportunity. When the process is successfully run through, resources are assigned and the initiative is realized within the scope of a project.

These five constituting elements describe the subsequent process steps within the initiation stage. Moreover, they help to clarify the organizational requirements for the emergence of initiatives. Even though Hauschildt claims that the initiation stage is highly dependent on an individual staff, we argue that the idea generation of any individual initiator is highly related to customer values. For instance, point 2 and point 3 both direct initiator’s view towards the discrepancy between reality and desired situation, in which customer feedback might play an important role. Therefore, we propose that CRM activities can enhance the idea generation efficiency and provide useful information in regards of selecting the right idea to continue with:

H1a Information sharing has a positive impact on innovation initiation.
H1b Customer involvement has a positive impact on innovation initiation.
H1c Long-term partnership has a positive impact on innovation initiation.
H1d Joint problem-solving has a positive impact on innovation initiation.
H1e Technology-based CRM has a positive impact on innovation initiation.
3.2 **Innovation Input and CRM Activities Hypotheses**

The traditional focus in product innovation research is on the company’s ability to generate new scientific/technological information (Wheelwright and Clark, 1992, p. 118). They claim that a company acquires this competency by regular allocation of large funds to R&D in relation to sales. Early studies (Mansfield, 1968; Schmookler, 1966) analyzed innovation inputs, such as R&D spending, number of scientists employed, to explain the output and frequency of innovation activities. They believe that the higher the inputs the better the scientific and technological competence. There is a positive relation between R&D input and the number of important product technologies generated (Mansfield, 1968; Schmookler, 1966) because higher R&D investment increases the level of research activity within a company and permits it to engage in basic research, essential for generating proprietary scientific information (Nelson, 1959). Moreover, basic research generates and breeds fundamental knowledge within the company, endowing it with the ability to create new information by harmonizing existing accumulated information. It helps develop
competence in potential fields of knowledge, leading to the development of frontier
technologies. Furthermore it equips a company with the ability to identify and exploit
new information, spilling over from industry-level R&D (Cohen and Levinthal, 1990).

Thus, higher R&D spending, over the long-term, also equips a company with an
experience necessary to turn research projects into successes. Because R&D
engenders learning through time, consistent long-term investment not only builds
knowledge base, but also increases a company’s ability to carry out effective research
(Grabowski, 1968; Hambrick and Macmillan, 1985).

As R&D spending develops deep expertise within the company by allowing it to
recruit and retain talented scientific and engineering specialists (Freeman, 1982;
Roberts, 1988). Deep expertise widens the scope within which knowledge can be
applied, thereby increasing the potential to generate several new technologies

One synthesis of this is higher R&D spending enhances the level of research activity
within a company and builds specialized scientific/technological expertise as a result.
From the literature review, we find that customer’s role in this stage is not mentioned
or very limited. We put the initial hypotheses as below:

H2a Information sharing has a positive impact on innovation input.
H2b Customer involvement has a positive impact on innovation input.
H2c Long-term partnership has a positive impact on innovation input.
H2d Joint problem-solving has a positive impact on innovation input.
H2e Technology-based CRM has a positive impact on innovation input.
3.3 **Innovation Throughput and CRM Activities Hypotheses**

Various studies showed that the success of innovation is affected by innovation strategy management of the organisation. Innovation output will be explained by company's innovation strategy or in the other words, the continuous innovation dynamic along with variants of the innovation process through. The complexity and interaction of the innovation process should be studied and identified. (Berkhout, Hartmann, van der Duin & Ortt, 2006)

To deliver the innovative product or service from innovative input, the company will face with the challenges such as integrated view of customer information, richness of customer data, analysis of customer data, consistency of communication, intelligence at the operational touch points and feedback mechanism from customer. Moreover the relationships – inter-organizational relations between the organizations and the technical, environmental science and business in which it operates. (Peppers and Roger, 2004)
Finally, effective innovation throughput management will affect the success of the new innovative product or service. From the literature review, we find that customer’s role in this process is limitedly mentioned and need to study from different viewpoints. Therefore, we put the initial hypotheses as below:

H3a Information sharing has a positive impact on innovation throughput.
H3b Customer involvement has a positive impact on innovation throughput.
H3c Long-term partnership has a positive impact on innovation throughput.
H3d Joint problem-solving has a positive impact on innovation throughput.
H3e Technology-based CRM has a positive impact on innovation throughput.

![Figure 4 Model 3— Innovation Thoroughput and CRM Activities Hypotheses](image)

### 3.4 Innovation Output and CRM Activities Hypotheses

The innovation throughput which is the transformation of innovation input into innovation output, it is also critical to study about the innovation output based on the practice of the organisations. There is the fundamental problem as most organisations have an unbalanced approach to managing their investments in innovation process. The company’s focus on some resources in which they tend to focus to invest, such as technology, venue and media publishing, but usually ignore the other needs area for investment such as time, effort and people to develop the capabilities required to leverage those investments. (Vlok, 2005)
In some researches, innovation outcome refers to the tangible benefits of innovation, which is measured as the percentage of total sales accounted for by either products and/or services that were technologically improved or technologically new.

It is necessary to develop a basis for understanding innovation as a process which not only results in the implementation of a new good or service, but a new way to product production, and to set up distribution which has combination of delivering product and service. Innovation management should therefore need to aim for both technological advances and organizational improvements to advance in a given context. (Vlok, 2005) This practice will help the organisation in picking up signals about emerging innovations.

In addition, there is the finding by Guo and Zhao on a positive correlation significant between innovation input and innovation output as well as between innovation output and company competitiveness after controlling for factors such as capital intensity (Guo D. and Zhao, 2010). It showed the linkage between innovation input and output as well as innovation output and the company performance.

In recent years, the topic of innovation and its relationship with productivity or company performance has been the focus of attention. Growing empirical research has been conducted on testing the correlation between innovation and performance of the company. Loof and Heshmati (2001) examined the relationship between innovation and the organisation performance by using different data samples. The result is confusing at the country to country level through. They also found that only in Sweden, the relationship between innovation input and innovation output is significant. Moreover, the innovation output significantly and positively associated with company performance in Finland but not in Norway and Sweden. (Loof and Heshmati, 2001)

In studying about delivering the innovation output, it would be valuable to include the effects of the five mentioned dimensions of CRM on innovation capabilities with one-to-one associations. From the literature review, we find that customer's role in the
innovation output process will need to test further. Therefore, we put the initial hypotheses as below:

H4a Information sharing has a positive impact on innovation output.
H4b Customer involvement has a positive impact on innovation output.
H4c Long-term partnership has a positive impact on innovation output.
H4d Joint problem-solving has a positive impact on innovation output.
H4e Technology-based CRM has a positive impact on innovation output.

Figure 5 Model 4— Inovation Output and CRM Activities Hypotheses

4. Research Methodology

Our study explores how CRM activities influence innovation process by testing several competing models. Because of the exploratory and complex nature of the process our aim is to provide scientific illustration of our selected research design. As much of the input is known in the literature, we find a quantitative research approach is considered to be the appropriate method.

4.1 Survey

A Likert-scale questionnaire was sent to 100 respondents working with product innovation or marketing department in various companies, mainly consumer durable manufacturers. The questionnaire was pre-tested by two R&D managers to ensure
survey content is understandable and valid. These managers represent a strategic business unit. A copy of the questionnaire is presented in the Appendix. In order to improve the response rate, follow-up calls were made to push for responses within 3 weeks. The purpose of the study was described in the cover letter. In the end, 83 questionnaires were returned.

4.2 Measures

The scale for both CRM and innovation process were developed based on previous literature. For example, the scale for each CRM activities comes from Lin, Chen and Chiu (2010). The measurement of innovation initiation was adopted from Talke, Salomo and Mensel (2006). The innovation input scale was based on Parthasarthy and Hammond (2002).

A seven-point Likert scale (1 “strongly disagree” and 7 – “strongly agree”) was used to evaluate the degree of implementation for CRM scheme during the innovation process.

4.3 Statistical Analysis Methods

There are two stages of statistical analyses: factor analysis and regression analysis. In the first stage, a factor analysis is conducted to assess the reliability of the study. Invalid factors were eliminated in this stage. Then a regression analysis is carried out to show the relationships between CRM activities and innovation stages.

5. Statistical Results

5.1 Factor Analysis

Factor analyses are performed by examining the pattern of correlations between observed measures. Measures that are highly correlated are likely influenced by the same factor, while those that are relatively uncorrelated are likely influenced by different factors. By examining item-to-item correlation, the validity of the measures was assessed and guaranteed.
Items with low item-to-item correlation were eliminated because they did not correlate within the same factor. The remaining questions are reported in Table 1 Means and Standard Deviation, which shows their means and standard deviations.

Table 1 Means and Standard Deviation

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Table 2 below shows the correlations of the remaining factors. Each of the measures that have positive and substantial correlations means they measure the same thing. We mark them in bold.

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<td>-.13</td>
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<td>.56**</td>
<td>.53**</td>
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</tbody>
</table>

*p<.01; *p<.05
As the measures did measure what they purported to measure and correlated within each construct, they were aggregated to one measure. Means, standard deviations and correlation of the aggregated measures are reported in Table 3.

<table>
<thead>
<tr>
<th>Mean</th>
<th>Std. Dev</th>
<th>IN</th>
<th>IT</th>
<th>IP</th>
<th>IS</th>
<th>CI</th>
<th>LP</th>
<th>TB</th>
<th>JS</th>
<th>IO</th>
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</thead>
<tbody>
<tr>
<td>IN</td>
<td>4.98</td>
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<td>1.00</td>
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<td>1.17</td>
<td>.13</td>
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<td>1.00</td>
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<td>.10</td>
<td>.00</td>
<td>1.00</td>
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<tr>
<td>IS</td>
<td>4.58</td>
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<td>-.13</td>
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<td>.38**</td>
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<td>-.11</td>
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<td>1.00</td>
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</tr>
<tr>
<td>TB</td>
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<td>1.08</td>
<td>-.14</td>
<td>.04</td>
<td>.03</td>
<td>.16</td>
<td>.17</td>
<td>.24*</td>
<td>1.00</td>
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</tr>
<tr>
<td>JS</td>
<td>3.88</td>
<td>1.59</td>
<td>.20</td>
<td>.61**</td>
<td>.38**</td>
<td>-.15</td>
<td>.63**</td>
<td>.50**</td>
<td>.25*</td>
<td>1.00</td>
</tr>
<tr>
<td>IO</td>
<td>5.15</td>
<td>0.86</td>
<td>.05</td>
<td>.38**</td>
<td>.16</td>
<td>.36**</td>
<td>.17</td>
<td>.39**</td>
<td>.14</td>
<td>.25*</td>
</tr>
</tbody>
</table>

**p<.01; *p<.05

5.2 Regression Analysis

Regression analysis is a statistical tool for the investigation of relationships between variables. The result will show which CRM activity has larger role in which stage of innovation process. The strength of the relationship for the overall model is measured by Adjusted R Square. The significance of the relationship is expressed in probability levels: p-value. P value tells how unlikely a given correlation coefficient r will occur given no relationship in the population. The smaller the p-value, the more significant the relationship. The larger the correlation, the stronger the relationship.

5.2.1 CRM and Innovation Initiation

In model 1 adjusted R square (0.027) is too low. It tells us we can only explain 2.7 % of variance in the dependent variable, which is innovation initiation. Therefore Model 1 which attempts to test the impact of CRM on innovation initiation is not statistically significant. The P-value of Hypothesis 1a-1e are all greater than 0.05. It further proves that the relationship between CRM and innovation initiation stage is neither significant nor strong.
Table 4 Summary CRM and Innovation Initiation

<table>
<thead>
<tr>
<th>Model</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.293a</td>
<td>.086</td>
<td>1.12552</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), (TB2+TB3+TB4+TB5)/4, (IS1+IS2+IS5)/3, (CI1+CI2+CI3)/3, (LP1+LP2+LP5)/3, (JS1+JS2+JS3)/3

5.2.2 CRM and Innovation Input

In Model 2 adjusted R square (0.154) is not ideal but significant. We can explain 15.4% of variance in innovation input. However, the P-values of Hypothesis 2a-2e are all greater than 0.05 which means that these hypotheses are not supported.

Table 5 Summary CRM and Innovation Input

<table>
<thead>
<tr>
<th>Model</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>.453a</td>
<td>.205</td>
<td>1.13444</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), (TB2+TB3+TB4+TB5)/4, (IS1+IS2+IS5)/3, (CI1+CI2+CI3)/3, (LP1+LP2+LP5)/3, (JS1+JS2+JS3)/3

5.2.3 CRM and Innovation Throughput

Next model 3 in Table 5 report a slightly better adjusted R square (0.427), which proves that this model is likely best represent our idea. We can explain 42.7% of variance in innovation throughput. The P-value of Hypothesis 3a, 3b and 3e are all less than 0.05 which means that these hypotheses are strongly supported. The substantial standard coefficient of H3e shows a very positive relationship between joint-problem solving and innovation throughput.

Table 6 Summary CRM and Innovation Throughput

<table>
<thead>
<tr>
<th>Model</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>.680a</td>
<td>.462</td>
<td>.88523</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), (TB2+TB3+TB4+TB5)/4, (IS1+IS2+IS5)/3, (CI1+CI2+CI3)/3, (LP1+LP2+LP5)/3, (JS1+JS2+JS3)/3
Table 7 Coefficients* CRM and Innovation Throughput

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Independent Variable</th>
<th>Std. Coefficients (Beta)</th>
<th>Sign. P-value</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>H3a: IS → IT</td>
<td>(IS1+IS2+IS5)/3</td>
<td>.243</td>
<td>.006</td>
<td>Supported. P-value &lt; .001</td>
</tr>
<tr>
<td>H3b: CI → IT</td>
<td>(CI1+CI2+CI3)/3</td>
<td>.215</td>
<td>.049</td>
<td>Supported. P-value &lt; .005</td>
</tr>
<tr>
<td>H3c: LP → IT</td>
<td>(LP1+LP2+LP5)/3</td>
<td>.063</td>
<td>.518</td>
<td>Not supported</td>
</tr>
<tr>
<td>H3d: JS → IT</td>
<td>(JS1+JS2+JS3)/3</td>
<td>.521</td>
<td>.000</td>
<td>Supported. P-value &lt; .001 Std. Coefficient is substantial</td>
</tr>
<tr>
<td>H3e: TB → IT</td>
<td>(TB2+TB3+TB4+TB5)/4</td>
<td>-1.177</td>
<td>.051</td>
<td>Not supported</td>
</tr>
</tbody>
</table>

a. Dependent Variable: (IT1+IT3+IT4)/3

5.2.4 CRM and Innovation Output

Next model 4 we report an adjusted R square (0.293) that positively supports this model. We can explain 29.3 % of variance in innovation output. The P-value of Hypothesis 4a and 4c are less than 0.05 which means that these hypotheses are valid.

Table 8 Summary CRM and Innovation Output

<table>
<thead>
<tr>
<th>Model</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>.602a</td>
<td>.362</td>
<td>.293</td>
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</tbody>
</table>

a. Predictors: (Constant), (TB2+TB3+TB4+TB5)/4, (IS1+IS2+IS5)/3, (CI1+CI2+CI3)/3, (LP1+LP2+LP5)/3, (JS1+JS2+JS3)/3

Table 9 Coefficients* CRM and Innovation Output

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Independent Variable</th>
<th>Std. Coefficients (Beta)</th>
<th>Sign. P-value</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>H4a: IS → IO</td>
<td>(IS1+IS2+IS5)/3</td>
<td>.38</td>
<td>.000</td>
<td>Supported. P-value &lt; .001</td>
</tr>
<tr>
<td>H4b: CI → IO</td>
<td>(CI1+CI2+CI3)/3</td>
<td>-0.019</td>
<td>.878</td>
<td>Not supported: p-value &gt; .05 Standardized beta coefficient also reports a negative relationship.</td>
</tr>
<tr>
<td>H4c: LP → IO</td>
<td>(LP1+LP2+LP5)/3</td>
<td>.366</td>
<td>.001</td>
<td>Supported. P-value &lt; .005.</td>
</tr>
<tr>
<td>H4d: JS → IO</td>
<td>(JS1+JS2+JS3)/3</td>
<td>.002</td>
<td>.987</td>
<td>Not supported</td>
</tr>
<tr>
<td>H4e: TB → IO</td>
<td>(TB2+TB3+TB4+TB5)/4</td>
<td>-0.005</td>
<td>.959</td>
<td>Not supported: p-value &gt; .05 Standardized beta coefficient also reports a negative relationship.</td>
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</tbody>
</table>

a. Dependent Variable: (IO1+IO2+IO3+IO5)/4
6. Analysis

In our research question we asked: What CRM processes leads to innovative outcomes? To answer this question we tested various competing models of different innovative outcomes in an innovation process.

6.1 Model 1
Innovation Initiation and CRM Activities: Despite the importance of innovation initiation—the idea generation phase, the relationship between CRM and innovation initiation is not supported in the survey. This finding is partly understandable as pointed by Haushildt (2004) that initiative is highly dependent on individual initiative and capability. Company’s processes and procedures do not interfere in this stage yet. It is mostly the initiator’s curiosity, sensitivity, attention, power of observation and perception that determines whether or not an initiative is taken, correctly evaluated and announced in a suitable manner. The failure of the Model 1 confirms that innovation initiation stage is not directly influenced by CRM activities.

6.2 Model 2
Innovation Input and CRM Activities: It is believed that the higher the inputs the better the scientific and technological competence in previous studies. There is a positive relation between R&D input and the number of important product technologies generated. However, it is not testified in the previous study if and how the customer relationship plays a role to influence the decision of how much input should be allocated. This study shows that there is no relationship between CRM practices and decision making of innovation input. Customer information does not affect managements’ decision on resource allocation of product innovation.

6.3 Model 3
Innovation Throughput and CRM Activities:
Adjusted R square (0.427) of Model 3 proves that this model is strongly valid. The P-value of Hypothesis 3a, 3b and 3d from the statistical model running are all less than 0.05 which means that these hypotheses are strongly supported:
H3a Information sharing has a positive impact on innovation throughput.
H3b Customer involvement has a positive impact on innovation throughput.
H3d Joint problem-solving has a positive impact on innovation throughput.

The statistical result came as the authors expected, however as the results showed the long-term partnership and technology-based CRM seem not to have the strong focus and concerned to have the positive impact on innovation throughput from the participants in the survey. Customer involvement and the information shared by customers will help the organisation in picking up signals about emerging innovations.

Results provided are somehow supported in the same study conducted by R. Lin with computer manufacturers in Taiwan on CRM and Innovations, the study also showed different degrees of effects on the innovative capabilities. In general, it found out that companies can improve their innovation by CRM ad hoc relationship between customer participation and the process of innovation, moreover throughout the participation of customers and innovative strategy management, however their long-term partnerships are negligible, and CRM-based technology has a positive impact on all kinds of innovation. (R. Lin, 2004)

From the statistical data, we drawn out the finding that not all CRM activities contribute to the innovation throughput. Since the long-term partnership and technology-based CRM is the strategy of any company to distinguish themselves from competitors in the eyes of customers. And although there are still some low-costs based companies that are less dependent on CRM as a means of different driving competition, and they feel that it is not necessary invest in CRM technology-based process management and effective customer experience study. Increasingly, the companies are realizing that CRM is a long term investment, with the effective gains through customer relationships for life.

As shared by in the survey, most of the officers in R&D think that they could distinguish themselves by focusing on the relationship construction aspects of CRM. By using new initiatives to drive customer insight and improve customer value, the company can improve the return from their CRM programs. However, so far their companies have used CRM primarily competitive "catch-up" rather than a mean of...
the difference. Therefore, management should arrange the development of their management practices and innovative CRM capabilities.

From an operations perspective, Butler (2004) pointed out that CRM is an integrated technology and business process adopted to meet the needs of a client in any for the interaction. While the potential benefits are attractive, CRM activities must be carefully managed to provide the results. In order to be successful firms in development of CRM systems and its activities, should be involved and expectations of management. Business processes also need to be changed as well as technology. It also should be concerned for management and the ones in R&D as drawn from the technology-based CRM activities toward Innovation throughput that there are more coming efficient firms, which are often new entrants in industries with rapidly evolving technologies especially industries producing and using information and communication.

The high coefficient (0.521) and low P-value (0.000) establish H3d joint problem-solving as the most significant factor to innovation throughput. Joint problem solving refers to collaboration between manufacturers and customers in solving problems together and sharing responsibilities when they encounter difficult or unexpected situations (McEvily and Marcus, 2005).

During the stage of product design and development, problems and difficulties are unavoidable. It takes time and resource to get over problems. Innovation process gets prolonged if problems cannot be solved efficiently. However, the heated competition in the market requires an effective and efficient product development process. The survey result proves that joint problem-solving has become a critical factor in enhancing innovation throughput.

This result is in line with the findings of Maklan (2008) in “New trends in innovation and customer relationship management: A challenge for market researchers”. Marklan points out that the focus of marketing will be to work with customers as co-creators to build value-in-use. In today’s economy, customers are active participants in product design and development. Co-creation becomes a more important component of
innovation and growth strategies because customer’s participation can increase
customer value and yields greater returns.

6.4 Model 4
Next we tested the relationship between Innovation Output and CRM Activities:
Adjusted R square (0.293) of Model 3 proves that this model is valid. The P-value of
Hypothesis 4a and 3d from the statistical model running are all less than 0.05 which
means that these hypotheses are strongly supported:

\[ H4a \text{ Information sharing has a positive impact on innovation output.} \]
\[ H4c \text{ Long-term partnership has a positive impact on innovation output.} \]

For a business to maximize its long-term performance in terms of customer
satisfaction, trust, return on sales, and return on investment, it must build, maintain,
and enhance long-term and mutually beneficial relationships with its target buyers
(Sin et al., 2005). Moreover, based on mutual trust and understanding, manufacturers
are able to maintain close partnerships with their customers and are more likely to
precisely identify customer demands and thus provide an acceptable pricing scheme,
promotion activities, and retailing and marketing strategies (Lin and Germain, 2004).

Economist Intelligence Unit conducted the report involved an investigation with 405
senior executives from many European countries, plus the series of interviews in
depth with a number of people directly responsible for R&D and Innovation. In the
survey, the majority of participants supported the idea of a more open Innovation
strategy. A total of 68% believe that by increasing the cooperation and information
sharing with third parties in R & D, they will increase their innovation output.
Furthermore, nearly 46% mentioned that it makes sense to share the innovation ideas
with the open source community. Moreover, the report concluded that European
companies increasingly believe that cooperation with third parties in research and
development will support them to utilize the value of their intellectual property
(Surveyed by Economist Intelligence Unit). By developing more multiplex
relationships with individual customers or through the pursuit of cooperation expand
partnership on R & D; the company will be able to increase closely the contact points
between them. Therefore, a deep relationship, commitment and a closer knowledge sharing with information exchange will occur.

During the survey of the authors, there was some sharing that although in the past, organizations tend to invest in R&D and focusing on their technology, the respondents during the survey believed it is the best way to protect and obtain the economic benefits from the innovation. However, they believe that in the fast changing and information-rich environment today, the management of company need to know that this approach to innovation instead would be tentatively replaced by a more open approach to innovation, whereas the innovative ideas could be obtained from the flows of information sharing from inside and outside of the company.

7. Conclusions

As we asked what CRM processes lead to innovative outcomes we now can propose an answer relative to our findings. First of all we tested various competing models competing models of different innovative outcomes in an innovation process. We find that these processes are valid but needs to be organized and well planned. Each process has their own logic.

But first, CRM is a popular concept in the discussion of how to improve company’s innovativeness and thus to enhance the company’s core competence. However, previous studies have not integrated CRM activities with innovation process. This study proposes and tests the impact of five most common CRM activities on four stages of innovation process. The statistical results indicate that not all CRM activities make contribution to each step within innovation process. Companies might consider aligning their CRM activities with a certain stages of innovation process.

Specifically, information sharing has positive influence on both innovation throughput stage and output stage. Customer involvement and joint problem-solving have significant effects on innovation throughput. Long-term partnership contributes to innovation output. In contrast, technology-based CRM is not proved to play any role in any stages of innovative process.
The followings are the hypotheses that being supported in the survey (Figure 6):

H3a Information sharing has a positive impact on innovation throughput.
H3b Customer involvement has a positive impact on innovation throughput.
H3d Joint problem-solving has a positive impact on innovation throughput.
H4a Information sharing has a positive impact on innovation output.
H4c Long-term partnership has a positive impact on innovation output.

![Figure 6 Conclusions](image)

### 7.1 Implications

The statistical results indicate that not all CRM activities make contributions to each step within innovation process. Companies might consider aligning their CRM activities with a certain stages of innovation process.

1. **Several effective CRM activities for innovation throughput and output.**

Respondents in our sample tend to agree that information sharing effectively enhances both innovation throughput and innovation output. Customer involvement and joint problem-solving exert positive influence on innovation throughput stage, while long-term partnership has significant effects on innovation output. It is of great significance
to corporate management in terms of allocation of resources and establishment of cooperation across sectors and departments. These identified CRM practices should be well communicated or executed during the corresponding innovation processes.

(2) *CRM activities have no impact on innovation initiation and input.*

This study shows that CRM practices have no direct impact on innovation initiation and input so far. One explanation is that idea generation of innovation is highly dependent on individual initiative and capability (Hauschildt, 2004). Apparently, it is risky for any company to be too reliable on individuals. Therefore, managerial staff can explore how to standardize this process and how to incorporate CRM activities with these early stages in an optimal way.

We have also identified a lack of academic study on how these two early stages of innovation are being operated in the business world. The previous research on these two stages focused on how they influence the ultimate innovation performance and emphasized their importance to the innovation output. However, what factors influence innovation initiation and input has not been thoroughly discussed. Further study on the nature of these two stages might supply additional explanations to our study.

(3) *Technology-based CRM*

Technology-based CRM is the least effective mechanism during the whole innovation process. Our survey shows the relationship between technology-based CRM and the four stages of innovation process are rather weak.

The importance of technology-based CRM is well recognized in the world of customer-oriented marketing. For example, Dyche (2001) suggested that manufacturers should apply information technology, such as online data analysis, data mining, customer information systems, and service centres, to understand and communicate with their customers. However, these technological benefits are not recognized by the innovators (designer and R&D engineers). It might be due to the lack of internal communication between marketing and R&D department. We do believe that technology-based CRM makes indirect contributions to innovation
process because information sharing has been identified as a significant factor in our study. Technology-based CRM certainly facilitates information sharing in general.

(4) *Industries and countries*

The sample respondents of this study are mainly from the consumer durables industry in Sweden and Vietnam. It is not known if the other industries and geographical areas would result in different findings. We believe the nature of the product lifecycle, market conditions and industry structure might affect the relationship between the two construct in our study. Future research could compare variances between different industries and countries.


Scattering the seeds of invention: The globalization of R&D, Economist Intelligence Unit


Vavra, T.G. (1992), Aftermarketing: How to Keep Customers for Life through Relationship Marketing, Business One-Irwin, Homewood, IL.


**Appendix**

**Questionnaire**

Your company industry:
Main products:
Company age:
Number of employees:
Your department:

<table>
<thead>
<tr>
<th>No</th>
<th>Questions</th>
<th>Strongly Disagree</th>
<th>Neither</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1 2 3</td>
<td>4 5</td>
<td>6 7</td>
</tr>
<tr>
<td>1</td>
<td>The start of idea generation is highly dependent on an individual in our company.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>An innovative idea in our company is generated to meet customer expectation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>New idea is brought up no matter if R&amp;D staff is competent to realize it or not.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Customers are invited to participate in &quot;selecting and evaluating&quot; initiative ideas before design.</td>
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<td></td>
</tr>
</tbody>
</table>

**Product Design & Development**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Strongly Disagree</th>
<th>Neither</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Delivery of innovative research into real product is well managed in our company.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>6</td>
<td>There is a strong cooperation between R&amp;D and Production teams in delivering the new product in our company.</td>
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<tr>
<td>7</td>
<td>The top management involves an assigned executive as a sponsor to deliver the new product</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Communications with market research team are also conducted to update the customer feedback during the innovation design &amp; development stage.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Project management is applied in the innovation design &amp; development process.</td>
<td></td>
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</tr>
</tbody>
</table>

**Innovation Output**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Strongly Disagree</th>
<th>Neither</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>The new product is carefully reviewed by diversified group of customers.</td>
<td></td>
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<tr>
<td>11</td>
<td>Feedback from customers on new product during pilot period is carefully studied.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>12</td>
<td>The top management cares a lot about negative feedbacks from customers.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>The marketing plan for new product is well planned in advance.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>A market research is continually conducted after the new product launched out.</td>
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</table>

**R&D Resources**

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<tbody>
<tr>
<td>15</td>
<td>The allocation of R&amp;D in relation to sales revenue is quite big in our company.</td>
</tr>
<tr>
<td>16</td>
<td>Total investment in innovation is big compared to other costs in our company.</td>
</tr>
<tr>
<td>17</td>
<td>R&amp;D spending enhances our company’s innovation competence in the long-run.</td>
</tr>
<tr>
<td>18</td>
<td>R&amp;D engineers and designers are capable in doing their jobs in our company.</td>
</tr>
<tr>
<td>19</td>
<td>Good talents in R&amp;D/design like to work for our company.</td>
</tr>
</tbody>
</table>

**Information Sharing**

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<table>
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<tbody>
<tr>
<td>20</td>
<td>When something important happens to a major custo of market, the whole business unit knows about it within a short period.</td>
</tr>
<tr>
<td>21</td>
<td>Our company uses technology related methods such as product website and social network for customers to share their ideas.</td>
</tr>
<tr>
<td>22</td>
<td>Our company also listens to internal customers on the new product.</td>
</tr>
<tr>
<td>23</td>
<td>Our company records the information from customers in different categories.</td>
</tr>
<tr>
<td>24</td>
<td>Our business unit periodically circulates documents (e.g., reports, newsletters) that provide information on our customers.</td>
</tr>
</tbody>
</table>

**Customer Involvement**

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>25</td>
<td>Our key customers are involved in new product development activities with us.</td>
</tr>
<tr>
<td>26</td>
<td>Our key customers are involved with us in modifying products.</td>
</tr>
<tr>
<td>27</td>
<td>Our key customers are involved with us regarding market evaluations.</td>
</tr>
<tr>
<td></td>
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<td>---</td>
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</tr>
<tr>
<td>28</td>
<td>Our customers do not hesitate to sue the hotline to give their opinion/complaint.</td>
</tr>
<tr>
<td>29</td>
<td>We periodically review our product development efforts to ensure that they are in line with what customers want.</td>
</tr>
</tbody>
</table>

**Long-term Partnership**

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<table>
<thead>
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<tbody>
<tr>
<td>30</td>
<td>Our company is committed to improving product of whatever customers suggest.</td>
</tr>
<tr>
<td>31</td>
<td>Our customers are trusted and willing to provide suggestions for products and services for our company.</td>
</tr>
<tr>
<td>32</td>
<td>Our company has a process to provide customized products and services to our key customers.</td>
</tr>
<tr>
<td>33</td>
<td>Our company actively monitors customer loyalty or retention rate.</td>
</tr>
<tr>
<td>34</td>
<td>Our company maintains interactive, two-way communication with customers.</td>
</tr>
<tr>
<td>35</td>
<td>Our company cares about long-term development partnership with customers.</td>
</tr>
</tbody>
</table>

**Joint Problem Solving**

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>36</td>
<td>Our key customers work with us to solve problems in product design.</td>
</tr>
<tr>
<td>37</td>
<td>Our company is jointly responsible with our key customers for getting things done.</td>
</tr>
<tr>
<td>38</td>
<td>Our company works with our key customers to help solve each other’s problems.</td>
</tr>
</tbody>
</table>

**Technology-based CRM**

<p>| | |</p>
<table>
<thead>
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<tbody>
<tr>
<td>39</td>
<td>Our company uses a service center to deal with customer suggestions.</td>
</tr>
<tr>
<td>40</td>
<td>Our company uses Sales Force Automation (SFA) to track sales processes.</td>
</tr>
<tr>
<td>41</td>
<td>Our company uses Management Information System (MIS) to analyze customers’ trade-off information.</td>
</tr>
<tr>
<td>42</td>
<td>Our company has an integrated customer relationship management (CRM) performance evaluation system.</td>
</tr>
<tr>
<td>43</td>
<td>Our company establishes perfect web-based customer interaction.</td>
</tr>
</tbody>
</table>