CO-CREATION AND FIRM PERFORMANCE:

INNOVATION SUCCESS ENHANCING EFFECTS OF AND MOTIVES FOR CUSTOMER INVOLVEMENT

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MANAGEMENT SUMMARY

Both the academic and consulting world is experiencing the increasing impact of the connected, informed and active consumer and is developing new theories and service offerings to support this development. Based on this development, this research seeks to answer the following research question: To what extent has co-creation impact on firm performance through innovation success in large firms and what is the international position of large Dutch firms in respect to co-creation and innovation success? Co-creation is the extent in which a firm has a deep interactive dialogue with its customers; firm performance is the extent in which a firm is capable of reaching sustained competitive advantage; innovation success is the successful exploitation of new ideas; and large firms are firms with more than 500 FTE of employees.

To answer the research question, this study first explored the role of customers in firm performance and innovation success in different organizational functions and the motives for involvement of customers. The research subsequently constructed a conceptual model hypothesizing a positive effect of co-creation on innovation success and a positive moderating effect of the number of involved functions in co-creation on the effect of co-creation on innovation success. The research applied secondary survey data analysis on a sample of 327 firms to test the hypotheses using GLM analysis. The research executed a supplementary survey resulting in a sample of 50 firms and two interviews with firm managers to research the motives for co-creation using descriptive analyses. The two surveys were combined to test the international position of Dutch firms using Student's t-tests and descriptive analyses.

The research concludes that there is no main effect of co-creation on innovation success, but that the moderating effect of the number and type of organizational functions involved does make this relation significant. The direction of the effect depends on the exact configuration. In general and for an increased positive effect on innovation success, firms should combine low levels of co-creation with a higher number of involved functions and high levels of co-creation with few involved functions. Co-creation takes relatively equally place in the marketing/sales, service/support and product development functions of firms, while co-creation in the production and logistic organizational function is far less common. The research further concludes that firms are highly engaged in co-creation and notice an increasing trend. Both firms and their customers are ready for co-creation, but firms do not have the time to set up the proper processes and capabilities. The main drivers are the identification of new needs and improvement of customer loyalty, while increasing markets share, customer base and brand awareness is less important. The research also finds that co-creation benefits innovation success through the development of new markets, products and new customers. This shows that while firms are motivated to engage in co-creation by better serving current customers and to leverage a wide range of innovation antecedents, co-creation eventually results in serving new customers mainly through operation innovation antecedents. Firms with more commodity type products or that are deeper in the value chain are more constraint in co-creation. Lastly, the research concludes that there are no large differences between Dutch firms and foreign firms in either of these dimensions. The research did show that Dutch firms are less active in co-creation in the NPD and service/support functions of the firm in comparison with firms worldwide.

The main managerial implication of this research is that managers should balance additional knowledge and increasing project complexity by choosing between a combination of a high level of co-creation and few involved functions or a low level of co-creation and many involved functions. The choice should be made on the basis of the progression of the firm's offerings and closeness of the firm to the end-consumer. The discussion of the academic implications shows that the co-creation concept as developed by Prahalad and Ramaswamy (2004) and Vargo and Lusch (2004) needs more explication in the role of different organizational functions and the process towards engaging in high levels of co-creation. The open innovation model (Chesbrough, 2003) is affected, because this research shows a non-significant effect of knowledge partner involvement and a moderated (by the number of involved functions) effect of customer involvement on firm performance. The role of exploitative absorptive capacity deserves more attention in the open innovation model, because this research shows a very strong positive effect of this factor on innovation success.

PREFACE

Inspired by earlier work on co-creation, I started my master thesis in January this year to complete my studies in Business Administration and Innovation, Knowledge and Entrepreneurial Dynamics. Although neither university put much emphasis on this future of competition, it immediately appealed to me because of its focus on experiences instead of products. This distinction, however, also resulted in a problem throughout the research. Both the business and scientific community consider the product to be the source of competitive advantage, often limiting the focus of my research. I am convinced that co-creation will be the most important answer to deal with changes in society and economy; whether everyone is ready for this answer is a different question.

I would like to thank all the people who helped me during my research. My four supervisors Dries Faems, Isabel Thijssen, René Nielsen and Erwin Hofman helped me to see the limitations of my research and advised me on sometimes difficult decisions. The business innovation team consisting of Koen, Ardo, Jaco, Bas, Freek, Remy, Isabel, Daan, Thijs, Micha, Daan, Mourad and Bart helped me to understand the business value of co-creation. And of course all my friends and family, who supported me during this last phase of my studies. Thanks to all of you for your time and patience!

I hope the reader will experience an interesting and maybe even inspiring read on the value of co-creation.

Arjan

Utrecht, July 25th, 2010

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1. INTRODUCTION

This first chapter serves as an introduction to the concept of co-creation and its effect on firm performance through innovation and will formulate research questions on the basis of this. The chapter starts by indicating the academic and practical relevance of this research by discussing some important contributions to the concept of co-creation and areas that deserve additional research in paragraph 1.1. Subsequently, the main concepts that will be used in this research are defined in paragraph 1.2. Paragraph 1.3 formulates the research goal and paragraph 1.4 the research questions. The chapter concludes with paragraph 1.5, presenting the structure of this research report.

1.1. BACKGROUND

Since the late 1990s, the role of consumers[1] in the industrial system is changing and the impact of the connected, informed and active consumer keeps increasing through information access, a global view, networking and experimentation (Prahalad & Ramaswamy, 2004). During the last ten years, a range of new theories in innovation management, knowledge management and marketing management have been developed that try to deal with this change and try to find new ways to add value, all claiming that a new age has started and firms will have to fundamentally alter their perceptions on external parties in order to stay viable (Chesbrough, 2003; Pine & Gilmore, 1999; Prahalad & Ramaswamy, 2004; Vargo & Lusch, 2004; Von Hippel, 2005).

The concept of the experience economy has had an especially large impact on this debate and takes a broad and historical perspective on the issue. The experience economy is the next stage in the progression of economic value, following the service economy (Pine & Gilmore, 1999). The theory states that each step in the progression of economic value was driven by commoditization of the firm's offerings and the need to find new ways to add value. Firms need to keep customizing their offerings in order to avoid commoditization and customizing services will result in experiences. Experiences are derived from the interaction between the consumer and the staged event of the firm. An experience always uses services to set the stage and goods as props in order to engage an individual in a personal manner. The result is that no two people will ever have the same experience; an experience is highly context dependent and depends on the individual's prior state of mind. The centrality and importance of the consumer can also be seen in the four realms that are needed to turn a plain space in a distinctive place for staging experiences: entertainment, education, escape and estheticism. Only full engagement of the consumer can result in experiences.

Research on lead users has found that in the industrial system, consumers are the only party that directly benefit from innovation, resulting in a high participation of consumers in innovation (Von Hippel, 2005). Because the needs of consumers are highly heterogeneous, the chance that an offering on the market is exactly what a consumer needs is very low. Instead of letting firms develop the offering so that it exactly meets their needs, consumers often innovate themselves because of the lower agency costs and the enjoyment and learning experience it brings. Consumers are willing to share their innovations, because it is the only realistic way of further developing and improving it. Being open for consumer innovations is attractive for firms, because it is the best way to deal with sticky information. Product or service development is essentially bringing consumer needs information and firm solution information together. Consumer need information is sticky (i.e. difficult and expensive to obtain), which can be solved by democratized innovation.

Prahalad and Ramaswamy (2004) describe co-creation as: "co-creation is about *joint* creation of value by the company and the customer. It is not the firm trying to please the customer" (Prahalad & Ramaswamy, 2004, p. 8) and "co-creation is […] creating an experience environment in which consumers can have active dialogue and co-construct personalized experiences; product may be the same […] but customers can construct different experiences" (Prahalad & Ramaswamy, 2004, p. 11). The concept of co-creation was first posited by Prahalad and Ramaswamy (2000), where they state that changing customer behavior fundamentally changes the dynamics of the marketplace. The consequence for the firm is that customers become a new source of competence, consisting of the knowledge and skills they possess, the willingness to learn and experiment and the ability to engage in active dialogue. The world consists of value creation spaces, where "value lies in the co-creation experience of a specific [consumer], at a specific point in time, in a specific location, in the context of a

[1] This report alternates the use of the words 'consumer', 'user' and 'customer'. All three words mean the same, which is the end consumer of a firm's offering.

specific event" (Prahalad & Ramaswamy, 2004, p. 10). These spaces consist of experience environments, which is "a framework that allows the firm to facilitate a variety of co-creation experiences with millions of consumers" (Prahalad & Ramaswamy, 2004, p. 51). The experience environment facilitates unique context-specific experiences for consumers and is formed through experience innovation. Experience innovation is the challenge that results from the evolving role of consumer communities "that cannot be predicted a priori" (Prahalad & Ramaswamy, 2004, p. 54). This is where co-creation between consumers and the nodal firm comes in. The nodal firm is "an experience network of multiple firms and consumer communities" (Prahalad & Ramaswamy, 2004, p. 85) and facilitates experiences through experience channels, which are portions of the experience environment. To harness the customer competence, firms must manage four fundamental realities: encourage active dialogue, mobilize customer communities, manage customer diversity and co-create personalized experiences. Managing the personalized experience involves creating the opportunity for customers to experiment with and decide the level of involvement. Firms can help this process by managing multiple channels of experiences; manage variety and evolution; and shape customers' expectations. To prepare the organization for the new marketplace, firms must have a stable center and flexible organization.

In a response to the increasingly globally interconnected and turbulent world, the marketing literature suggests a shift from a goods-dominant logic to an S-D logic (Vargo & Lusch, 2004). This logic focuses on the interaction of the firm, the consumer and the rest of the value chain to co-create value through collaboration. Knowledge and skills are the only resources for sustained competitive advantage; these are operant resources and no longer the operand resources of the goods-centered economy. Goods in the S-D logic are only transmitters of the operant resources and value results from the use of these resources. Because value takes place when the resources are in use, firms can only make value propositions.

Not only scientific research has been active with the development of theories addressing this change, the consulting world has also been developing thoughts and offerings on this trend ((Capgemini, 2007; Global Commerce Initiative, 2008; Lawer, 2006; Pater, 2009). These firms also notice the change towards a more consumer-centric competitive world in which engagement of the consumer becomes a critical factor for success. The application of co-creation management techniques show that the business world agrees that this will lead to a better competitive advantage.

This research is set up to test whether consumer involvement works as a lever for firm performance and what the mechanisms behind such a relation are. This is done by taking innovation success as the mechanism through which co-creation affects firm performance. This research further explores the international position of Dutch firms in respect to these concepts. The rest of this chapter defines the core concepts, objective, research questions and applied method.

1.2. CENTRAL CONCEPTS

In order to stay viable and keep their competitive advantage, firms will have to interact with consumers to harness their innovation potential and together deliver personalized experiences through co-creation (Prahalad & Krishnan, 2008). Co-creation is an interactive dialogue between (a group of) firms and (a community of) consumers, that can vary in depth of interaction, with the goal of jointly enhancing the value of the offerings to both the firms and the consumer. Co-creation is the extent in which a firm has a deep interactive dialogue with a customer and its effects can be increased by increasing the number of organizational functions with which co-creation is applied. The relation between the level in which a firm engages in co-creation and improvements in firm growth and profitability has been widely discussed (Pine & Gilmore, 1999; Prahalad & Ramaswamy, 2000, 2004). There are many case studies that proof part of this relationship (Auh, Bell, McLeod, & Shih, 2007; Kim & Bae, 2008; Sogn-Grundvåg, Rånes, Grønhaug, & Gray, 2009), and a few quantitative studies to parts of such a relation (Zhang & Chen, 2008). Firm performance is the extent in which a firm is capable of reaching sustained competitive advantage as leveraged by resources that are valuable, rare, imperfectly imitable and have no strategically equivalent substitutes (Barney, 1991).

All these researchers on co-creation suggest or imply a relation between co-creation and firm performance in their articles, but rarely fully conceptualize it. The authors do seem to agree that the positive effect of co-creation on firm performance goes through an improved production, innovative and marketing capability (Ngo & O'Cass, 2009). An improvement of production capability is, for example, noticeable through improved co-production where consumer labor is better exploited by the firm. An improvement of the innovative capability is, for example, noticeable through improved customization by better insight in customer needs and increased

collective creativity. An improvement of marketing capability is, for example, noticeable through improved customer equity where customer loyalty and word-of-mouth is increased. All these capabilities leverage firm performance through increased success of the firm's innovations. Innovation success is the successful exploitation of new ideas (Roberts, 1988).

1.3. RESEARCH GOAL

The research objective functions as a way to steer the research question, evaluate on the relevance, execution and results and motivate the researcher, sponsor and target group. This research is a combination of a learning and theoretical research. To formulate the research goal, the learning goal, knowledge goal, research theme, personal relevance and the addition of this research to knowledge (based on the theoretical relevance) has to be identified. The learning goal is the development of the skill to independently apply theory, research a problem, acquire in-depth knowledge, reflect on own work and plan an assignment (School of Management and Governance). The research theme is the impact of co-creation on firm performance through innovation success.

The research objective focuses on the changing world towards one with more active interaction and co-creation with the consumer. Following paragraph 1.1, it is presumed that co-creation has a relevant impact on firm performance. Paragraph 1.2 defined co-creation and identified the mechanism through which co-creation impacts firm performance. The research population is large firms, because the research' sponsor draws it customers from this pool. Large firms are firms with more than 500 FTE of employees. The research objective of this master assignment is: to obtain insight in the impact of co-creation on firm performance through innovation success in large firms and the international position of large Dutch firms in respect to co-creation and innovation success.

1.4. CENTRAL QUESTION AND RESEARCH QUESTIONS

The research question addresses the knowledge that is necessary to reach the research objective. Depending on the premises underlying the research question and the nature of the research, the research question will be more or less informative. The underlying premises of this research question can be found in paragraph 1.1 and 1.2. The central research question is an explanatory question, because it focuses at explaining the effects of co-creation on firm performance. The central question is:

> ***To what extent has co-creation impact on firm performance through innovation success in large firms and what is the international position of large Dutch firms in respect to co-creation and innovation success?***

The research question consists of a central question and research questions, which function as a roadmap to answer the central question. The research questions structure the research by dividing the central question into several more specific questions. The research questions have a clear logic and are based on the research model. To structure the research, the Research Process model of Babbie (2004, pp. 107-115) is used. The research starts by an initial interest, idea or theory, forming the background (this step has been developed in paragraph 1.1 and 1.2) and is further developed in the theoretical framework. The second part of the research contains a survey focusing on the relation between co-creation and innovation success. This question is an explanatory research question, because it tests the relation between co-creation and innovation success. Part two answers the second research question:

- *Is there a relation between co-creation and innovation success in large firms?*

The third part of the research contains an interview questionnaire and a survey focusing on explaining the (lack of a) relation found in the second part. The second research question is also explanatory, because it sets out to explain the underlying mechanisms behind the relation between co-creation and innovation success:

- *What are the mechanisms behind the relation between co-creation and innovation success in large firms?*

The fourth part of the research combines the surveys from the second and third part to focus on the comparison between Dutch firms and the global mean. The third research question is descriptive, because it is focused on describing the situation without explaining why the situation is the way it is.

- *How engaged are large Dutch firms in co-creation and how successful are their innovations in an international perspective?*

The fifth and last part of the research draws conclusions from the analysis and answers the central research question. This part also formulates implications on the impact of co-creation on firm performance through innovation success from both a managerial and an academic perspective.

1.5. STRUCTURE

After this introduction, this research report will continue by answering the research questions and concluding on the central research question. For this purpose, a theoretical framework will first be constructed to formulate hypotheses for research question one and give a theoretical background for research question two. After the theoretical framework, the methodology with which this research has been conducted will be discussed, followed by an overview of the results. The last chapter concludes on the research questions and discusses the managerial and academic implications.

2. THEORETICAL FRAMEWORK

This chapter forms the theoretical framework, which will be used for three purposes. Firstly, the theoretical framework will result in a conceptual model containing the hypotheses to be tested. Secondly, the theoretical framework will identify places where co-creation can take place, motivations to engage in co-creation and potential costs and benefits. Finally, the theoretical framework will identify the mechanisms of the relation between co-creation and firm performance through innovation. This will be used to analyze the results of the surveys and interviews.

The theoretical framework will discuss the relation between co-creation and firm performance through innovation success in increasing depth. Paragraph 2.1 will start by elaborating on the relation between customers and firm performance, followed by a discussion on the relation between co-creation and innovation success in paragraph 2.2. Paragraph 2.3 zooms in on the organizational functions where co-creation can take place and discusses each of them. Paragraph 2.4 concludes the theoretical framework by presenting the conceptual model with its hypotheses and shortly summarizing the theoretical framework.

2.1. THE ROLE OF CUSTOMERS IN FIRM PERFORMANCE

Where the use and interpretation of co-creation widely differs between different authors and disciplines (e.g. O'Hern & Rindfleisch, 2008; Prahalad & Ramaswamy, 2004; Vargo & Lusch, 2004), the foundation of it can generally be deducted to a combination of two organizational theory foundations. The co-creation literature often combines the resource-based view with resource dependence theory to make the basic argumentations on co-creation. Resource-dependence theory is used to explain why organizations are highly dependent on customers and to state that organizations need to deal with increasing customer power in order to stay viable. Many authors (e.g. Chesbrough, 2003; Mohr & Sarin, 2009; Wind & Rangaswamy, 2001) describe a few societal shifts, such as increasing globalization and intensifying use of communication technology, to illustrate the growing power of customers over firms. The resource-based theory is used to indicate the micro-processes of a co-creation initiative and pinpoint the main benefits and risks. The argumentation logic is that knowledge is the most important resource that firms need to reach competitive advantage and the main challenge is the integration of specialized knowledge. Bringing co-creation back to these foundational theories enables a theoretical exploration of the mechanism through which co-creation affects innovation and competitive advantage of firms. The resource-based view and resource-dependence theory are very well researched and form a thorough foundation for hypotheses.

It is very common to combine two or more fundamental theories of the firm and instances where resource-dependence theory is used on its own are actually quite unique (Hillman, Withers, & Collines, 2009). Although it is far more common to combine resource-dependence theory with other systems theories, the combination with the resource-based theory offers some unique advantages. Because both theories emphasize the importance of resources (hence the names), the theories can be well synthesized. Although applying different perspectives, both theories agree that knowledge is at the very source of competitive advantage of firms. For the resource based view, this resource is used to explain the very existence of firms; combining tacit specialized knowledge in order to be able to produce is not possible in a market setting, thus needing hierarchical firms (Grant, 1996). For the resource dependence theory, this resource is crucial to manage its power position; without knowledge about the rest of the system, firms are not able to compete effectively (Hillman, Withers, & Collines, 2009). The resource-based theory and resource-dependence theory are very suitable to further explore the organizational processes through which and conditions under which co-creation happens, because they combine an inside and an outside perspective. The resource-based view can be used to specify resource needs and the resource-dependence theory to specify how these resources can be obtained (Hillman, Withers, & Collines, 2009).

Competitive advantage does not come from resources themselves (tangible, intangible or otherwise), but from the capability of deploying and coordinating these resources (Verona, 1999). This is because resources are tradable on markets, whereas capabilities are inherently idiosyncratic (because of path dependency and firm specificity). The knowledge-based theory is basically a variant on the resource-based view, stating that knowledge is the single most important resource a firm possesses (Grant, 1996). The theory states that the firm is in principle a mechanism to integrate tacit knowledge in order to produce. The utilization of knowledge is, then, mainly dependent on the transferability, capacity for aggregation, appropriability, specialization and the knowledge requirements of production. Transferability depends on the type of knowledge, being either tacit or

explicit. This distinction has great consequences on the other utilization factors. Now that the needed resource has been identified (knowledge), the source and the leverage of this resource can be identified. This is where co-creation and innovation comes in.

2.2. THE EFFECT OF CO-CREATION ON INNOVATION SUCCESS

Customers are considered to be a resource belonging to the environment and particularly important to the firm (Salomo, Steinhoff, & Trommsdorff, 2003). Firms' current and potential customers are the ones who possess context-of-use information, which is valuable to firms, because this is the factor their offerings have to comply with (Von Hippel, 2005, pp. 8-9). Because customer knowledge is so valuable to firms, firms who are better able to incorporate customer knowledge into their business processes should be better able to reach competitive advantage. Because of the high dependence on information of critical factors influencing customer demand, firms apply bridging strategies to manage the corresponding uncertainty and increase their power position over customers. Cooperation with customers is an extension of the inter-organizational relationships bridging strategy. This is especially important in innovation contexts, because it reduced market related risks by decreasing the information asymmetry between the firm and its customers. This incorporation of customer knowledge in firms' business processes in which value creation between the consumer and the firm is central is what is understood under co-creation.

The deepest form of co-creation is achieved by using qualitative, interactive dialogue-oriented and informal interaction, leading to a situation where both explicit and tacit knowledge can be effectively shared between firm and customer (Salomo, Steinhoff, & Trommsdorff, 2003). To successfully reach this situation, customers and firms together have to create a situation of dialogue, access to each other, risk sharing between each other and transparency about each other, resulting in increased value for both sides through more dimensions of choice (Prahalad & Ramaswamy, 2004). Co-creation situations wherein all these elements are present represent the deepest form of co-creation.

Being able to provide offerings that fit with customer needs by embedding customer knowledge through co-creation, indicates the main organizational lever through which this process works: successful innovation. There are different ways in approaching the success of innovation. This research follows (Tatikonda & Montoya-Weiss, 2001) and (Carbonell, Rodriguez-Escudero, & Pujari, 2009) in distinguishing between operational and market antecedents to innovation success. The operational ones are product quality, unit cost and time-to-market; the market ones are customer satisfaction and relative sales. An important part of product quality is the level of innovativeness. Although there is general consensus on the definition on innovation innovativeness, there is a variance in the details. Innovativeness can vary in its type (e.g. new-to-the-market and new-to-the-firm) and in its elements (e.g. new technology and new product attributes). From an end consumer perspective, newness has a positive impact on innovation success, because it leads consumers to more product trial through novelty effects; it triggers variety-seeking behavior; and it results in repeat purchase when it better satisfies consumers' needs (Szymanski, Kroff, & Troy, 2007). Others are appropriateness (usefulness), novelty, quality, adherence to budget and schedule and speed to market (Mohr & Sarin, 2009). If an innovation scores positively on quality, costs, time-to-market, customer satisfaction and relative sales, then the innovation can be considered a success.

This results in the first hypothesis:

H1: Co-creation is positively related to innovation success.

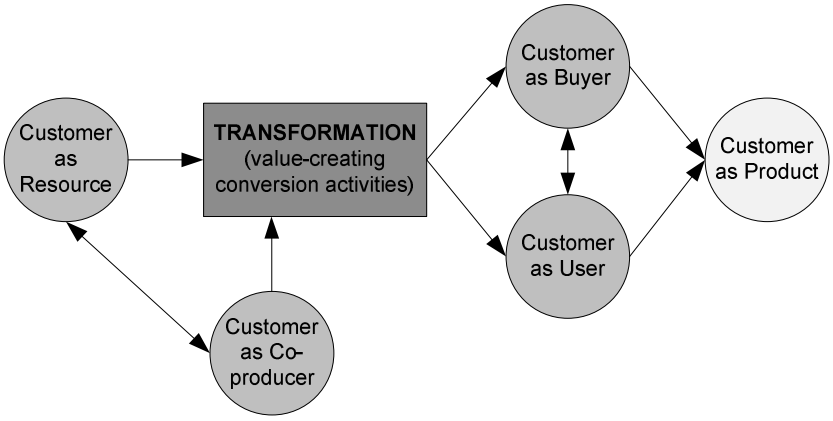
2.3. CO-CREATION IN ORGANIZATIONAL FUNCTIONS

Co-creation is about the resource customer knowledge. Customer knowledge is especially valuable in three value-generating integrative organizational routines: production capability, marketing capability and innovative capability. In this context, these capabilities are all integrative, because they seek to integrate critical internal and external knowledge resources. The marketing capability, for example, could integrate customer knowledge about potential customers to increase word-of-mouth, thus increasing customer equity. The innovative capability is further focused on in this research and is defined as: "the integrative process of applying the collective knowledge, skills, and resources of the firm to perform innovation activities pertaining to technical innovation [...] and non-technical innovation"(Ngo & O'Cass, 2009).

Since innovation is about the successful exploitation of new ideas (Roberts, 1988), the process does not only involve the resource and development function of a firm as is sometimes thought. Following the definition, innovation includes both the initial creation of new ideas and the sustained successful exploitation of these ideas. In order for an innovation to be successful, research and development needs to anticipate on latent customer needs; production needs to integrate customer context-of-use with firm solution knowledge; marketing needs to set the stage for the experience; and service and support needs to organize further refinement and customization. The breadth in which co-creation is applied within a firm is an important factor for the success of the co-creation form itself; the broader co-creation is applied, the more successful deeper forms of co-creation will be.

Interacting with the customers in different functional business areas engages different customer roles and results in different risks and benefits for innovation (Lengnick-Hall, 1996). Functional areas that are positioned at the beginning of the value creation process, such as product development[2] and production have the opportunity to involve the customer in their role as resource and co-producer. The functional areas that are positioned at the back-end of the value chain can involve customers in their role as buyer, user and even product. As a resource, customers can supply all kinds of tangible and intangible factors of production, such as wealth, information, ideas etc. As a co-producer, customers can be either directly or indirectly be involved in transformation activities of the firm. Examples include participation in managerial decision making, policy development, design choices, customization, logistics etc. As a buyer, customer can be directly and indirectly involved in converting potential customers in actual customers by improving perceived quality, for example through word-of-mouth advertisement. As a user, customers can be used to measure the gap between expectation and outcome, potentially improving customer satisfaction and overall quality. As a product, customers are part of the transformation process, aimed at changing the customer himself. The position of the different customer roles can is graphically displayed in Figure 1.

FIGURE 1: CUSTOMER INVOLVEMENT ROLES [SOURCE: BASED ON LENGNICK-HALL, 1996]



The customer roles can be linked to the innovation success antecedents previously discussed. The customers roles 'customers as resource' and 'customers as co-producer' are part of the operation antecedents to innovation success and the customers roles 'customer as buyer', 'customers as user' and 'customer as product' of the market antecedents.

[2] This report alternates the use of the words 'product development' and 'NPD'. Both terms mean the same, which is the organizational function in which ideas for offerings are generated, developed and tested.

Using customers as a resource has a positive effect on innovativeness, product quality and costs, because it diversifies the information and resources that is available to the development teams. This diverse information can help "identify which marketing trends and opportunities to pursue, what the appropriate product attributes should be, and what the product concept will be" (Fang, 2008, p. 92). There is, however, a risk of creating a lock-in situation where in the development team is supplied with information from closed circles, leading to more homogeneous information, when "the extent to which [downstream customers] are connected directly instead of through a third party" (Fang, 2008, p. 91) is high. This same factor moderates the effect between customers as a resource and the third operation innovation success antecedent, time-to-market, in the opposite direction. This is the case, because a quick development process requires constantly updated market information and this is most easily gathered when the firm is highly connected with downstream customers (Fang, 2008).

In contrast with the traditional view of a trade-off between customerization and time or costs, using customers as co-producer enables both customerization and higher quality or lower costs. This is possible through the flexibility of the production process and detailed information about customers (Wind & Rangaswamy, 2001). Applying co-production in the product development function enables higher quality through better information about customer needs; and better time-to-market through reduced cycle times (Carbonell, Rodriguez-Escudero, & Pujari, 2009).

The effect of the market customer roles of customers on innovation success is less well developed than the operation ones. Researchers also seem to agree that there is a partial relation between the operation roles and the market roles; the operation roles seem to be an antecedent to the relation between the market roles with innovation success (Carbonell, Rodriguez-Escudero, & Pujari, 2009). Theoretical support for the relation, however, is strong. Especially upcoming concepts such as the service-dominant logic of marketing clearly supports the crucial role of marketing new offerings effectively and in close cooperation with end consumers (Vargo & Lusch, 2004). Both from a user and a buyer role are customers important in improving perceived quality and overall satisfaction.

This results in the third hypothesis:

> ***H2: The number of functions involved positively moderates the effect of co-creation on innovation success.***

The next paragraphs discuss the relation between co-creation in specific functions with innovation success.

2.3.1. CO-CREATING PRODUCT DEVELOPMENT

The product development function of a firm executes the more traditional new product development stages involving ideation, design and development. The role of the customer in these processes is split; the ideation phase uses the customer as an information resource and the design and development phase uses the customer as a co-developer.

The ideation phase uses customers as a source for ideas for new offerings or improvements (Nambisan, 2002). The utility of customers in this process depends on the maturity of the underlying technology; the alignment of the offering with the customer base; the ability to select appropriate customer innovators; the ability to provide appropriate incentives; and the ability to understand customers outside their natural setting (Nambisan, 2002). The reason why the maturity of the underlying technology and the alignment of the offerings with the customer base have influence on the utility of customers in the ideation phase is that customers tend to think from current experiences and are less intimately acquainted with technological possibilities than the firm itself. If, however, the technology is mature and the offerings are well aligned with the customer base, these limitations do not fully apply. The combination of highly matured technology and highly aligned offerings points towards incremental innovation possibilities. In radical innovation situations (less matured technology and less aligned offerings), customers can still add value in ideation, but only in passive ways such as surveys or focus groups. Obviously, situations of less matured technology and less aligned offerings are particularly the case in fast moving industries such as the high technology sector.

The design and development phase uses customers as co-developer for new offerings or improvements. Because this is heavily challenged by increasing levels of project uncertainty when customers are involved; the limited product and technology knowledge level of customers; and the need to integrate customers with new product development teams (Nambisan, 2002). Different theories with different types of customers have been developed to deal with these limitations. Lead users are often mentioned in business-to-business settings, because of their high awareness of their domain-specific needs. Lead user theory is, however, less relevant in business-to-consumer settings, because of the difficulty to find lead users under consumers. Other theories suggesting typical users or innovative consumers (Hoffman, Kopalle, & Novak, 2009), also do not deal with the limitations mentioned above; only firms with a high maturity of the underlying technology and well aligned offering with the customer base will be able to successfully co-create in the design and development phase of new product development. The alternative to this is to select consumers that have the ability to commit to the project, have a high product and technology knowledge level, and are able to integrate with the teams. This kind of consumers is sometimes called consumers with an emergent nature (Hoffman, Kopalle, & Novak, 2009). Their traits and abilities include openness to new experiences and ideas, intellective reflection, an experiential and rational processing style, process information verbally and visually, highly creativity and optimism.

The ability to select appropriate customer innovators, the ability to provide appropriate incentives, and the ability to understand customers outside their natural setting is mainly limited by practical reasons and cost considerations (Nambisan, 2002). Drivers for involvement are motivation (short-term benefits), possession of the knowledge domains, and reciprocal interplay between customers and firm (firm obtains use knowledge and latent needs; customers obtain technical knowledge) (Magnusson, 2009).

2.3.2. CO-CREATING PRODUCTION

The production function of a firm is sometimes considered to be outside the innovation process. It is here considered as an important part of successful innovation, because the production is the function that has to customize each offering to the customers. In order for an innovation to be successful, production has to be capable of letting the customer co-produce the offering with them, in order for the offering to become customized to the specific customer needs.

The use of customers as co-producers is often costly and technology intensive. Customerization is particularly dependent on the Internet and related technologies. In developing a strategy for customerization, firms should be guided by their operational capabilities; some offerings have no need for customerization (e.g. salt), while others have a high need of customerization (e.g. software). Other offerings carry significant costs when customized, (e.g. cars) (Wind & Rangaswamy, 2001). Drivers for involvement are enhanced self-esteem (consisting of control, discretion and opportunity for choice) and of course greater customization. The propensity to co-create can be synthesized in the emotional connection customers have with specific offerings. With this dimension, offerings can be categorized into offerings with which customers have a strong emotional bond (i.e. fashion sensitive goods such as clothes, cars and jewelry) and offerings that do not have this characteristic.

2.3.3. CO-CREATING MARKETING AND SALES

The marketing and sales function engages customers mainly as buyers, which is an output-focused customer contribution and is highly dependent on perceived quality. Customers almost always lack information about the product's real quality and rely on perceived quality indicators such as reputation and image. Customers are more likely to buy a firm's offerings when the perceived quality of the offering meets the needs of the customer. This perceived quality can be influenced either directly or indirectly. Indirectly uses the general external communication channels, where directly fosters a mutually-beneficial customer-firm bond (Lengnick-Hall, 1996).

Offerings can be marketed and sold in different ways. Vargo and Lusch (2004) distinguish between a goods-dominant and service-dominant logic. Although selling an offering is always an exchange of services, some firms are better capable of adding value to the exchange and leveraging this value than others. The value of the offering is determined by the value that was created in the interaction between the firm and the customer. Because selling an offering is inherently interactive with a customer, value is always unique to this customer. The more a firm is aware of this and markets its offerings into value propositions with which it is easy for customers to co-create, the more value the customers will add to the offering and the more value will flow back to the firm (Vargo & Lusch, 2008). This theory is congruent with other similar important theories. The

delivering of services and staging experiences in Pine and Gilmore's (1999) progression of economic value corresponds very well with the premises of the S-D logic. The same counts for the concept of experience innovation as developed by Prahalad and Ramaswamy (2004). A big difference, however, is that in the theories of Pine and Gilmore and Prahalad and Ramaswamy, the interaction of jointly creating value with customers is associated with specific (more progressed) types of value offerings, whereas this in the theory of Vargo and Lusch is always the case, because all economies are service economies.

Challenges in the co-creation of marketing and sales effort include: turning passive participants into active participants; focusing on both the articulated and unarticulated needs of customers; tailor the offerings; create a direct pipeline from R&D to the market; set up a negotiable pricing system; educate your customers about the offerings; set up creative distribution mechanisms; and developing the ability to generate higher customer value than the added cost of providing that value (Wind & Rangaswamy, 2001).

2.3.4. CO-CREATING SERVICE AND SUPPORT

The service and support function of a firm is often thought of as outside the new product development phase. It is here considered as an important part of successful innovation, because service and support is the function that ensured ongoing success of innovations. While the other functions are only involved at the beginning of the customer experience, service and support is the platform to persistently build customer loyalty and keep the customer engaged.

The support phase uses customers as a user of offerings. The utility of customers in this process depends on the homophily between the customers (Nambisan, 2002). Homophilic customers are better able to understand their peers' concerns and problems, better being able to help them. Another critical factor is the level of knowledge and expertise some users must have in order to help other users. Since the support process between customers is often an interactive and creative process, new ways or using the products can easily arise, enhancing the value of the offering overall. Using customers as users in the service and support function of a firm is challenged by costs of the necessary platform on which the support has to be delivered and the engagement of a diverse set of customers (Nambisan, 2002).

2.3.5. CO-CREATING ACROSS FUNCTIONS

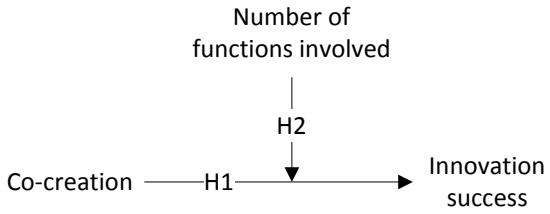
Besides applying co-creation at the different functional areas independently, combinations can also be made. Combining functions is called cross-functional integration and is in context of new product development defined as "the magnitude of interaction and communication, the level of information sharing, the degree of coordination, and the extent of joint involvement across functions in specific new product development tasks" (Song & Montoya-Weiss, 2001, p. 65). Research on cross-functional integration indicates that more involved functions do not necessarily have to increase the success chance of innovation. Song et al. (1998) propose that the benefits of cross-functional integration depend on the development stage of new product development. The advantages of cross-functional integration are improved horizontal communication, increase in efficiency and stimulated creativity; the disadvantages are violated management principles, conflict, costs and difficulties to manage. Later research affirmed the theory of Song et al. and indicated that innovation success not only depends on the development stage and number of integrated functions, but also on the level of integration, type of integration, and type of information shared (Troy, Hirunyawipada, & Paswan, 2008). This research also indicates that there are not only advantages, but also serious disadvantages to cross-function integration. The increase in communication frequency and amount of information flow enables a common understanding about the offering and increases decision consistency, which are often considered to be important for innovation success. Cross-functional integration also pools organizational capabilities, increasing flexibility and utilization of resources. On the other side, these mechanisms can also increase decision complexity; participative decision making and conflict resolution can increase time consumption; employee satisfaction can decrease through increased job pressures; and working with colleagues with different backgrounds can cause tensions (Troy, Hirunyawipada, & Paswan, 2008).

This research is supported by a large amount of other research, but all focus on the new product development process and not on co-creation. The basic argument, however, in principle also applies for different kinds of co-creation. And for these processes, firms should also try to balance the increase of complexity caused by deeper forms of co-creation against integrating more functions.

2.4. SUMMARY AND CONCEPTUAL FRAMEWORK

This chapter explored the effect of co-creation on firm performance through innovation success in increasing depth. The chapter started with the centrality of knowledge in firms and how this resource is the key for competitive advantage. Firms having the capability of integrating tacit knowledge into their organization are better able to adapt to their environments and will have sustained competitive advantage. An important knowledge source is customers, who possess context-of-use information and involving this knowledge source deeper will better enable a firm to create successful innovations. Co-creation can increase both the operational and market antecedents of innovation success. Besides the level of depth in which a firm can co-create with customers, co-creation can also vary over organizational functions. Four organizational functions were identified in which co-creation can occur, each engaging customers in different ways through different roles. Combining co-creation over different functions increases the effect of co-creation on innovation success. The conceptual framework with the hypotheses can be found in Figure 2. The next chapter will elaborate on the method used to test the hypotheses and research the motives for co-creation and international position of Dutch firms.

FIGURE 2: CONCEPTUAL FRAMEWORK



3. METHODOLOGY

This chapter discusses the methodology used to study each of the research questions. The first research question, focusing on testing the hypotheses formulated in the previous chapter, uses general linear model (GLM) analysis on a survey. The second research question, focusing on the mechanisms behind the relation between co-creation and innovation success, uses descriptive analyses on a second survey and two interviews. The third research question, focusing on the international position of Dutch firms, uses Student's t-tests and descriptive analyses on the combination of the two surveys mentioned before. Since this research uses three datasets based on surveys, the first survey dataset will be referred to as 'large survey', the second survey data set will be referred to as 'small survey' and the third survey data set will be referred to as 'combined survey' from here on. This chapter will discuss each of the three methodologies consecutively, starting with the GLM analysis on the large survey (paragraph 3.1), followed by the descriptive analyses on the small survey (paragraph 3.2) and finally the t-tests and descriptive analyses on the combined survey (paragraph 3.3). The parts will each time first discuss the data source in general, followed by a discussion about the variables and ending by an explication of the analysis method.

3.1. RESEARCH QUESTION 1 – CO-CREATION AND INNOVATION SUCCESS

This first method concerns the first research question, which is: is there a relation between co-creation and innovation success in large firms? This relation has been conceptualized into two hypotheses in the previous chapter: co-creation is positively related to innovation success, and the number of functions involved positively moderates the effect of co-creation on innovation success. These hypotheses are tested by constructing a model that can predict innovation success and subsequently testing how well this model works. The rest of this paragraph will discuss the population of the survey, the variables of the model and analysis method used to test the model.

The survey was executed under the name 'Global Innovation Survey 2010' to be presented on the World Innovation Forum. The survey is an online survey and the study population was approached through e-mail. The number of firms and managers that were approached for the survey and the follow-up procedure is unknown. The survey invitations were spread through personal contacts of Capgemini Consulting consultants worldwide and through contacts of HSM Americas, inc. This has as a consequence that the response rate and study population is unknown, which results in a possibly large bias. Part of the potential bias results from the uncertainty about the representativeness of the sample in relation to the population. The lack of data on the exact size of the respondents' firms makes it difficult to determine whether the sample is representative to the population. The sample can contain respondents that fall outside the population (have less than 500 FTE of employees). Because 80% of the sample consists of firms with a turnover above 500 million dollars and the revenue distribution is one of the control variables, the effect on the reliability of the survey data is limited. This same bias can also occur, because the contacts of Capgemini employees and HSM Americas, inc. do not represent the population. This can lead to internal validity issues, because the observed outcomes might be representative for a different population than the one under study (Shadish, Cook, & Campbell, 2002, pp. 53-63). It is impossible to test or control for this potential bias.

A third part of the potential bias results from the possible confounding of treatment effects because of the unknown population distribution. This limits internal validity, because the observed outcomes may be related to structural differences between the part of the population that did fill out the survey and the part that did not (Shadish, Cook, & Campbell, 2002, pp. 53-63). The control variables in the regression analyses that will follow control for such a bias in certain areas, but do not cover the entire possible bias. It is impossible to test or control for the full bias and the interpretation of the outcomes should be carefully interpreted.

The survey gathered 379 responses. Of these responses, 39 were listwise deleted, because of a large amount of missing data (data was missing on at least the variables Co-creation, Involved functions and all Innovation readiness variables). One case was listwise deleted, because of missing data on the dependent variable. Another 12 cases were listwise deleted, because they did not indicate that they engage customers in any of the indicated functions. These cases were left out for two reasons. Firstly, it is impossible to see the difference between firms that do not engage customers in any of the functions and firms that did not complete the question. Secondly, the research does not focus on firms that do not have contact with customers at all. The sample results in 327 cases.

3.1.1. VARIABLES

The survey is used to form eleven variables, consisting of five model variables and six control variables that will be used in GLM models. The model variables concern the concepts under study in this research. In the next section, the variables will be discussed one by one, starting with the model variables.

3.1.1.1. MODEL VARIABLES

Innovation success is the dependent variable and is a combination of two survey questions. The first survey question (question 1) is: "What is the estimated success rate of your firms innovation efforts? What percentage of your efforts has a positive material impact on business results?". The answer options are: (1) Less than 25%, (2) 25-49%, (3) 50-74% and (4) Over 75%. The second survey question (question 2) is: "Compared to peers in your industry, how would you rate your company's innovation success?" The answer options are: (1) Much less successful than industry peers, (2) Somewhat less successful than industry peers, (3) Neither more nor less successful than industry peers, (4) Somewhat more successful than industry peers and (5) Much more successful than industry peers. These two Innovation success variables have a two-tailed Pearson correlation of 0,486 (significant at the 0,001 level), which make them highly correlated.

The two Innovation success variables are combined by standardizing both variables and subsequently averaging them. Both variables are considered and not just one, because it strengthens the dependent variable. The combined variable is more valuable in the statistical analysis, because it researches the Innovation success construct more thoroughly. This combination method puts some assumptions on the variables. First of all, the variables need to have a scale measurement level. This is for both of the variables the case; the answer options of question takes steps of 25% points and the answer options of question two are on a five point Likert scale. The Innovation success variables also reasonably follow a normal distribution. By first standardizing the variables, potential problems with the answer categories (one question has four categories and the other one five) and the variation within the answers is not relevant. This method further assumes that both Innovation success variables are of even relevance to the higher order construct. This is reasonable to assume, because both variables measure the higher order construct on the same level. When the report refers to Innovation success from here on, the combined variable will be meant. The Innovation success variable is distributed with a mean of 1 and a standard deviation of 0,861. The standardization and averaging of the innovation success variables initially resulted in a mean of 0, but this was increased by one to improve readability of the graphical overviews of the results.

For the concept of co-creation, two variables are constructed, differing in their categories. The first variable measures the presence of co-creation and is called Co-creation presence and the second variable measures the level of co-creation and is called Co-creation level. Co-creation presence is an ordinal independent model variable and is based on one survey question. The survey question is: "How involved are your customers in your innovation efforts?" The answer options are: (1) We do not actively engage customers in our innovation efforts, (2) We consult customers on their changing needs and gather feedback on ideas which are generated in-house, (3) We maintain ongoing dialogue with our customers to support multiple elements of the innovation process and (4) Our customers work closely alongside our employees, even becoming integrated with our project teams, to support our innovation activities. Since Co-creation presence is purely a measure between either applying co-creation or not applying co-creation, a dummy variable is the result. The distribution of Co-creation presence can be found in Table 1.

TABLE 1: CO-CREATION PRESENCE DISTRIBUTION

	N	% of total
(1) No	31	9,5
(2), (3), (4) Yes	296	90,5
	327	

Co-creation level is an ordinal independent model variable and is an extension on the variable Co-creation presence. It takes the same survey questions and survey answer options, but applies different coding. It takes each answer option as a measurement of the depth of co-creation. The variable is ordinal and not scale, because the answer options do not fulfill in the equal distances assumption that applies for scale variables.

There is, however, a clear increasing trend in the answer options, which makes it ordinal and not nominal. The distribution of Co-creation level can be found in Table 2.

TABLE 2: CO-CREATION LEVEL DISTRIBUTION

	N	% of total
(1) Very low	31	9,5
(2) Low	124	37,9
(3) Medium	123	37,6
(4) High	49	15,0
	327	

Number of functions involved is an ordinal independent model variable and is based on one survey question. The survey question is: "In which parts of the value chain do you engage your customers? Select all that apply.". The answer options are: (a) We engage customers in Marketing & Sales, (b) We engage customers in Service and After Sales Support and (c) We engage customers in New Product Development. The answer options are recoded to represent the extent in which customers are engaged in the value chain: (1) one engaged function, (2) two engaged functions and (3) three engaged functions. The variable is ordinal and not scale, because the answer options do not fulfill in the equal distances assumption that applies for scale variables. There is, however, a clear increasing trend in the answer options, which makes it ordinal and not nominal. The distribution of Number of functions involved can be found in Table 3.

TABLE 3: NUMBER OF FUNCTIONS INVOLVED DISTRIBUTION

	N	% of total
(1) Low	135	41,3
(2) Medium	101	30,9
(3) High	91	27,8
	327	

To increase the analysis possibilities, a second variable is constructed on the basis of the same survey question. This second variable measures the specific functions involved in the co-creation efforts. This variable is more specific on the exact source of the moderation effect, but is less reliable; the number of cases in each of the categories is far lower than in the variable Number of functions involved. A dummy variable for separate functions is not possible because of the limited sample size. Specific functions involved is a nominal independent model variable. The answer options are recoded to represent the combination of engaged functions: (1) Marketing/sales, (2) Service/support, (3) NPD, (4) Marketing/sales and Service/support, (5) Marketing/sales and NPD, (6) Service/support and NPD and (7) All three engaged functions. A risk with applying this coding method is the applied level of analysis. Because this coding method enables an analysis on the function level and all other variables have their level of analysis on the firm level, potential bias results. Because of this reason, the further analyses will not use the opportunity to make function level analyses. The distribution of Specific functions involved can be found in Table 4.

TABLE 4: SPECIFIC FUNCTIONS INVOLVED DISTRIBUTION

	N	% of total
(1) Marketing/sales	43	13,1
(2) Service/support	41	12,5
(3) NPD	52	15,9
(4) Marketing/sales & Service/support	30	9,2
(5) Marketing/sales & NPD	46	14,1
(6) Service/support & NPD	25	7,6
(6) All engaged functions	90	27,5
	327	

3.1.1.2. CONTROL VARIABLES

Industry is a nominal control variable and is based on one survey question and desk research. The survey question is: "In which industry segment does your company operate?". The answer options are: (a) Automotive, (b) Consumer products, (c) Energy, oil & gas, (d) Financial services - banking, capital markets, (e) Financial services – insurance, (f) Healthcare providers, (g) High tech, (h) Life sciences – pharmaceuticals, (i) Life sciences – medical devices, (j) Professional services, (k) Public sector, (l) Retail, (m) Telecommunications and media, (n) Transportation and logistics and (o) Utilities. The desk research consists of researching the SBI (Standaard Bedrijfsindeling) 2008 codes of some firms. Based on the survey and the desk research, the industry variable was recoded into seven categories, first stating the SBI 2008 codes and then the main industry: (1) 8-43: Industrial, (2) 46-55: Trande & transport, (3) 58-63: Information & Communication, (4) 64-69: Financial Institutions, (5) 73-74: Business Services, (6) 84-94: Public Services, Education & Health Care and (7) Unknown. The categories were recoded, because a better distribution between the categories would be reached and a more objective standard could be used through the SBI 2008 codes. A large number of firms had not indicated their industry or put another industry in the answer option 'other:'. The SBI 2008 codes were well suited to properly score almost every firm. The industry of 31 firms was also after this process unknown and were put in the seventh answer category 'Unkown'. The distribution of Industry can be found in Table 5.

TABLE 5: INDUSTRY DISTRIBUTION

SBI '08	N	% of total
(1) 8-43: Industrial	110	33,6
(2) 46-55: Trade & Transport	32	9,8
(3) 58-63: ICT	18	5,5
(4) 64-69: Financial	40	12,2
(5) 73-74: Business	54	16,5
(6) 84-94: Public	45	13,8
(7) Unknown	28	8,6
	327	

Revenues is a nominal control variable and is based on one survey question. The survey question is: "What are your company's annual revenues?". The answer options are: (1) Less than $500m, (2) $501m - $999m, (3) $1b - $10 billion, (4) $10.1 - 25 billion and (5) $25 billion†. Some firms had not indicated their annual revenues and were put in the sixth category (6) Unknown. The distribution of Revenues can be found in Table 6.

TABLE 6: REVENUES DISTRIBUTION

	N	% of total
(1) Less than $500m	143	43,7
(2) $501m - $999m	28	8,6
(3) $1b - $10 billion	68	20,8
(4) $10.1 - 25 billion	21	6,4
(5) $25 billion†	28	8,6

(6) Unknown	39	11,9
	327	

Ownership is a nominal control variable and is based on one survey question and desk research. The survey question is: "Is your firm...?" The answer options are: (1) Publicly traded and (2) Privately owned. Some firms had not indicated their ownership position and were put in the third category (3) Unknown. The desk research consists of researching the stock position of some firms. Some firms had not indicated their ownership structure and could be researched in this way. The distribution of Ownership can be found in Table 7.

TABLE 7: OWNERSHIP DISTRIBUTION

	N	% of total
(1) Privately held	107	32,7
(2) Publicly traded	184	56,3
(3) Unknown	36	11,0
	327	

Knowledge partner is an ordinal independent control variable and is based on one survey question. The survey question is: "To what extent do you use external third parties to support your innovation efforts?" The answer options are: (1) We do not use external parties to support our efforts at innovation, (2) We engage third parties on an ad-hoc basis for specific innovation projects, (3) We use a few select partners in well-defined relationships to support our innovation efforts and (4) We actively engage a broad cross section of external partners (idea labs, individual inventors, academic institutions) in formal and informal ways to support our innovation efforts. In the survey questions, the answer options were inversed and the meaning of 'external partners' was explained in the first answer option. The variable is ordinal and not scale, because the answer options do not fulfill in the equal distances assumption that applies for scale variables. There is, however, a clear increasing trend in the answer options, which makes it ordinal and not nominal. The distribution of Knowledge partner can be found in Table 8.

TABLE 8: KNOWLEDGE PARTNER DISTRIBUTION

	N	% of total
(1) None	36	11,0
(2) Low	116	35,5
(3) Medium	105	32,1
(4) High	70	21,4
	327	

Innovation readiness is a construct that consists of two independent scale control variables and these variables are based on one survey question with nine sub questions. The Innovation readiness construct was reduced to two variables using factor analysis on these nine sub questions. The main questions is: "Please rate how strongly you agree or disagree with the following statements, as they relate to your organization's innovation management capabilities:". The sub questions are: (1) We have a formal innovation governance structure (roles & responsibility, target and scope, management involvement) to govern innovation in our organization, (2) We have well-defined processes for promoting and harvesting innovation in our organization (provision of time and funding, stage gates, formal recognition of success, etc.), (3) We have well understood metrics and methods to evaluate innovation performance and success in our organization (e.g. performance measurement, ROI, time to market, etc.), (4) We have a clearly defined way to manage our innovation portfolio and prioritize innovation efforts in our organization, (5) We have strong new product development capabilities to drive innovation in our organization (project management, go-to-market and launch capabilities), (6) We actively facilitate the idea generation and enablement process with appropriate culture and tools, (7) Employees at all levels and functions in our organization are involved in the process of innovation, (8) Employees at all levels have a clear understanding of how ongoing technology changes directly relate to or impact our innovation efforts and (9)

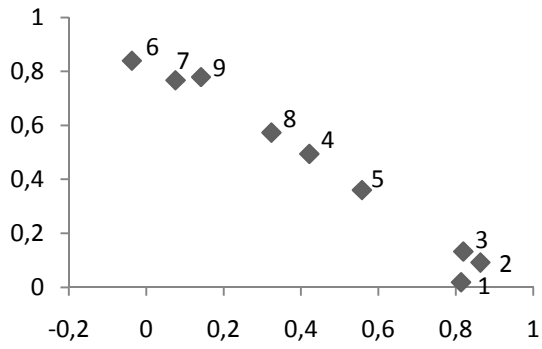
We have a high degree of executive level commitment to innovation. The questions were answered with a seven-point likert scale, ranging from strongly disagree to strongly agree.

Exploratory principal component analysis was used as the extraction method. The initial component matrix extracts two components with an Eigenvalue of higher than one. The Varimax with Kaiser Normalisation rotated component matrix converged in three iterations and shows three items that should be left out, as is shown in Table 9 and Figure 3.

TABLE 9: INITIAL ROTATED COMPONENT MATRIX

	Component	
Item	1	2
1	0,8	0,018
2	0,9	0,091
3	0,8	0,132
4	0,4	0,494
5	0,6	0,36
6	-0	0,839
7	0,1	0,766
8	0,3	0,573
9	0,1	0,779

FIGURE 3: ITEM CONCENTRATION



With the items 4, 5 and 8 left out, relatively high communalities appear indicating that the components explain most of the variance. See Table 10 for the item communalities.

TABLE 10: ITEM COMMUNALITIES

Item	Initial	Extraction
1	1	0,736
2	1	0,771
3	1	0,695
6	1	0,737
7	1	0,623
9	1	0,691

Two factors were produced with an Eigenvalue larger than 1. These two factors together explain over 70% of the variance. The first two factors also show a natural distinction with the rest of the factors, which have much lower Eigenvalues. Table 11 shows the total variance explained.

TABLE 11: TOTAL VARIANCE EXPLAINED

	Initial Eigenvalues		Rotation Sums of Squared Loadings	
Component	Total	% of Variance	Total	% of Variance
1	2,6	42,794	2,221	37,018
2	1,7	28,098	2,032	33,875
3	0,5	9,087		
4	0,5	7,893		
5	0,4	6,401		
6	0,3	5,727		

The first component mainly contains the first three sub questions and the second component the sub questions 6, 7 and 9. As can be seen from the sub questions, the first three address formal expressions of innovation readiness, whereas the other sub questions address cultural expressions of innovation readiness. The first

factor will from here on be called Innovation structure and the second factor Innovation culture. Using the Varimax rotation method with Kaiser Normalisation (the rotation converged in 3 iterations) shows this nicely by only considering the loadings of the factors with a higher Eigenvalue than 1 (see Table 12).

TABLE 12: ROTATED COMPONENT MATRIX

	Component	
Item	Innovation structure	Innovation culture
1	0,9	0,056
2	0,9	0,085
3	0,8	0,124
6	-0	0,858
7	0,1	0,779
9	0,2	0,815

Because of the factor analysis, Innovation structure and Innovation culture are distributed with a mean of zero and a standard deviation of one and is not correlated with each other (Pearson correlation of 1).

3.1.2. MISSING VALUES

The treatment of the missing values on Innovation, Co-creation level, Number of functions involved, Industry, Ownership and Revenue were already discussed. Thus far, a relative simple process was used to treat the missing values. The relevance of the missing values on Innovation, Co-creation level and Number of functions involved was so large, that these had to be listwise deleted. The missing values on Industry, Ownership and Revenue could be put into a separate category. The missing data on Innovation structure and Innovation culture is completed using multiple imputation. In the overviews that follow, the same indicators are used as in the previous paragraph.

Supplementary to the ten variables, the variables Co-creation level, Number of functions involved, Knowledge partner and two other variables were used only as predictors. The first of these two other variables is based on the survey question: “Where does innovation rank among your organization’s strategic priorities?”. The answer options are: (1) Not a priority, (2) Top-ten priority, (3) Top-three priority and (4) Top priority. The second of these two other variables is based on the survey question: “Does your organization have someone at the executive level who is formally accountable for innovation (e.g. Chief Innovation Officer, Chief Transformation Officer)?”. The answer options are: (1) No and (2) Yes. These variables are suited to supplement the ten variables with, because they represent the same higher order construct (they are highly correlated) and do not obstruct the relationship with the dependent variable. and there is limited space for adding variables (multiple imputation can only be done with a limited number of parameters). The imputation was done on 340 cases; this is the dataset after the cases with many missing values were listwise deleted, as explained earlier in this chapter. Figure 4, 5 and 6 show the outcomes of the missing value analysis.

FIGURE 4: OVERALL SUMMARY OF MISSING VALUES

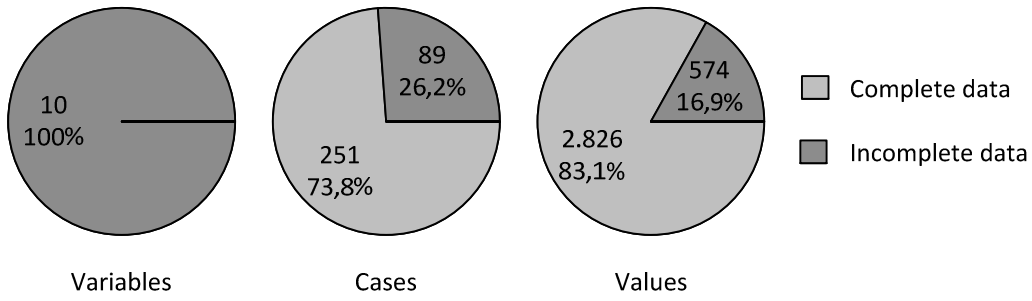


FIGURE 5: MISSING VALUE PATTERNS

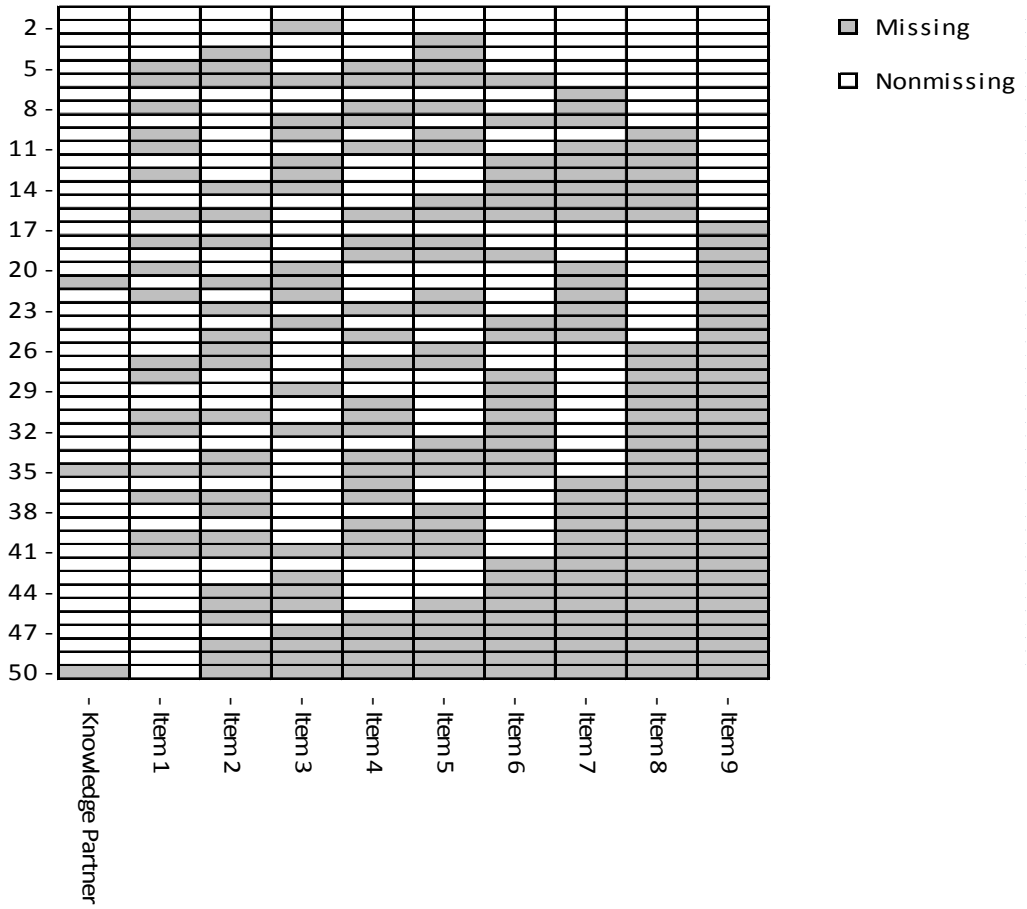


FIGURE 6: MISSING VALUE PATTERN FREQUENCIES

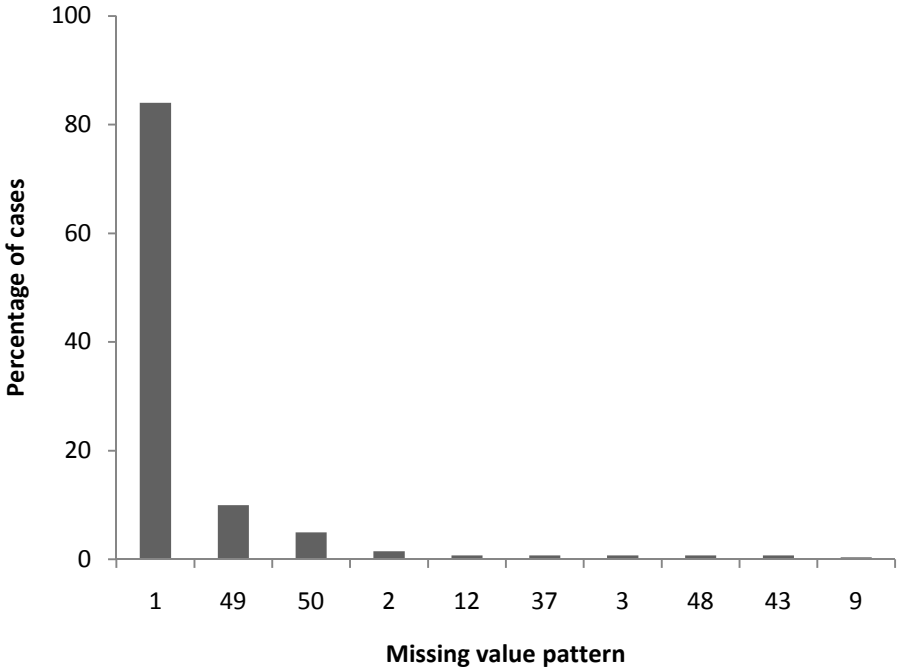


Figure 4: Overall Summary of Missing Values shows in its first chart that each of the ten analyzed variables has at least one missing value. The second pie chart shows that about 26 percent of the cases have at least one missing value in the twelve variables. The third pie chart shows that about 17 percent of the values is missing. This information shows that with the use of other methods, such as listwise deletion, would lose very much information and that imputation is unavoidable.

Theoretically, Figure 5: Missing Value Patterns can have 1024 (2^{10}) patterns, but only 50 were detected. From the distribution of the missing and non-missing values, it is clear that the dataset is far from monotone. This low score on monotonicity means that a simple imputation method would not be appropriate and that many values will have to be imputed in order to reach acceptable monotonicity.

Figure 6: Missing Value Pattern Frequencies shows that more than 80 percent of the missing values have the same pattern. Together with pattern 1, pattern 49 and 50 explain almost all of the missing values. Pattern 1 represents the pattern without any missing values, which supports imputation. Patterns 49 and 50, however, represent patterns with all and all minus one missing values. The value of the supplementary variables that were only used as predictors are particularly valuable on these patterns.

Because of their ordinal nature, all variables are imputed by using the logistic regression model. Five imputations were performed. To make the imputation replicatable, the random number generated was set to Mersenne Twister with a fixed value of 20100515. The third imputation was chosen to continue the analyses with, because this imputation fits best within the other imputations and with the original data.

3.1.3. GLM ANALYSES

This research uses GLM models to test its hypotheses, because it uses ANCOVA, which is particularly useful in models with a continuous dependent variable and both factors and covariates as predictor variables. It also enables detailed examination of the sum of squares and the pairwise differences in the estimated marginal means. Type III sum of squares is used is used as the indicator for effect size, because there is no reason to assume that the variable introduction order is relevant in the model and the type III sum of squares provides the most useful information.

Since the interaction terms in the models (the moderating effect of Number of involved functions and Specific function involved on the relation between Co-creation level and Innovation success) consist of factors, a large number of factor combinations are a result. To be able to use the full richness of the data, all reference categories possibilities of the interaction terms need to be considered. This is done through pairwise comparison of the estimated marginal means. Studies such as that of Peduzzi et al. (1996) suggest that analyses with a low number of cases in parameter cells can easily result in large standard errors (because the normality condition is not met), which will subsequently result in very high or very low parameter estimates. In order to prevent the misinterpretation of the results due to low statistical power, only the significant mean differences that are based on cells with more than 10 cases each are considered in order to prevent misinterpretation. The data confirms this by showing a fast increasing standard error when the case number in one of the cells drops below 10. The mean difference is used as the indicator for the effect size in the pairwise comparison analyses.

Because many of the variables are of ordinal or nominal nature, different coding techniques have to be applied than in the more commonly used linear regression techniques. Since there is no reason to suspect a relationship within the variables, dummy coding is applied to all nominal and ordinal variables (Chen, Ender, Mitchell, & Wells, 2003). The reference categories of the dummy coding vary and will be mentioned in the results chapter at the appropriate results. For the control variables, the reference category is not very relevant and will always be the last category.

The GLM models assume that the dependent variable and covariates are normally distributed and that the model has homogeneity of variances. The model is, however, robust enough to accept small departures from normality; symmetry (skewness) of the data is more important than flatness (kurtosis). This research uses Levene's homogeneity test to test for homogeneity of variances. Table 14 shows the results of the tests and the non-significant result indicates that the variance is homogeneous. The models numbers in the table refer to the different models tested and will be further explained in the next chapter. The assumption of normality is tested by inspecting the Skewness and Kurtosis statistic and standard error of the variables. Table 13 shows the results of the tests and that all three variables have an acceptable deviation from normality. Multicollinearity is tested

for by tracking the adjusted R-square of the different models. The results for this will be presented in the next chapter.

TABLE 13: SKEWNESS AND KURTOSIS TEST OF NORMALITY

	Skewness statistic	Kurtosis statistic
Innovation success	-,049	-,418
Innovation structure	-,036	-1,047
Innovation culture	-,413	-,625

TABLE 14: LEVENE'S TEST OF HOMOGENEITY OF VARIANCES

	F	Sig.
Model 1	,830	,872
Model 2	1,070	,332
Model 3	1,173	,165
Model 4	1,334	,082
Model 5	1,423	,081

3.2. RESEARCH QUESTION 2 – CO-CREATION MECHANISMS

The second method concerns the second research question, which is: what are the mechanisms behind the relation between co-creation and innovation success in large firms? These mechanisms have been discussed in the theoretical framework chapter, which gave some first indications on what the main motivations for engaging in co-creation are and how these motivations vary over different organizational functions and levels of co-creation depth. A survey (small survey) and two interviews were conducted to empirically investigate the mechanisms underlying the relation between co-creation and firm performance; the rest of this paragraph expands on these two methods, starting with the survey and subsequently the interviews.

3.2.1. SMALL SURVEY

The small survey is an online survey and respondents were approached through telephone. When the respondents said to be willing to participate, a link to the survey was sent through e-mail to the respondent's e-mail address. When not having completed the survey after a week, a reminder e-mail would be sent. A second reminder e-mail would be sent after another week.

The small survey gathered 54 responses. Four cases were listwise deleted, because they did not indicate that they engage customers in any of the indicated functions. These cases were left out for two reasons. Firstly, it is impossible to see the difference between firms that do not engage customers in any of the functions and firms that did not complete the question. Secondly, the research does not focus on firms that do not have contact with customers at all. The sample results in 50 cases. Of the 30 variables, only two values were missing in one variable. The missing values were left untreated and were listwise deleted in the analyses that used that variable.

The study population of the small survey is based on the FEM 500 list of 2007, which is the most recent one. The FEM 500 list is made by FEM Business and is a list of the 500 most important Dutch firms at that moment. The advantage of using the FEM 500 list over a simple list with the 500 firms with the highest turnover, is that FEM Business uses additional selection criteria. For example, financial holding firms that are only registered in the Netherlands for financial reasons are not included in the list and firms that are mostly owned by foreigners, but that are considered to be of Dutch heritage, are included in the list. Investment firms or private equity firms are also not included in the list. The turnover, profit and employee numbers, on which the list is mostly based, are mostly drawn from the LexisNexis database. This database draws its data from yearly reports. The data concerns the fiscal year 2005 and 2006. Disadvantages of using this list will be clear; some of the selection criteria are subjective in nature and the data is relatively old. For the use of the data in this research, however, these objections are not very relevant. It is not of big importance that the firms are still among the 500 largest ones of the Netherlands, as long as they can be considered relatively large. The data is not old enough for this assumption to be violated. The somewhat subjective criteria earlier discussed strengthen the assumptions that the selected firms have a Dutch culture, which is valuable for the analysis.

Not the entire list was selected to be approached for the research. Only the firms among the first 250 firms in the list were approached which engage in marketing. Both these criteria are pragmatic in nature. Because of time constraints, it was only possible to approach the first 250 firms. Whether firms engage in marketing

indicates if the theme has any relevance to the firm. If a firm does not engage in marketing at all, the market is so stable and global (e.g. coal trading) or the distance to the consumer is so great (e.g. consultancy) that no useful perspectives are expected. 191 Firms were approached, which results in a response rate of 28 percent. This is generally considered a poor response rate, although a demonstrated lack of response bias is far more important than the response percentage (Babbie, 2004, p. 261). No specific industries or types of firms were consistently unwilling to participate; no pattern in responding and non-responding firms was detected.

30 Variables are formed, each addressing a driver, benefit, constraint or result from co-creation. Because of the small sample of the small survey, only descriptive analyses are performed. For this reason, no control variables or homogeneity tests are necessary. The thirty variables consist of four groups of variables and one independent variable. All group variables are dummy coded as (1) is yes and (0) is no. The groups of variables had the same overlapping survey question.

Six of the variables come from the following question: “What are (would be) the primary drivers for involving your consumers in your value creation? (Multiple answers possible)”. The answer options are: (a) Competitive advantage, (b) Gain market share, (c) Improve customer loyalty, (d) Attract new customers, (e) Understand new needs and (f) Higher brand awareness. Another six of the variables come from the following question: “What are (could be) the benefits for your consumers to be involved in your value creation? (Multiple answers possible)”. The answer options are: (g) Customized product - resulting in better fit between needs and product, (h) Explicit incentives - loyalty points, discount, money, (i) Feeling of being part of the team of your favorite brand, (j) Experience of the co-creation - fun, creativity, (k) Peer recognition - show know-how, skills and (l) Higher brand awareness. Eleven of the variables come from the following question: “What most constraints your company's ability to achieve consumer interaction? (Multiple answers possible)”. The answer options are: (m) We are too far in the value chain to be interacting with the end consumer, (n) We are a commodity product, so it is difficult to show our unique value to the customer, (o) Previous attempts did not turn out satisfactory in (financial) results, (p) Financial constraints, (q) Lack of skills within the organization, (r) Lack of formal processes, (s) Urgency of pressing day to day business demands, (t) Inadequate technological capability, (u) Inadequate leadership commitment, (v) Failure to gain buy-in at lower levels of the organization and (w) My customer is not able to co-create. Six of the variables come from the following question: “What results did involving customers bring to your organization (Multiple answers possible)”. The answer options are: (x) Competitive advantage, (y) Higher market share, (z) Less retention of customers, (aa) New customers, (ab) New products or services and (ac) Higher brand awareness. The variable names can be found in Table 15.

TABLE 15: CO-CREATION MOTIVATORS

(a) Competitive advantage driver	(p) Financial constraint
(b) Market share driver	(q) Skill constraint
(c) Customer loyalty driver	(r) Formal process constraint
(d) New customers driver	(s) Urgency constraint
(e) New needs driver	(t) Technological constraint
(f) Brand awareness driver	(u) Leadership constraint
(g) Customized product benefit	(v) Lower level buy-in constraint
(h) Explicit incentives benefit	(w) Customer inability constraint
(i) Favorite brand benefit	(x) Competitive advantage result
(j) Co-creation e\xperience benefit	(y) Market share result
(k) Peer recognition benefit	(z) Retention result
(l) Brand awareness benefit	(aa) New customers result
(m) Value chain constraint	(ab) New products result
(n) Commodity product constraint	(ac) Brand awareness result
(o) Previous attempts constraint	

The last variable is derived from the following question: "What trends in your innovation results do you expect to be co-created with customers by 2012?". The answer options are: (1) I expect my co-created innovation results to decrease, (2) I expect neither decrease or increase and (3) I expect my co-created innovation results to increase. Since none of the respondents chose option one as their answer, the analysis only involved answer options two and three, which are recoded as dummy: (2) Stable co-creation trend and (3) Increasing co-creation trend.

The results will be presented in the next chapter through two perspectives; the perspective of co-creation level and that of the number of functions involved. Co-creation level is based on the following question: "How involved are your end consumers in your innovation efforts?". The answer options are: (1) We do not actively engage customers in our innovation efforts; (2) Customers are involved in test marketing following initial design; (3) Customers are proactively involved in design and development; and (4) We maintain ongoing customer conversation to support multiple elements of our innovation processes. The distribution of Co-creation can be found in Table 16.

TABLE 16: CO-CREATION LEVEL DISTRIBUTION OF SMALL SURVEY

	N	% of total
(1) Very low	10	18,5
(2) Low	18	33,3
(3) Medium	13	24,1
(4) High	13	24,1
	54	

Number of functions involved is based on the following question: "Where in the value chain do you involve customers in your value creation? (Multiple answers possible)". The answer options are: (1) R&D, (2) Production, (3) Logistics, (4) Marketing, (5) Sales, and (6) Services. The distribution of the answer options can be found in Table 17.

TABLE 17: MEASURED FUNCTIONS OF SMALL SURVEY

	N	% of total
(1) R&D	26	48,1
(2) Production	8	14,8
(3) Logistics	6	11,1
(4) Marketing	32	59,3
(5) Sales	21	38,9
(6) Services	29	53,7
	54	

This distribution is recoded to let it fit with the large survey. For the recoding, only the categories R&D, Marketing, Sales and Services were considered, wherein Marketing and Sales was aggregated as one. The recoding is as follows: (1) no engaged functions, (2) one engaged function, (3) two engaged functions and (4) all three engaged functions. The distribution of Specific functions involved can be found in Table 18.

TABLE 18: SPECIFIC FUNCTIONS INVOLVED OF SMALL SURVEY

	N	% of total
(1) None	4	7,4
(2) Marketing/sales	19	35,2
(3) Service/support	19	35,2
(4) NPD	12	22,2
	54	

3.2.2. INTERVIEWS

The interviews are the second method applied to identify the mechanisms of the relation between co-creation and firm performance through innovation success. Two firms were interviewed for this purpose. Interviewees were selected based on the small survey respondents. The interaction term between Co-creation level and Number of involved functions was taken as the ruler for which firms would be approached to partake in the interviews; the eight highest scoring firms were approached. Of these eight firms, two people were willing to participate and were interviewed.

The questionnaire contains eight main questions and eleven sub questions. The main questions are divided in two groups; background of the respondent and co-creation. The background questions ask about the background of the respondent and the expertise in the area of innovation and co-creation. The co-creation questions ask about current and possible co-creation activities in product development, production, marketing/sales and service/support. These parts of the firm were chosen, because they match well with the surveys and were indicated in the theoretical framework chapter as having co-creation possibilities. The sub questions ask about the exact reasons for engaging or not engaging in co-creation in each of the function of the firm. The interviews were unstructured and the questionnaire was used more as a guideline than a script.

The interviews were performed face-to-face in the interviewee's office building and qualitative interviewing was applied. Applying qualitative interviews has the consequence that the validity will be much greater than other kinds of research, such a survey or experiment, can be. The reliability, however, has some serious potential problems. Because of the qualitative nature of this kind of field research and the interactive way the data is gathered, it is difficult to guard against researcher bias and other forms of reliability problems. The interviews took about one hour and a voice recorder was used to record the observation. After the interviews, an interview summary was sent to the interviewees and the interviewees were asked to check for false or incomplete data; both interviewees responded and comments were processed. The final versions of these interview summaries can be found in appendix B. The questionnaire is only used as a guideline for the interview and to check if all aspects have been covered. The use of examples during the interviews has been limited as much as possible, a strong preference has been used to rephrase the question and not give examples. This has been done to see the extent in which the interviewees are themselves capable of seeing and understanding co-creation possibilities. The interviewees were promised complete anonymity and the way their answers would be used in reports was clearly discussed and agreed on. This was done to assure that the interviewees would respond truthfully and not socially desirable.

3.3. RESEARCH QUESTION 3 – INTERNATIONAL POSITION OF DUTCH FIRMS

The second method concerns the second research question, which is: how engaged are large Dutch firms in co-creation and how successful are their innovations in an international perspective? The large and small survey are combined into the combined survey on a select number of variables and is used to compare Dutch firms with firms worldwide using descriptive analyses and independent-sample t-tests. The combined survey combines the 327 cases of the large survey with 50 cases of the small survey, which results in 377 cases. Because only a limited number of variables were present in both surveys, there is not enough data to construct a full testable model. For this reason, only t-tests and descriptive analyses are applied. Both methods are applied, because not all variables completely fulfill the assumptions of the t-test. T-tests assume equal distances between the variables' categories and, as discussed earlier, the variables Co-creation level and Number of functions involved do not fully fulfill this assumption. The t-test is, however, not very sensitive to small violations of its assumptions. The additional descriptive analyses are used to increase the reliability of the t-tests by confirming its results.

The combined survey uses the following four variables: Innovation success percentage, Co-creation level, Number of functions involved, Specific functions involved and Country. Innovation success percentage is an ordinal variable and based on the following survey question: "What is the estimated success rate of your firms innovation efforts? What percentage of your efforts has a positive material impact on business results?". The answer options are: (1) Less than 25%, (2) 25-49%, (3) 50-74% and (4) Over 75%. Co-creation level, Number of functions involved and Specific functions involved use respectively the same coding as the Co-creation level, Number of functions involved and Specific functions involved variables of the large survey, but then on the combined sample. Country scores the cases either as (1) Not in the Netherlands or (2) In the Netherlands

Two of the five variables contain missing values. Innovation percentage contains two missing values. The cases of these missing values were listwise deleted only in the analyses that use Innovation percentage combined as one of its variables. Country contains 55 missing values. All missing values were scored as (1). To correct for the potential bias, the descriptive comparisons are made between (2) and (1) † (2). This way, the only assumption that is made in respect to the potential missing value bias of the Country variable, is that the cases that have a missing value on Country and should be scored (2), have the same distribution as the cases that were correctly scored as (2). This is a reasonable assumption to make, because most of the cases that should have been scored (2) will have been scored correctly as (2) instead of missing. This is the case, because the small survey has no missing values on Country and are all scored correctly as (2). The distribution of Country can be found in Table 19.

TABLE 19: COUNTRY DISTRIBUTION OF COMBINED SURVEY

	N	% of total
USA	163	42,8
Netherlands	70	19,4
Unknown	55	14,4
South-America	24	6,3
Canada	21	5,5
Europe	16	4,2
India & Middle-East	9	2,4
Africa	8	2,1
Asia	8	2,1
Australia	3	0,8
	377	

The independent-sample t-tests assume normality of the variables under study. To determine the correct method to calculate the t-value with, the homogeneity of the variances of the variables under study needs to be determined. Table 20 presents the descriptive statistics, tests of normality and Levene's test of homogeneity of variances.

TABEL 20: DESCRIPTIVES, TEST OF NORMALITY AND TEST OF HOMOGENEITY

	Descriptive statistics			test of normality		Levene's test of homogeneity of variances	
	N	Mean	S.D.	Skewness	Kurtosis	F	Sig.
Innovation success percentage	375	2,18	,92	,369	-,695	1,376	,242
Co-creation level	377	2,57	,888	,007	-,745	2,467	,117
Number of functions involved	377	1,86	,816	,253	-1,453	2,658	,104

The tests of normality show that the assumption of normality is not violated by the variables; the kurtosis of Number of functions involved is a relatively high, but the independent-sample t-test mainly needs a normal skewness so this is not a problem. The Levene's test of homogeneity of variances shows that the procedure of the independent-sample t-test homogeneity of variances can be assumed.

4. RESULTS

Based on the theoretical framework as presented in chapter two and with the methods as described in chapter three, empirical research was conducted. This chapter presents the results of this research following the research questions. The first research question concerns the relation between co-creation and innovation success and GLM analyses were performed to test this relation; the results of this process will be discussed first. The second research question concerns the mechanisms behind the relation between co-creation and innovation success and descriptive analyses were applied to investigate this; the results of these analyses will be presented second. The last research question is about the international position of Dutch firms and is answered using a combination of descriptive analysis and t-tests; this chapter will conclude with the presentation of these results.

4.2. RESEARCH QUESTION 1 – CO-CREATION AND INNOVATION SUCCESS

This first results paragraph concerns the first research question, which is: is there a relation between co-creation and innovation success in large firms? This relation has been conceptualized into two hypotheses in the previous chapter: co-creation is positively related to innovation success, and the number of functions involved positively moderates the effect of co-creation on innovation success. In this paragraph, the statistical tests on the relations of the hypotheses are presented. All tests shown here include the control variables (Industry, Ownership, Revenues, Knowledge partners, Innovation structure and Innovation culture), but are left out in some of the written and graphical overviews to improve understandability and readability. Table 21 shows the means, standard deviations and Pearson correlations (two-tailed) of the continuous variables.

TABLE 21: DESCRIPTIVE STATISTICS AND CORRELATIONS

Variables	Mean	S.D.	1	2	3
1. Innovation success	1	0,861	1		
2. Innovation structure	0	1	,289***	1	
3. Innovation culture	0	1	,274***	,000	1

*** p < ,001

Table 22 shows the results of the GLM analysis. The delta R-square statistic is the change of the model as compared with the model preceding it in the buildup of variables. This is not necessarily the model to the left of it, because the delta R-square statistic is only relevant when variables are either added or removed and not when variables are both added and removed. The significance level of the delta R-square statistic as indicated with the stars is the significance of the F-change of the same model comparison.

Model 1 presents the control variables predicting innovation success. This model shows that the extent in which firms have a structure and culture that is conducive to innovation results in significantly higher innovation success. The beta of Innovation structure is 0,238 with a standard error of 0,049; the beta of Innovation culture is 0,235 with a standard error of 0,047. The other control variables are not significant, meaning that variations in industry, firm revenues, ownership structure or the use of knowledge partners does not explain the variation in innovation success. The control variables already explain a large part of the variance in innovation success among the firms; the R-square is 0,188. The adjusted R-square is 0,140 which is only a difference of 0,048 with the R-square, which means that multicollinearity between the variables is low. The observations for control variables are relevant for all five models and will not further be discussed in this chapter.

In model 2, the variable Co-creation presence is added to model 1 as a main effect predicting innovation success. This model also shows the highly significant effect of innovation structure and culture. The beta of Innovation structure is 0,234 with a standard error of 0,049; the beta of Innovation culture is 0,227 with a standard error of 0,047. This model tests hypothesis 1. The prediction that co-creation would be positively related to innovation success is not supported in this model; the simple step from passively involving consumers to actively involving consumers does not affect the success of innovations. This is also supported by the not-significant improvement of R-square.

TABLE 22: RESULTS OF GLM BETWEEN-SUBJECTS ANALYSIS - DEPENDENT VARIABLE: INNOVATION SUCCESS

Variables	**Model 1** Type III Sum of Squares	**Model 2** Type III Sum of Squares	**Model 3** Type III Sum of Squares	**Model 4** Type III Sum of Squares	**Model 5** Type III Sum of Squares
Constant	45,381***	46,681***	47,274***	60,983***	70,673***
Intercept	103,015***	53,427***	89,714***	44,190***	54,807***
Error	196,299	194,999	194,407	180,698	171,007
Control variables					
Industry (7 Categories)	,653	,645	,508	,829	1,152
Revenues (6 Categories)	1,840	1,926	1,736	2,314	2,366
Ownership (3 Categories)	,935	,868	,899	,542	,025
Knowledge partner (4 Categories)	3,021	3,018	2,896	3,783	5,199
Innovation structure (Continuous)	15,075***	14,527***	14,641***	14,405***	10,063***
Innovation culture (Continuous)	15,923***	14,533***	12,931***	13,302***	9,881***
Model variables					
Co-creation presence (Yes, No)		1,300			
Co-creation level (Very low, Low, Medium, High)			1,893	3,298	2,442
Number of functions involved (One, Two, Three)				2,189	
Specific functions involved (7 Categories)					5,132
Co-creation level x Number of functions involved				13,630**	
Co-creation level x Specific function involved					20,298**
Model					
R^2 (Adjusted R^2)	,188 (,140)	,193 (,143)	,196 (,140)	,252 (,179)	,292 (,182)
Delta R^2 (Adjusted R^2)		,005 (,003)	,008 (,000)	,056** (,039)	,096* (,042)

** p < ,01
*** p < ,001

In model 3, the variable Co-creation level is added to model 1 as a main effect predicting innovation success. This model, too, confirms the effect of innovation structure and culture on innovation success. The beta of Innovation structure is 0,235 with a standard error of 0,049; the beta of Innovation culture is 0,218 with a standard error of 0,048. This model also tests hypothesis 1 and comes to the same general conclusion. Even when different levels in co-creation are considered, does co-creation not affect the success of innovations. This is supported by the not-significant improvement of R-square and equal level of adjusted R-square.

In model 4, the variable Number of functions involved is added as a main effect together with the interaction effect between Co-creation level and Number of functions involved to model 3. The effect of innovation structure and culture is still highly significant. The beta of Innovation structure is 0,235 with a standard error of 0,048; the beta of Innovation culture is 0,228 with a standard error of 0,049. The interaction effect shows a strongly significant effect on innovation success with a sum of squares of 13,630. The overall model also improves greatly; the R-square significantly improves with 0,056 to 0,252. The adjusted R-square improves less with 0,039 to 0,179. This shows that there is some multicollinearity between the added variables and the previous variables, but that the added variables still significantly improve the model. The size and direction of the effect of this interaction term on innovation success is further explored using pairwise comparison of the estimated marginal means. Table 23 shows the cell combinations with a case number lower than 10, which means that no reliable conclusions can be made on pairwise differences that involve one of these cell combinations. Pairwise differences that involve these cells will be left out in the rest of the presentation of the results. Please note: the estimated marginal means in Table 23 are calculated with the same covariate levels as the other GLM analyses. The values in the linear regression analysis, that will follow later in this paragraph, are

calculated differently, which means that the values in Table 23 should not be compared with the values of the linear regression analysis but can be compared with those of the GLM analysis.

TABLE 23: CELL COMBINATIONS BETWEEN CO-CREATION LEVEL AND NUMBER OF FUNCTIONS INVOLVED WITH A CASE NUMBER LOWER THAN 10 – DEPENDENT VARIABLE: INNOVATION SUCCESS

Co-creation level	Number of functions involved	Estimated marginal mean
Very low	2	1,169
	3	-0,878

Table 23 and Figure 7 show the significant mean differences between pairs of Co-creation level and Number of functions involved categories with cell numbers above 10.

TABLE 24: RESULTS OF PAIRWISE DIFFERENCE BETWEEN CO-CREATION LEVEL AND NUMBER OF FUNCTIONS INVOLVED - DEPENDENT VARIABLE: INNOVATION SUCCESS

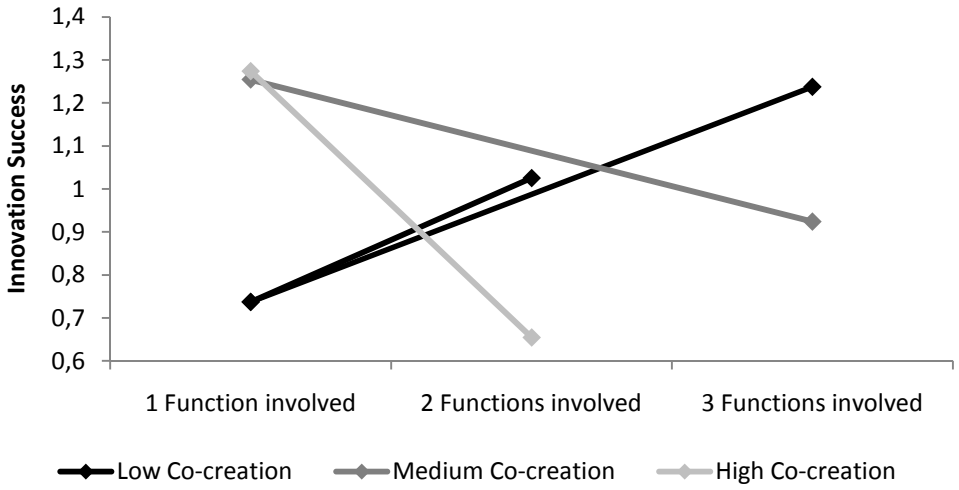
Co-creation level	[I] Number of functions involved (cell N)	[J] Number of functions involved (cell N)	Mean Difference [I-J]	Std. Error
Low	1 (50)	2 (42)	-,288†	,167
Low	1 (50)	3 (32)	-,500**	,183
Medium	1 (39)	3 (40)	,330†	,183
High	1 (22)	2 (13)	,619*	,280

† p < 0,1

* p < ,05

** p < ,01

FIGURE 7: RESULTS OF PAIRWISE DIFFERENCE BETWEEN CO-CREATION LEVEL AND NUMBER OF FUNCTIONS INVOLVED



- ***How to read the graphs***

The graphs are based on the tables right above it added with the starting point of each pairwise difference. The lines in the graph are interpolated, which means that only the begin and endpoint of the lines are relevant. The absence of a line or category can mean two things; either one of the compared cells has a case number lower than 10, or there is no significant effect between the compared cells. An example: the 'Medium Co-creation' line in the graph above shows the difference of medium co-creation between 1 function

involved and 3 functions involved. The absence of a line between 1 function involved and 2 functions involved means that there is no significant difference between these two categories in the case of medium co-creation.

The overviews show that when a firm engages in a low level of co-creation, this can better be done in two or three functions than just in one. A difference between two and three functions, however, is not significant. When a firm engages in higher levels of co-creation, the effect of co-creation is negatively influenced by the number of functions involved. Medium level of co-creation can better be applied in just one function than three with no significant difference with two functions. High level of co-creation can better be applied in one function than two with no significant difference with three functions. Comparing Number of functions involved with Co-creation level results in Table 25 and Figure 8.

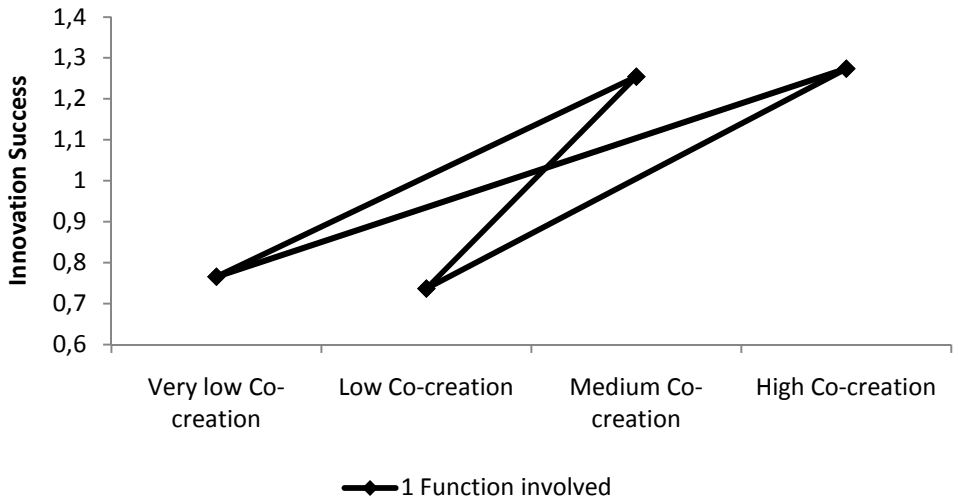
TABLE 25: RESULTS OF PAIRWISE DIFFERENCE BETWEEN NUMBER OF FUNCTIONS INVOLVED AND CO-CREATION LEVEL - DEPENDENT VARIABLE: INNOVATION SUCCESS

Number of functions involved	[I] Co-creation level (cell N)	[J] Co-creation level (cell N)	Mean Difference [I-J]	Std. Error
1	Very low (24)	Medium (39)	-,488*	,207
1	Very low (24)	High (22)	-,508*	,238
1	Low (50)	Medium (39)	-,517**	,171
1	Low (50)	High (22)	-,537*	,211

* p < ,05

** p < ,01

FIGURE 8: RESULTS OF PAIRWISE DIFFERENCE BETWEEN NUMBER OF FUNCTIONS INVOLVED AND CO-CREATION LEVEL



The overviews show that when a firm co-creates in just one function, an increasing co-creation level significantly increases the effect on innovation success, although the steps from very low to low and medium to high are not significant. Just as interesting are the missing lines; when a firm co-creation in two or three functions, deeper forms of co-creation do not increase the effect on innovation success.

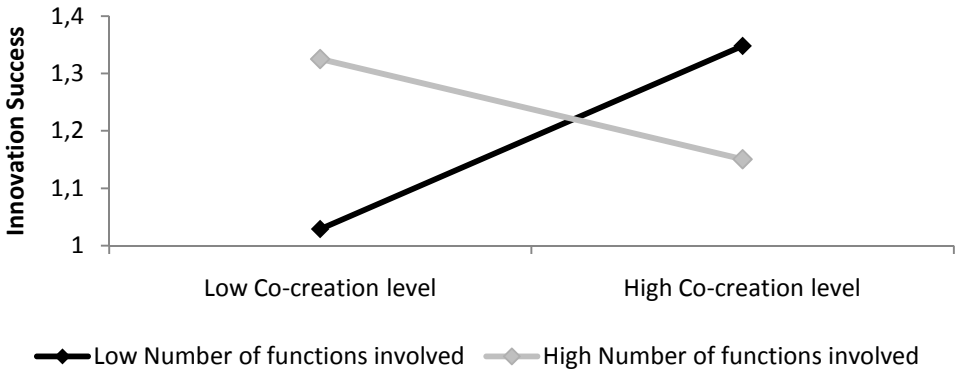
To test the robustness and reliability of the applied GLM method, the same variables can be used in a different analysis method and with a different measurement scale. Table 26 and Figure 9 show the result of a linear regression analysis with the model variables of model 4 entered as scale variables. The variables Co-creation level and Number of functions involved have been centered with a mean of 0 and a standard deviation of 0,857 and 0,822 respectively.

TABLE 26: RESULTS OF LINEAR REGRESSION ANALYSIS WITH MODEL VARIABLES AS SCALE VARIABLES - DEPENDENT VARIABLE: INNOVATION SUCCESS

Variables	B	Std. Error
Constant	1,213***	,183
Control variables		
SBI 8-43: Industrial industry	,098	,412
SBI 46-55: Trade & Transport industry	,156	,421
SBI 58-63: ICT industry	,042	,446
SBI 64-69: Financial industry	,032	,422
SBI 73-74: Business industry	,133	,423
SBI 84-94: Public industry	,038	,411
Less than $500m revenues	-,269	,253
$501m - $999m revenues	-,249	,287
$1b - $10 billion revenues	-,177	,265
$10.1 - 25 billion revenues	-,463	,303
$25 billion† revenues	-,124	,298
Privately held ownership	,000	,310
Publicly traded ownership	,130	,302
None knowledge partner	-,182	,179
Low knowledge partner	-,077	,130
Medium knowledge partner	-,264*	,129
Innovation structure	,227***	,049
Innovation culture	,217***	,049
Model variables		
Co-creation level	,042	,058
Number of functions involved	,030	,058
Co-creation level x Number of functions involved	-,175*	,067
Model		
R^2 (Adjusted R^2)	,212 (,157)	

* p < ,05
*** p < ,001
The omitted variables are: Unknown industry, Unknown revenues, Unknown ownership and High knowledge partner.

FIGURE 9: RESULTS OF LINEAR REGRESSION ANALYSIS WITH MODEL VARIABLES AS SCALE VARIABLES



The overviews confirm the observations from the pairwise comparisons and nicely summarize the results from model 4. The negative beta of the interaction term confirms that higher levels of co-creation can better be combined with a lower number of involved functions while lower levels of co-creation can better be combined with a higher number of involved functions. The only additional observation is the significance of Medium knowledge partner compared to high knowledge partner; this shows a possible positive effect of knowledge partner involvement on innovation success. The observations from this method are only used to test the robustness and reliability of the GLM analysis models. Since the model variables violate the assumption of equal distance when they are used as continuous variables, the linear regression model does not result in high validity observations and the exact results will not further be used.

In model 5, the variable Specific functions involved is added as a main effect together with the interaction effect between Co-creation level and Specific functions involved to model 3. The effect of innovation structure and culture is highly significant. The beta of Innovation structure is 0,204 with a standard error of 0,050; the beta of Innovation culture is 0,201 with a standard error of 0,050. The interaction effect shows a strongly significant effect on innovation success with a sum of squares of 20,298. The model improves significantly with 0,096, but the adjusted R-square only with 0,042. This shows that there is, relative to the step from model 3 to 4, much multicollinearity in the variables. This indicates that the observation from this model have less validity than that form model 4 and should be interpreted with caution. Table 27 shows the cell combinations with a case number lower than 10, which means that no reliable conclusions can be made on pairwise differences using one of these cell combinations. Pairwise differences that involve these cells will be left out in the rest of the presentation of the results. Please note: the estimated marginal means in Table 27 are calculated with the same covariate levels as the other GLM analyses. The values in the linear regression analysis, that will follow later in this paragraph, are calculated differently, which means that the values in Table 27 should not be compared with the values of the linear regression analysis but can be compared with those of the GLM analysis.

TABLE 27: CELL COMBINATIONS BETWEEN CO-CREATION LEVEL AND SPECIFIC FUNCTIONS INVOLVED WITH A CASE NUMBER LOWER THAN 10 – DEPENDENT VARIABLE: INNOVATION SUCCESS

Co-creation level	Specific functions involved	Estimated marginal mean
Very low	Service/support	0,737
	NPD	0,939
	Marketing/sales & Service/support	1,049
	Marketing/sales & NPD	1,659
	Service/support & NPD	Not observed
	All engaged functions	-0,778
Low	Service/support & NPD	1,191
Medium	Marketing/sales	1,04
	Marketing/sales & Service/support	0,897
High	Marketing/sales	0,035
	Service/support	1,016
	Marketing/sales & Service/support	0,724
	Marketing/sales & NPD	0,387
	Service/support & NPD	0,884

Table 28 and Figure 10 show the significant mean differences between pairs of Co-creation level and Specific functions involved categories with cell numbers above 10.

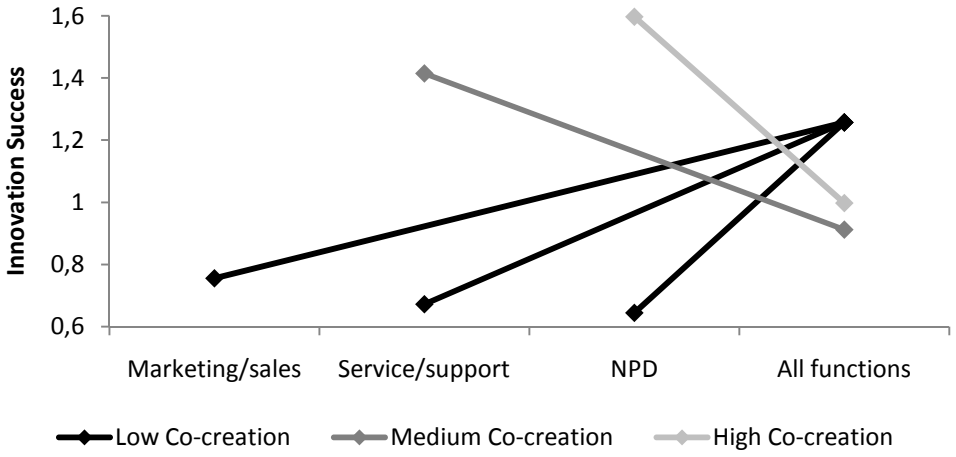
TABLE 28: RESULTS OF PAIRWISE DIFFERENCE BETWEEN CO-CREATION LEVEL AND SPECIFIC FUNCTIONS INVOLVED – DEPENDENT VARIABLE: INNOVATION SUCCESS

Co-creation level	[I] Specific functions involved (cell N)	[J] Specific functions involved (cell N)	Mean Difference [I-J]	Std. Error
Low	Marketing/sales (18)	All functions (31)	-,501*	,239
Low	Service/support (17)	All functions (31)	-,585*	,240
Low	NPD (16)	All functions (31)	-,612*	,248
Medium	Service/support (12)	All functions (44)	,502†	,265
High	NPD (15)	All functions (14)	,598*	,296

† p < 0,1

* p < ,05

FIGURE 10: RESULTS OF PAIRWISE DIFFERENCE BETWEEN CO-CREATION LEVEL AND SPECIFIC FUNCTIONS INVOLVED



- ***How to read the graphs***

The graphs are based on the tables right above it added with the starting point of each pairwise difference. The lines in the graph are interpolated, which means that only the begin- and endpoint of the lines are relevant. The absence of a line or category can mean two things; either one of the compared cells has a case number lower than 10, or there is no significant effect between the compared cells. An example: the 'Medium Co-creation' line in the graph above shows the difference of medium co-creation between Service/support and All functions. The absence of a line between Service/support and NPD means that there is no significant difference between these two categories in the case of medium co-creation.

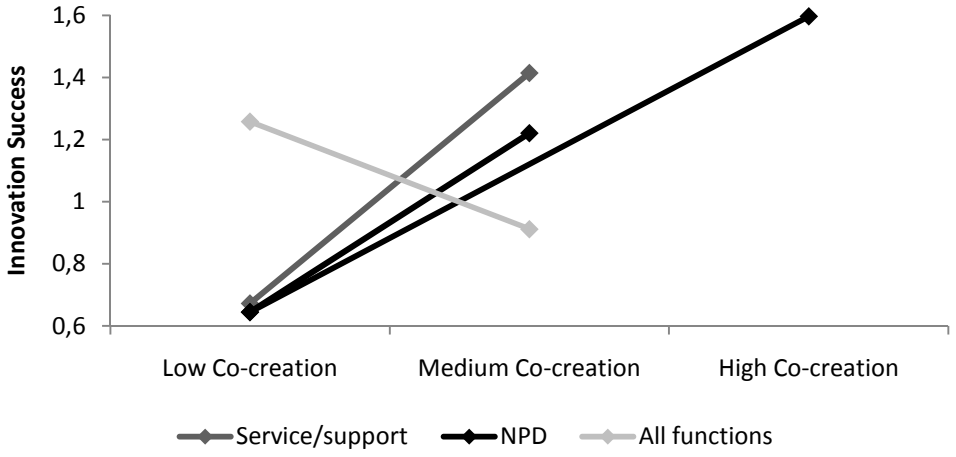
The overviews show the same relations as the previous ones, but then in more detail resulting in additional observations. For firms with a low level of co-creation, it is always the case that they can better co-create in all organizational functions than in just one. Higher levels of co-creation can better be applied in only service/support or NPD. Co-creation in two organizational functions are missing, showing that there are no significant differences from co-creating in two functions compared to one. Note that this last observation is the biggest difference with the previous overviews; only the aggregated effect of the dual combinations of functions show a significant difference, not the independent ones. Table 29 and Figure 11 show the results when comparing Specific functions involved with Co-creation level.

TABLE 29: RESULTS OF PAIRWISE DIFFERENCE BETWEEN SPECIFIC FUNCTIONS INVOLVED AND CO-CREATION LEVEL – DEPENDENT VARIABLE: INNOVATION SUCCESS

Specific functions involved	[I] Co-creation level (cell N)	[J] Co-creation level (cell N)	Mean Difference [I-J]	Std. Error
Service/support	Low (17)	Medium (12)	-,742*	,300
NPD	Low (16)	Medium (18)	-,575*	,272
NPD	Low (16)	High (15)	-,951**	,294
All functions	Low (31)	Medium (44)	,345†	,191

† p < 0,1
* p < ,05
** p < ,01

FIGURE 11: RESULTS OF PAIRWISE DIFFERENCE BETWEEN SPECIFIC FUNCTIONS INVOLVED AND CO-CREATION LEVEL



As was the case with the previous overviews, these overviews also show the same relations as previous overviews, but then in more detail resulting in additional observations. Of the firms that co-creation in one function, only the firms that co-creation in service/sales and NPD show significant differences in their effect on innovation success when compared with different levels of co-creation depth. Firms that only co-create in service/support or NPD can better apply medium co-creation depth than low. Firms that only co-create in NPD can better apply medium or high co-creation depth than low. Co-creation in all organizational functions should be combined with a low level of co-creation; otherwise innovation success will drop.

To conclude this section, an analysis has been done to determine the robustness of the dependent variable by taking the separate innovation success variables and testing model 4 and 5 again. The results show the same general pattern. Substituting innovation success by the values of the first innovation success question gives a type III sum of squares of 17,253 with a significance smaller than 0,001 on the interaction term in model 4 and a type III sum of squares of 10,723 with a significance smaller than 0,1 on the interaction term in model 5. Substituting innovation success by the values of the second innovation success question gives a type III sum of squares of 23,979 with a significance smaller than 0,05 on the interaction term in model 4 and a type III sum of squares of 22,713 with a significance of 0,125 on the interaction term in model 5. Although the estimated marginal means, standard errors and significance levels of the pairwise comparisons vary somewhat, the same pairs as described above show the highest significance and the pairs have the same direction as well.

4.2.2. SUMMARY OF FINDINGS FROM LARGE SURVEY

The analysis did not find proof that co-creation as a main effect influences innovation success. The simple act of engaging in co-creation or the act of engaging in progressively deeper levels of co-creation does not improve the success chance of innovation. About 90 percent of the firms of the large survey sample did engage in co-

creation, of which 15 percent even in a high depth level. The analysis partially confirmed that the interaction effect between co-creation level and the number of functions involved positively influences innovation success. This effect is, however, dependent on the exact combination of co-creation level and number of involved functions. To gain a positive effect on innovation success, firms should either keep their co-creation level or number of involved functions low, while increasing the other respective dimension. When increasing in the number of involved functions while engaging in a medium or high co-creation level from one function to two or three, a negative effect on innovation success will result. The analysis further showed that the specific industry, ownership structure, revenue level or involvement of knowledge partners does not influence the success chances of innovation. The level in which firms have their structure and culture organized for innovation does strongly positively influence innovation success chances.

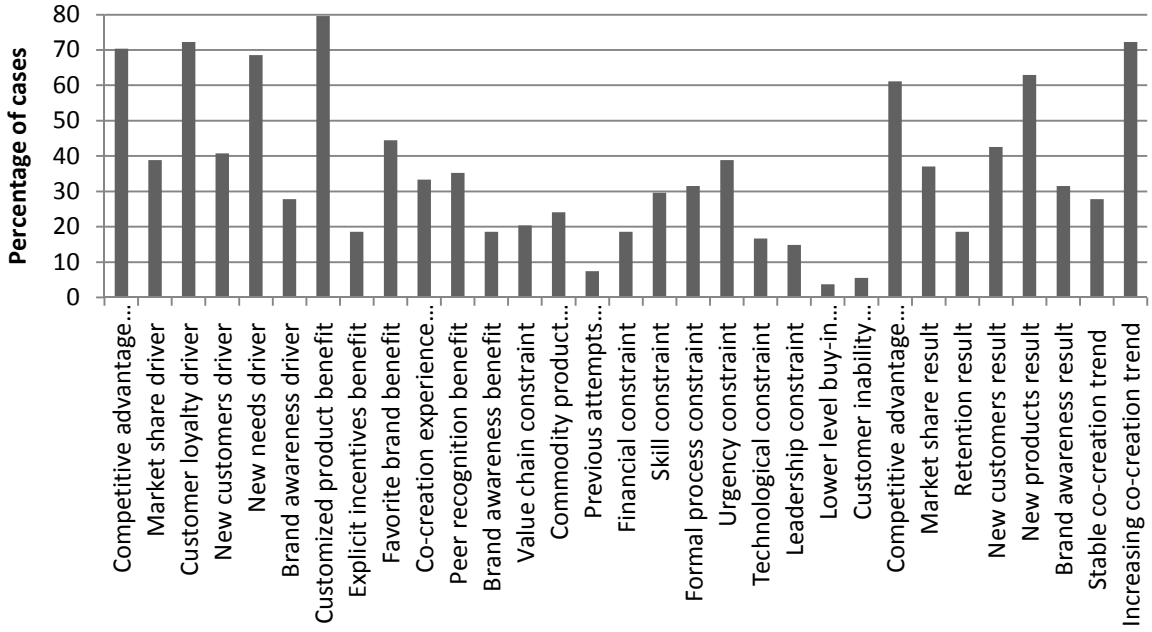
4.3. RESEARCH QUESTION 2 – CO-CREATION MECHANISMS

This paragraph will discuss the results concerning the second research question. The second research question focuses on the mechanisms behind the relation between co-creation and innovation success and the motives for engaging in co-creation. Two methods are applied to answer this research question; the small survey and two interviews. The results of these methods will be discussed in this order.

4.3.2. SMALL SURVEY

The results of a descriptive analysis on the data of the small survey show that there are clear differences between the importance of different drivers, benefits, constraints, results and trends of co-creation. Competitive advantage, customer loyalty and addressing new needs are the most important drivers for co-creation. Gaining market share, new customers and brand awareness are less important drivers. Providing customized products is by far the most important benefit of co-creation. Interaction with the favorite brand, the co-creation experience and peer recognition are also important benefits. Explicit incentives and brand awareness are less important. The respondents recognized only few constraints of co-creation, since none of the constraints was chosen by more than half of the sample. The most important constraints include lack of urgency, constraints from formal process and lack of skills. The position in the value chain, having a commodity product, financial restraints, technological restraints and leadership restraints are chosen by about twenty percent of the respondents. The constraints previous attempts of co-creation, lower level buy-in and customer inability are hardly recognized at all. The most important results of co-creation are competitive advantage and new products. Retention is the least recognized results, whereas market share, new customers and brand awareness are chosen by about forty percent of the respondents. Twice as many respondents see an increasing co-creation trend compared to a stable one. Figure 12 shows a summary of the results of the analysis.

FIGURE 12: RESULTS OF DESCRIPTIVE ANALYSIS ON CO-CREATION MOTIVES



This data can be zoomed in on from two perspectives; co-creation level and number of involved functions. Each of the categories will be discussed from these perspectives in the following sections, starting with the drivers in Figure 13 and 14.

FIGURE 13: CO-CREATION DRIVERS GROUPED BY CO-CREATION LEVEL

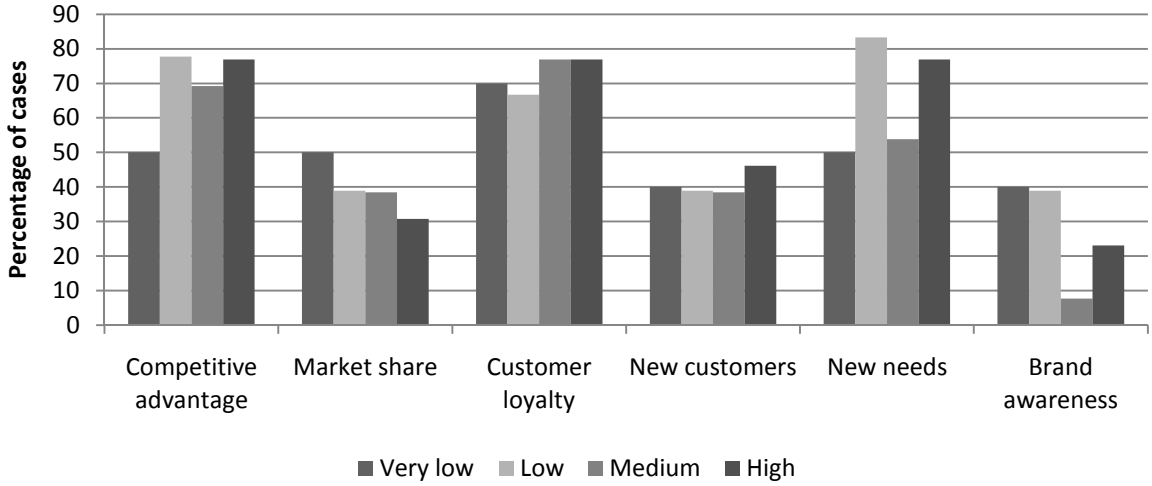
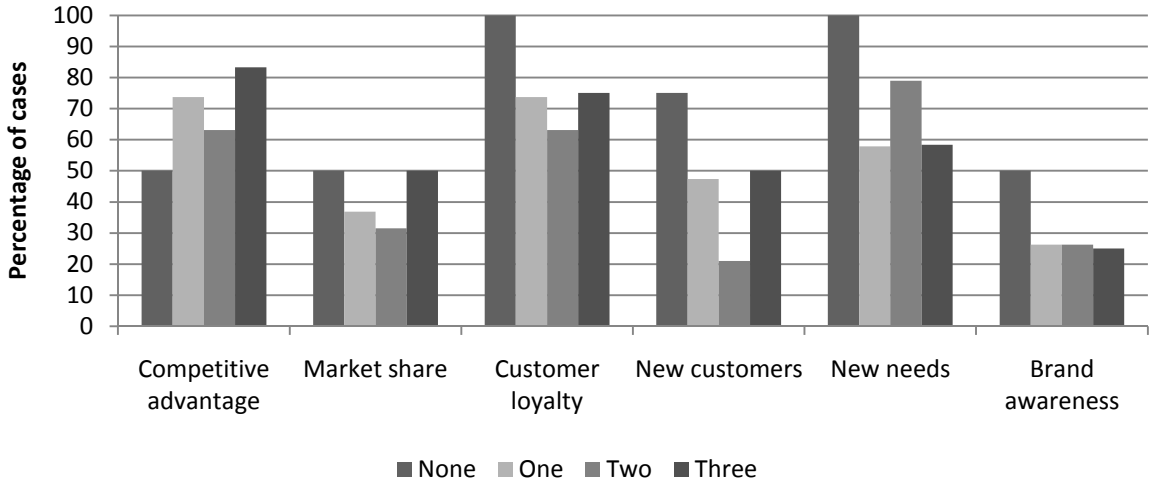


FIGURE 14: CO-CREATION DRIVERS GROUPED BY NUMBER OF INVOLVED FUNCTIONS



The figures show that the drivers competitive advantage, customer loyalty and addressing new needs score relatively stable in all co-creation categories. Market share and brand awareness become less important drivers while firms engage in deeper forms of co-creation. Taking the number of involved functions perspective, it seems that firms that have either one or three functions involved agree on the importance of the drivers. Firms with two drivers involved, seem to think that competitive advantage and new customers is less important as a driver and addressing new needs more important. The driver market share is more important for firms engaging three functions than those engaging just one or two. Figure 15 and 16 show the benefits of co-creation.

FIGURE 15: CO-CREATION BENEFITS GROUPED BY CO-CREATION LEVEL

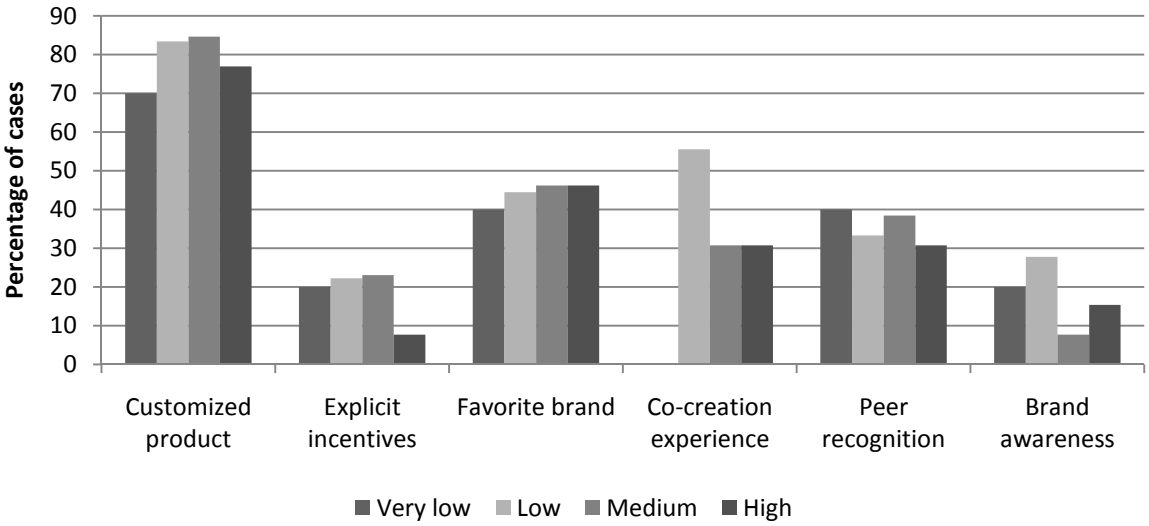
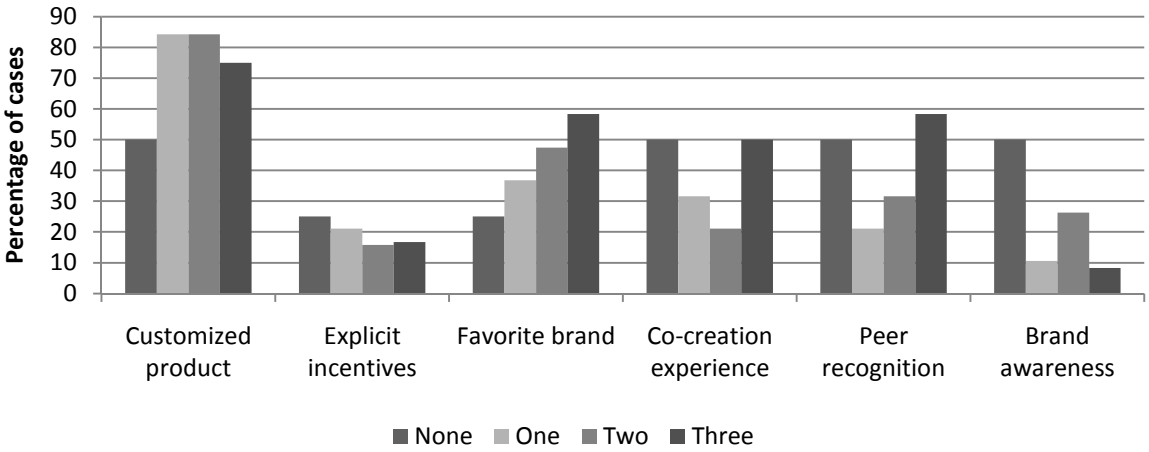


FIGURE 16: CO-CREATION BENEFITS GROUPED BY NUMBER OF INVOLVED FUNCTIONS



The only large discrepancy when taking the perspective of co-creation level is in the value of the benefit co-creation experience. Firms engaging in low depth co-creation think this benefit is more important than those engaging in medium or high co-creation. From the perspective of the number of involved functions, this situation is the other way around. Not only do the firms with a high number of involved functions see more value in the co-creation experience benefit, these firms also score stronger on peer recognition. The benefit of interacting with the favorite brand becomes increasingly more important while firms engage more functions. Brand awareness is most important for firms engaging two functions. Figure 17 and 18 show the constraints of co-creation.

FIGURE 17: CO-CREATION CONSTRAINTS GROUPED BY CO-CREATION LEVEL

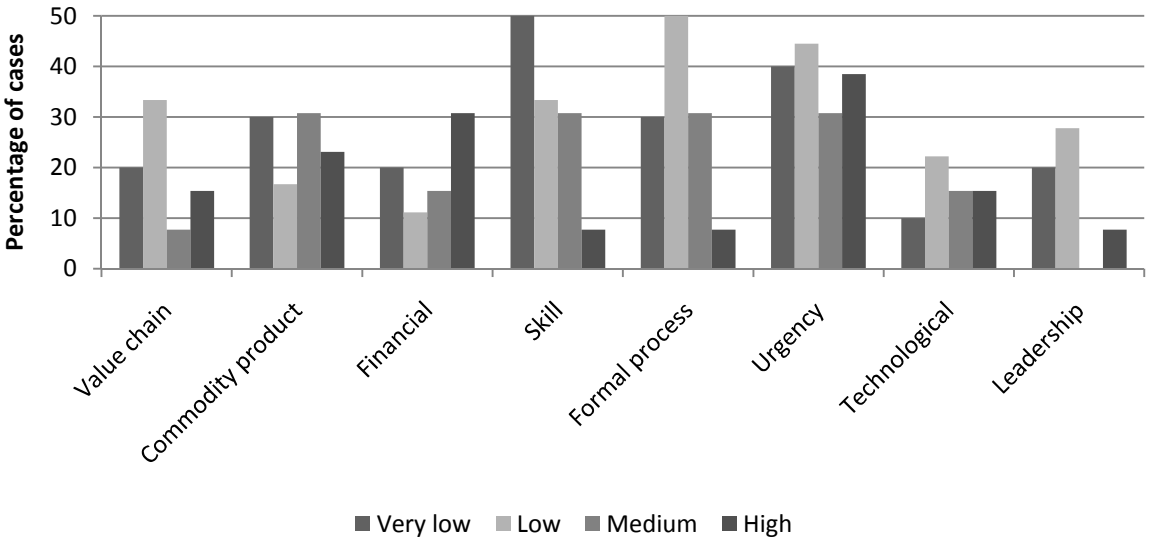
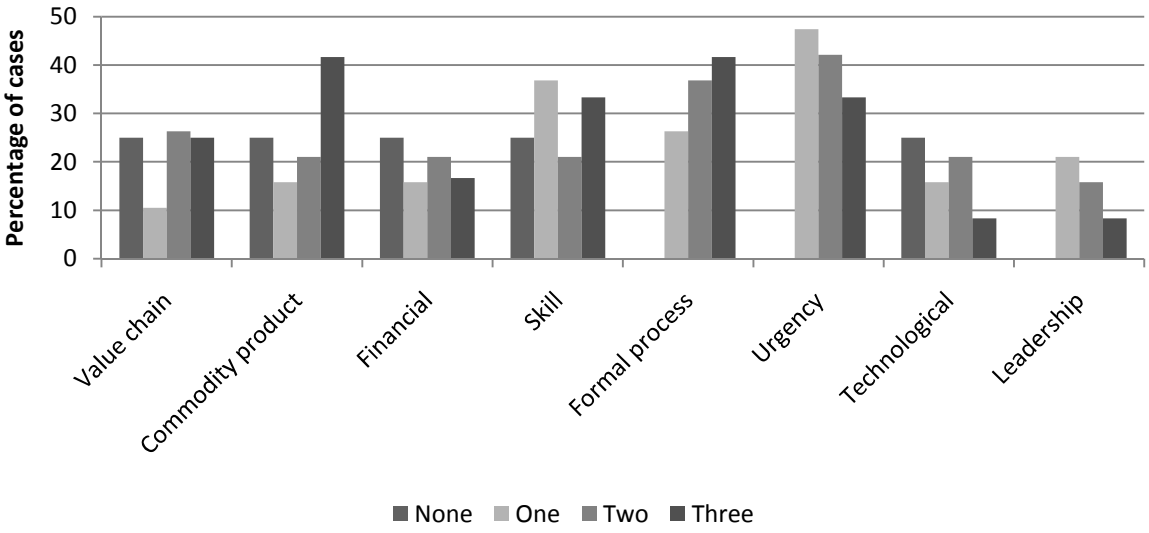


FIGURE 18: CO-CREATION CONSTRAINTS GROUPED BY NUMBER OF INVOLVED FUNCTIONS



The constraints of previous co-creation attempts, lower level buy-in and customer inability for co-creation were not included in the graphs because of their low score. From the perspective of co-creation level, the constraints of position in the value chain, inadequate skill level, lack of formal processes and a leadership constraint are especially important for firms with a low level of co-creation. Financial constraints become more important in high co-creation level firms. From the perspective of the number of involved functions, the constraints urgency, technological and leadership are most important to firms engaging a low level of functions. The constraints value chain, commodity product and formal process become more important when more functions are involved. Figure 19 and 20 show the results of co-creation.

FIGURE 19: CO-CREATION RESULTS GROUPED BY CO-CREATION LEVEL

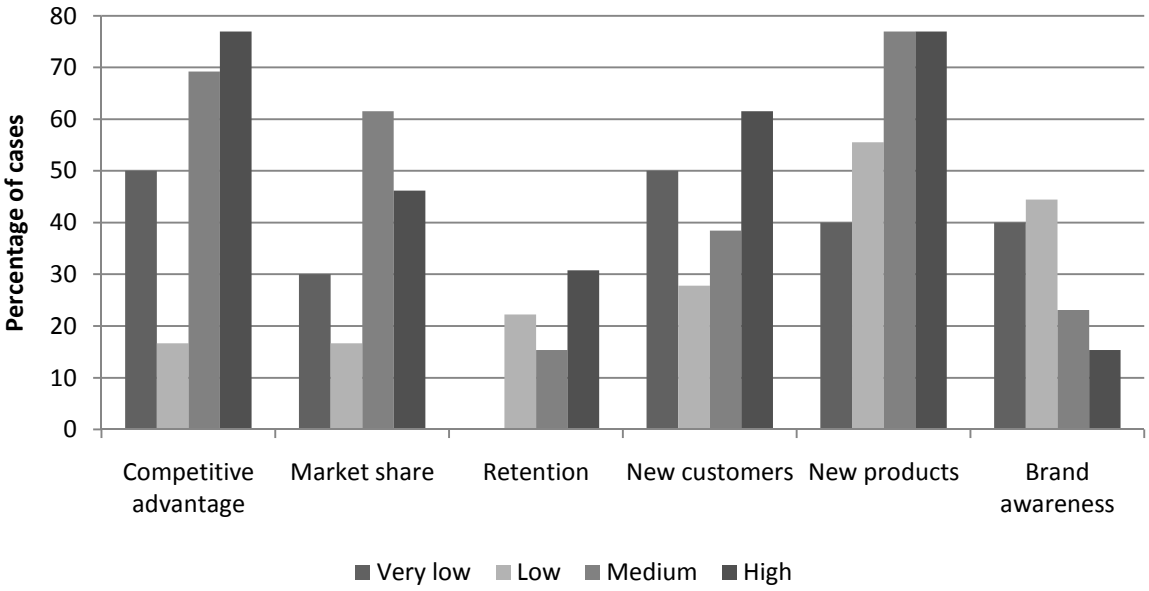
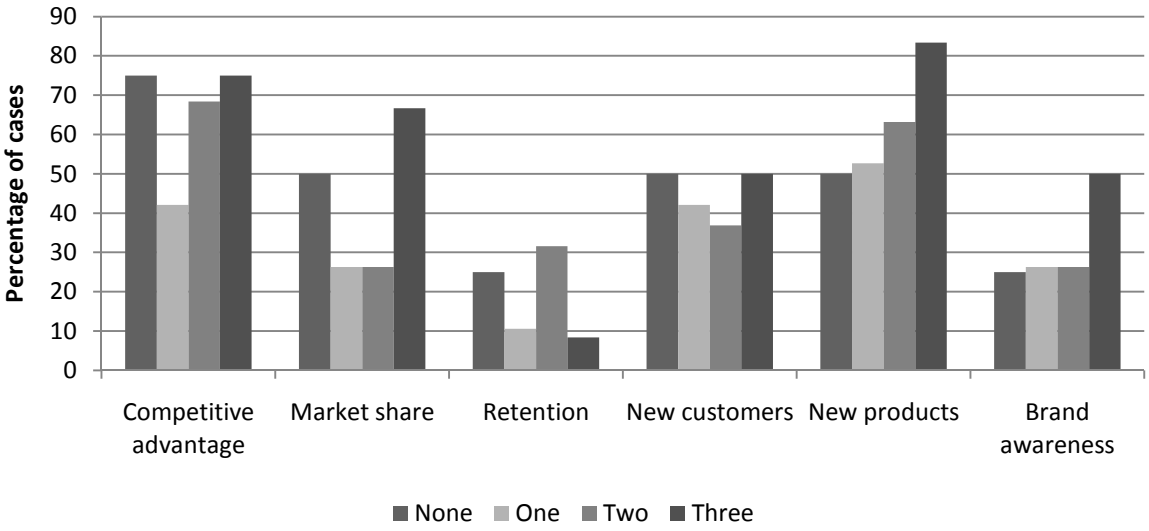


FIGURE 20: CO-CREATION RESULTS GROUPED BY NUMBER OF INVOLVED FUNCTIONS



Increasing competitive advantage, market share, new customers and new products becomes more important when consumers are involved more deeply. Improving brand awareness becomes less important with increasing co-creation level. From the number of involved functions perspective, large discrepancies between three involved functions and the other categories arise. On the results market share, new products and brand awareness, a high number of involved functions scores considerably higher than less involved functions. Competitive advantage becomes also more important when more than one function is involved. Figure 21 and 22 show the trends of co-creation.

FIGURE 21: CO-CREATION TREND GROUPED BY CO-CREATION LEVEL

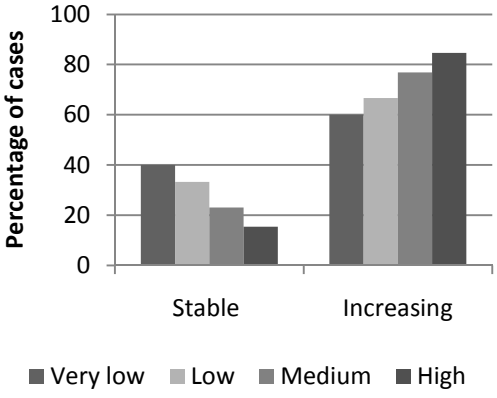
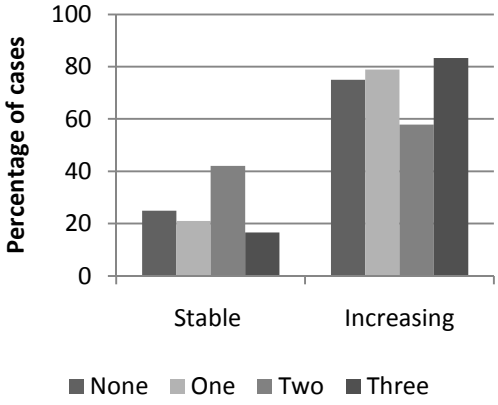


FIGURE 22: CO-CREATION TREND GROUPED BY NUMBER OF INVOLVED FUNCTIONS



A very clear pattern arises from the co-creation perspective, wherein a stable trend is less often checked and an increasing trend is more often checked when firms engage more deeply in co-creation. From the number of involved functions perspective, the medium category falls out of line, indicating that firms with two involved functions are less convinced of an increasing co-creation trend than firms engaging one or three functions.

4.3.3. INTERVIEWS

Where the small survey focused on the drivers, benefits, constraints, results and trends of co-creation in general and through the co-creation level and number of involved functions perspectives, the interviews give insight in the relations within the different functions as well. It also helps interpreting the results of the small survey by showing which motivators managers can come up with themselves.

Although both firms interviewed have recently or will soon make a drastic change in approaching consumers, they had great difficulties seeing all pros and cons of co-creation. As drivers for making the shift towards a more co-creation approach to consumers, firm A mentioned new needs of consumers, his reasoning: “And if you address the need (of the consumer), then you will have guaranteed success. That is the whole idea” (interview firm A). Firm B mentioned the internet and associated increasing price transparency and consumer power as the main driver for co-creation. The respondents disagreed, however, on the willingness of consumers to co-create. Where firm A stated “I think that the consumer is very much committed to the products […] they consume and buy” (interview firm A), firm B stated “You should not overestimate the role of the consumer in this (product type and brand choice). They simply don’t like to spend a lot of time on things like this” (interview firm B). Both firms have the same general struggle with co-creation: “We are actually in a dilemma between what the retailer wants, which is mainly a low price, and what the consumer eventually wants. This can be all kinds of thing, such as convenience, enjoyment, sustainability and of course cheap” (interview firm A).

Although firm B was more engaged in product development with consumers than firm A, both firms saw the same possibilities. They also both started with making the distinction between idea generation, idea development and idea testing. Both agreed that consumers can be involved in idea generation and testing should not be involved in idea development. Involving consumers in idea generation enables the development of unique products through increased knowledge about consumer needs: “Through their own consumption pattern, the consumer has an idea about what is missing […] in this area, they are the expert” (interview firm A). Involving consumers in idea testing increased the success chance: “Eventually it all comes down to ‘will I buy it or not’ and the consumer can be very clear about this” (interview firm A). The exact reasons for not involving consumers in idea development differ. Firm A mentions the inability of consumers to imagine possibilities; difficulties of consumer to express themselves; and the low level of market knowledge. Firm B states that involving consumers in the development of products can only be done by internal experts: “Don’t let the consumer determine what to produce, because then you will be lost” (interview firm B), “especially with major innovations, you should be stubborn and choose your own direction” (interview firm B).

Involving consumers in production is according to both firms simply not possible: (question: can you imagine involving consumers in production?) “No idea ([…] I don’t see how Dutch people could be involved in this” (interview firm B). Customization is not performed in production, but either in product development (firm A) or at the retailer (firm B).

Although both firms see the same potential benefits in co-creation in marketing/sales, the firms disagree about the value of co-creation in this function. The benefits are the increase in knowledge about consumer needs, which will increase product success chances and reduce risks. Firm B is of the opinion that consumers can add little value, because the internal expertise has enough knowledge: “You can also use your own common sense and take a look yourself at the good and bad sides” (interview firm B). Firm A is very aware of the limitations of their own network and opinions: “If you don’t watch out […], it will turn into an elite discussion. You yourself have certain eating patterns, a certain point of view, a certain group of family and friends in which you engage, but this does not mean that this is representative for the entire group of consumers that your serve. This can very fast turn into a mismatch […] between what you hear in social events and what the market really wants” (interview firm A).

Both firms currently only engage in service/support with consumers through their customer service centers. Firm A, however, does see the value of setting up an interactive platform in which consumers can engage with each other. This would, then, lead to early insight in consumer needs and a better competitive position. Firm B has a different opinion: “I do not believe in that (letting consumers interact with each other directly) at all […]. Eventually you don’t sell one product more because of it” (interview firm B).

Both firms agree on the synergy effect of cooperating with consumers and simultaneously cooperating with knowledge partners, but point to different functions and areas: “Absolutely […]. The project to which I referred that we were doing, setting up consumer panels, focus groups and surveys, involve consumer insights, but also a delegation from the product side, from the more fundamental research side. So this actually comes together and you see the synergy taking effect, because you can steer on ‘we can this and this and this’, but how should we translate this to the consumer” (interview firm A). Where firm A points to idea generation which will then lead to more focused innovation, firm B points to idea testing: “If you come up with certain things and you let consumers test this, then this can obviously help” (interview firm B). Firm A also sees synergy possibilities in marketing/sales, because if consumers have already indicated their needs, the knowledge partners can research with more focus. Table 30 and 31 show the results of the interviews.

TABLE 30: INTERVIEW SUMMARY FIRM A

	Product development			***Production***	***Marketing/sales***		***Service/support***
	Idea generation	*Idea development*	*Idea testing*	*Finished at: sell to consumer*	*Customer as intermediate*	*Directly to consumer*	
Current consumer involvement level	Low			Low	Low	Low	Low
Forms	Passive data collection through field employees. Active data collection through external market research.			None	Passive data collection through field employees. Active data collection through external market research.	None	Passive data collection through customer service.
Consumer involvement possibilities	High	Low	High	Low	Medium	Low	Medium
Argumentation	Good knowledge of missing products through personal experience.	Incapable of imagining possibilities. Difficulties expressing themselves. Little market knowledge.	Good knowledge of success chance through use experience.	No need for consumer involvement, because a consumer need for this would be incorporated in the product design.	Marketing help needed by customers vary greatly. Success chance increases through better knowledge about consumer needs. Consumers can indicate preferences as long as they can imagine the outcome.	The firm misses a brand to market because of their private label branding.	Possibilities of developing interactive platform to obtain early insight in consumer needs and be ahead of competitors. Obstacle is unfamilliarity.
Synergy consumer and knowledge partner	High	None	None	None	Medium	None	None
Argumentation	Knowledge partner indicates technological opportunities and consumer market opportunities. Combining leads to more focused innovation.				Consumer indicates consumer needs and knowledge partner can research this need with more focus.		

TABLE 31: INTERVIEW SUMMARY FIRM B

	Product development			***Production***	***Marketing/sales***	***Service/support***	
	Idea generation	*Idea development*	*Idea testing*	*Finished at: transport to customer*		*Firm as intermediate*	*Consumer to consumer*
Current consumer involvement level	Medium	Low	High	Low	Low	Medium	Low
Forms	Ad hoc panel discussions.	None	New product testing on consumer sample. External market research consisting of surveys and interviews.	None	Ad hoc external market research, involving surveys and interviews. Passive data collection through customer service and field employees.	Tips and tricks are collected by field employees and shared through the firm.	None
Consumer involvement possibilities	High	Low	High	Low	Low	Medium	Low
Argumentation	Enables development of unique products to distinguish the firm from competitors and be a frontrunner. Consumers can reduce uncertainty about consumer needs.	Internal experts are the only ones who can decide which products the firm should develop and produce.	Consumers can reduce uncertainty about consumer needs.	Distinction between the firm and the retailer is important to keep as it is.; involving the consumer would cause competition between these two parties.	Obtainment of insight in consumer needs of marketing materials will reduce risks. Consumer involvement has high costs. Highly dependent on customer needs.	The current forms suit well.	Consumer to consumer involvement would be too expensive and not result in an increase in sales.
Synergy consumer and knowledge partner	None	None	Medium	None	None	None	None
Argumentation			Consumers can test technologies developed by knowledge partners.				

4.3.4. SUMMARY OF FINDINGS IN SMALL SURVEY AND INTERVIEWS

The analyses show that more than twice as many firms see an increasing trend in co-creation as opposed to firms that predict a stable trend, while no firms indicated a decreasing trend. This observation only becomes stronger when looking through the co-creation level perspective, indicating that firms more engaged in co-creation are more convinced of an increasing trend than those with lower engagement in co-creation. Both interviewees were also drastically changing their co-creation practices in the direction of more consumer involvement.

The analysis further shows that firms are driven to engage in co-creation by a need for an improved competitive advantage, more customer loyalty and to better understand new consumer needs. All these drivers focus on improving the relation with existing customers and not expanding market share or winning new customers. This shows that co-creation is mainly seen as a way to improve quality and improve the long term relation with customers. This observation is supported by looking at the drivers from the co-creation level perspective; the main drivers are stable in importance through firms that engage consumers in a lower depth and firms that engage consumers in high depth, while the drivers for more market share and more brand awareness drop in importance over these categories of firms. The interviews support this observation; both firms point towards customer-drivers for co-creation such as new customer needs and increasing customer power.

The analyses indicate that many firms see benefits, notice results and feel constraint to engage in co-creation. The most important benefit of co-creation is an output-benefit which strongly mirrors the co-creation drivers; co-creation is about increasing the fit between the firm's offerings and customers' needs. Other important benefits are from the consumer experience; firms think co-creation benefits, because consumers like the experience, showing off to peers and being part of their favorite brand. Constraints of co-creation are mostly of purely practical nature; firms do not feel the urgency of co-creation under the pressure of day-to-day business. Time pressure results in inadequate formal processes in place with too low skill, technology and leadership capabilities. Firms do not, however, feel constraint by unwillingness; both lower-level employees and customer are deemed very willing of engaging in co-creation. Also important is the type of product or firm; firms deeper in the value chain or with a typical commodity product feel constraint in engaging in co-creation. The survey analysis is not suitable to make observations about the exact types of products or firms that are more constraining for co-creation.

The actual results of co-creation are an increase in competitive advantage, mainly through new products, but also through increased market share and new customers. This is surprising, because these results are not what drove firms to engage in co-creation in the first place. Although increased competitive advantage was the ultimate goal, the lever for this was through customer commitment, not new markets and customers. In fact, customer retention and brand awareness scored, in this order, lowest of all potential co-creation results. This trend even becomes stronger with deeper forms of co-creation, confirming the discrepancy between results for new customers and results for existing customers. This mismatch between drivers and results indicates that firms do not get out of co-creation what they strive for. The actual results show that co-creation is leveraged to develop products and markets away from the current ones. The use of innovation antecedents also shows the same tradeoff. While firms are driven to engage in co-creation to use both market and operation innovation antecedents, the eventual results show only the leverage of the operation antecedents. Co-creation is meant to lead to both increased product quality and customer satisfaction, but only actually leads to new products.

4.4. RESEARCH QUESTION 3 – INTERNATIONAL POSITION OF DUTCH FIRMS

Table 32 and Figure 23 and 24 show the results of the analyses investigating the difference between Dutch firms and firms in other countries in respect to their innovation success, co-creation levels, number of functions involved and specific functions involved in co-creation. The overviews only show few differences; no significant differences between the means are observed, which means that Dutch firms are about equally successful in their innovations, are equally engaged in co-creation and engage an equal amount of functions as compared to the global mean. Since most of the respondents come from far developed countries, the respondents will have had the same general pressures to deal with. When zooming in on the specific functions involved, two differences can be observed. While the global mean is equal in their preference of functions to co-create in, the Dutch firms vary greatly. Dutch firms seem to prefer co-creating in marketing/sales instead of NPD or service/support. The other combinations score about the same and there is no big difference between Dutch firms and the global mean.

TABLE 32: RESULTS OF INDEPENDENT-SAMPLE T-TEST - GROUPING VARIABLE: COUNTRY (DUTCH; GLOBAL)

	t-test for equality of means	
	t	Sig. (2-tailed)
Innovation success percentage	0,432	0,666
Co-creation level	0,612	0,541
Number of functions involved	-1,541	0,124

Equal variances assumed

FIGURE 23: INNOVATION SUCCESS PERCENTAGE, CO-CREATION LEVEL AND NUMBER OF FUNCTIONS INVOLVED OF GLOBAL AND DUTCH FIRMS

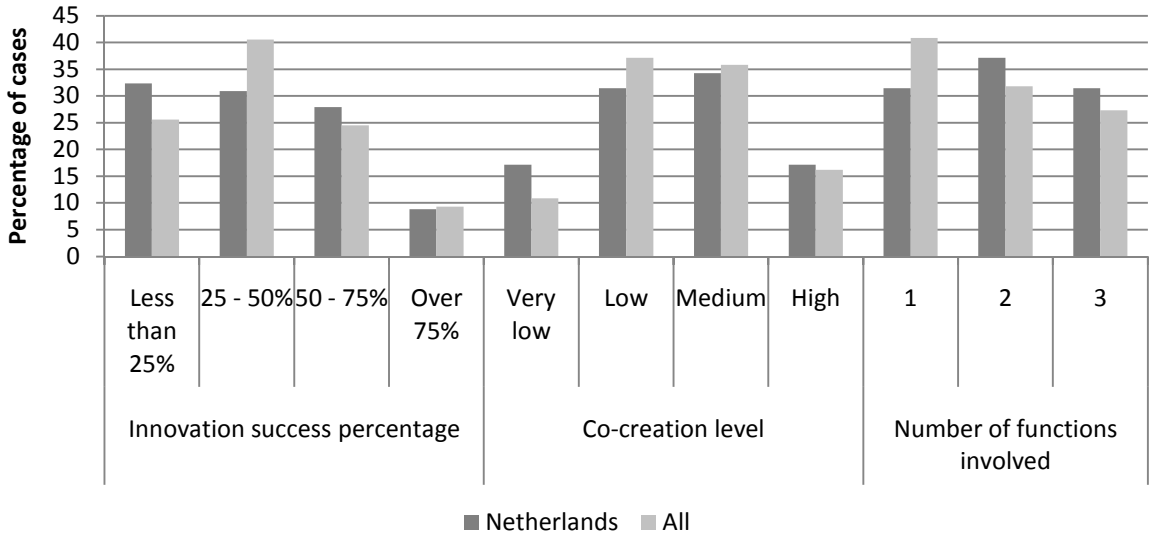
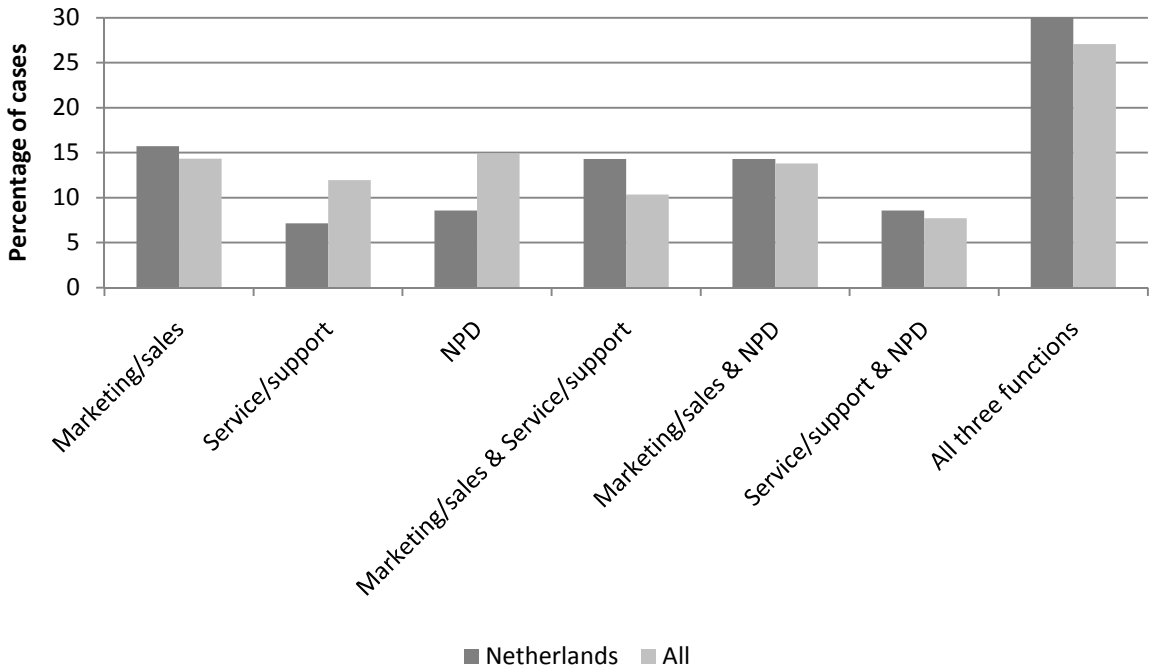


FIGURE 24: SPECIFIC FUNCTIONS INVOLVED OF GLOBAL AND DUTCH FIRMS



5. CONCLUSION AND DISCUSSION

The research began by suspecting that co-creation positively influences the success of innovations. Co-creation was subsequently theorized to have different levels of depth, depending on the extent in which consumers were engaged in qualitative, interactive, dialogue-oriented and informal interaction with the firm. These levels of co-creation were hypothesized to have interaction effects with the amount of organizational functions involved in the involvement of consumers. These questions were addressed using a research design combining GLM analysis with descriptive analysis of two survey sets and two interviews. This final chapter concludes the research and discusses the results by giving managerial and academic implications and suggests topics for future research based on the limitations of this one. The chapter starts with an overview of the main conclusions, followed by the managerial implications, the academic implications and finally the recommendations for future research

This research has as its central research question: To what extent has co-creation impact on firm performance through innovation success and what is the international position of Dutch firms in respect to co-creation and innovation success? To answer this question, the research first tested the relation between co-creation and innovation success. The research found that there is no main effect between these two concepts, but that the moderating effects of the number and type of organizational functions involved does make the relation between co-creation and innovation success significant. The direction of the effect depends on the exact configuration. In general and for an increased positive effect on innovation success, firms should combine low levels of co-creation with a higher number of involved functions and high levels of co-creation with few involved functions. Co-creation takes relatively equally place in the marketing/sales, service/support and product development functions of firms, while co-creation in the production and logistic organizational function is far less common.

Subsequently, the research identified mechanisms behind the relation between co-creation and innovation success. The research found that firms are highly engaged in co-creation and notice an increasing trend. Both firms and their customers are ready for co-creation, but firms do not have the time to set up the proper processes and capabilities. The main drivers are the identification of new needs and improvement of customer loyalty, while increasing markets share, customer base and brand awareness is less important. The research further finds that co-creation benefits innovation success through the development of new markets, products and new customers. This shows that while firms are motivated to engage in co-creation by better serving current customers and to leverage a wide range of innovation antecedents, co-creation eventually results in serving new customers mainly through operation innovation antecedents. Firms with more commodity type products or that are deeper in the value chain are more constraint in co-creation.

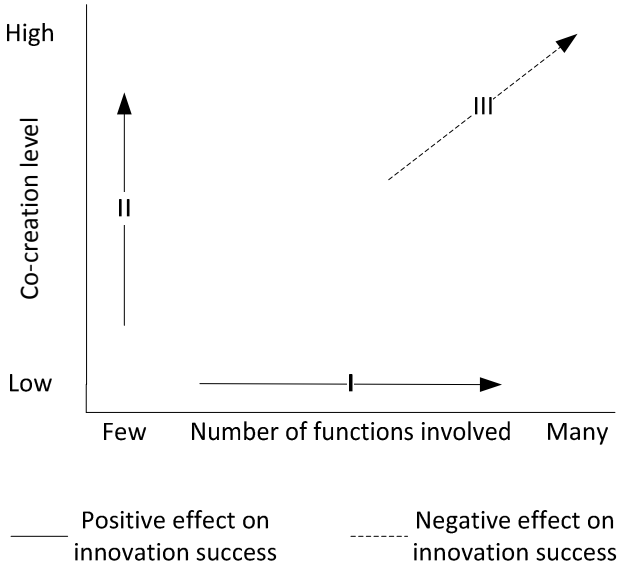
The research finally explored the international position of Dutch firms in respect to innovation success, co-creation level and number of functions involved in co-creation. The research found that there are no large differences between Dutch firms and foreign firms in either of these dimensions. The research did show that Dutch firms are less active in co-creation in the NPD and service/support functions of the firm in comparison with firms worldwide.

5.2. MANAGERIAL IMPLICATIONS

The main managerial implication is that managers should take into account their functional involvement when they engage in co-creation. The negative effect of situations wherein both co-creation level and the number of involved functions score high can be explained by manageability. A too complex system can well result in increased decision making complexity, time consumption, job pressures and tensions. Involving out-of-the-box thinking consumers in great depth while not being able to properly manage the process because too many people of different function are involved, can easily lead to the negative factors mentioned above. Balancing additional knowledge with increased project complexity is crucial for the success chances of innovations and the subsequent competitive advantage of the firm. Although firms do currently not experiencing great urgency to increase their co-creation engagement, the increasing co-creation trend indicates that the competitive advantage gained by current ways of co-creation will increasingly diminish. This will first happen in firms that have highly progressed offerings (non-commodity) and are close to the end-consumer. Firms that fit these conditions less will take more time till reaching the limits of the current forms of co-creation, because they can still leverage their offering's progression and consumer position. Firms should be aware that co-creation takes place in marketing/sales, service/support and NPD and should initially combine few involved functions with

high levels of co-creation or vice versa. Based on these co-creation configurations, firms can predict the success of their co-creation configuration or determine the needed co-creation resources to reach their goals. Industry, ownership or country is not a factor in the possibilities for co-creation. Although Dutch firms engage less in NPD and Service/support co-creation, the general international position of Dutch firms in respect to innovation and co-creation is equal to that of firms in the USA and other countries. This means that there are high interchange possibilities and that successful methods and practices developed in one country have a high chance of success in other countries as well. The following graph shows the co-creation configuration options and the rest of this paragraph will discuss these options in detail.

FIGURE 25: CO-CREATION DEVELOPMENT PATHS



The three paths shown above, profit from different innovation levers, which will be discussed in the next paragraphs. Firms that develop over path I shape the possibility for superficial consumer involvement in many business functions. These firms have partially customized their offerings, letting consumers co-create in all processes of the firm, but only in a simple manner. The firms keep most information and access internal, letting consumers only co-create on the aspects that they choose. A typical firm in this category is IKEA, which is letting consumers co-create in many business processes, but under strict control and with strict conditions. IKEA, for example, co-creates on logistics and assembly by letting consumers shop directly at the warehouse for assembly kits. Through 'My IKEA' and the 'Family card', consumers share their preferences and opinions, also letting consumers co-create on planning, product development and policy. Many firms fall into this category without knowing themselves. Consumer interaction and superficially involving them in business processes is in many industries very common. This form of co-creation lets firms keep their current business model, because the key challenges do not need to be addressed. Intellectual property is kept save and the added value of the co-creators is easily managed. The innovation lever used here is the expansion of markets and acquisition of new customers. By engaging involving many organizational functions, a firm is better capable of quickly developing offerings that the market needs, which will result in more successful new offerings.

Firms that develop over path II shape the possibility for deep consumer involvement in one specific business function. These firms have completely customized one small part of their offerings on which consumers can co-create their experience. For this part of their offering, these firms only create an environment and supply the tools and let consumers co-create their personalized experience. For the rest of their offerings, these firms are not transparent and are not in dialogue. A typical firm in this category is LEGO, which is letting consumers completely co-create in LEGO's Mindstorms, but is completely closed to consumers in all other aspects. The innovation lever used here is the improvement of customer relationships. By engaging customers very closely in an organizational function, customers feel more committed to LEGO, which will result in a longer life and higher revenue of the firm's innovations.

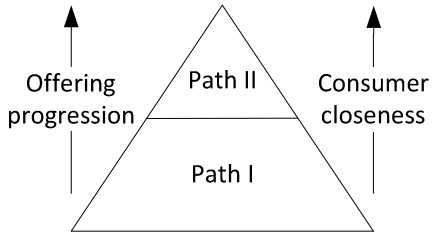
Firms that develop over path III shape the possibility for deep consumer involvement in all business processes. These firms have completely customized their offerings into co-creation experiences. The firms only set the

stage and supply the tools and let the consumers create their own personalized experience. A typical firm in this category is Linux, which is completely transparent, shares everything through full dialogue. The consequence is consumers who actively participate on all level with the development and distribution of co-creation environment in order to let more consumers co-create their personalized experience with Linux. Firms in this category are often small in size and non-profit. There are only very few firms that are in this co-creation category or are willing to change in order to reach this category, because of the high risks of such an endeavor. Completely sharing all information and granting access to consumers will considerably hamper the possibility of protecting intellectual property, police against rogue co-creators and defending against new entrants. As mentioned in the first part of this paragraph, engagement in this form of co-creation will result in manageability problems so large that firms entering this path will incur a negative effect on their innovation success.

Incorrectly choosing between the different paths is damaging to the firm. An example of a firm who first chose for expanding markets and acquiring new customers and subsequently changed its path to the improvement of customer relationships is Grolsch. In 2002, Grolsch developed more and more special beers with either lower amounts of alcohol or special (often sweet) flavors and even launched a different brand called Zinniz. The expected market share increase was not realized and already in 2003 the Zinniz brand was taken off the market, just like many of the other special beers. In 2008, Grolsch differentiated itself from other breweries with a special bottle for its standard beers. This was a success and greatly increased customer commitment to Grolsch. This example shows that specific development paths fit with specific kinds of firms. This research shows that the different in fit between the paths I and II lies in the progression of the firm's offerings and the closeness of the consumer to the firm.

The explanations of the development paths above and the example of Grolsch not only showed that firms can take different development paths and that there are more and less suitable choices, it also showed a maturation in the development paths. Path I is less risky and leads to lower potential benefits than path II. Risks do not only involve potential problems with intellectual property and financial and time investments, risks also include the fundamental altering of business models and firm strategy (in path II). The acquisition of new markets and customers is of lower benefit than the improvement of customer loyalty, because the second category is generally more valuable, rare, imperfectly imitable and has less strategically equivalent substitutes. This means that path I will lead to competitive advantage that cannot be sustained because competitors will imitate or come with equivalent substitutes, while path II leads to more sustainable competitive advantage. The example of Grolsch shows both the potential risks as the potential benefits in both paths. The newly developed special beers were easily imitated or substituted by competitors, while the new bottle creates lasting customer commitment. The newly developed special beers were developed outside the core business (premium beer) of Grolsch and less risky than the altering of the core business offerings of Grolsch as was the case with the new bottles. Since the research shows that path I leads to more innovation success than the other paths, it is recommended that firms engage in the lowest paths possible considering the progression of their offerings and closeness of their consumers, as is shown in the figure below.

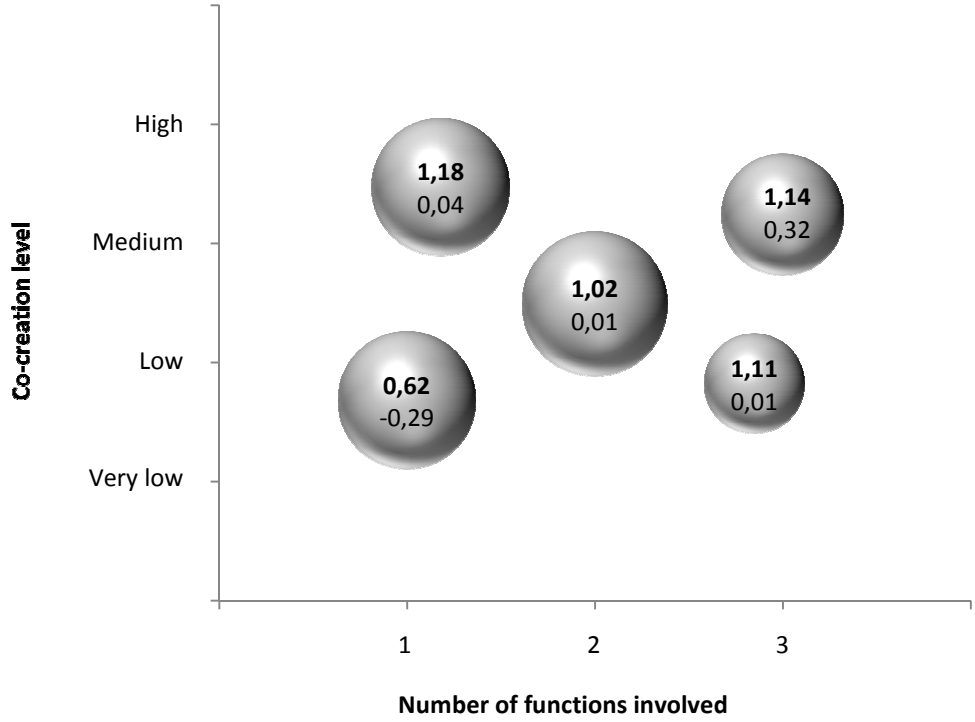
FIGURE 26: CO-CREATION DEVELOPMENT PATH HIERARCHY



A cluster analysis on the cases of the large survey of this research shows the position of groups of firms in the co-creation matrix presented earlier this paragraph. The size of the circles indicates the number of firms belonging to that cluster; the upper (bold) number is the average innovation success score (with a mean of 1) of that cluster and the lower number is the extent in which the firms have their organizational structure and culture organized to support innovation (with a mean of 0). This second number is important, because it is a strong predictor of innovation success. The high innovation success score of the cluster in the upper right, for

instance, is only so high, because that cluster also has their organizational structure and culture very well organized for innovation. The clusters in the bottom right and upper left score best with their relatively average innovation structure and culture score; these clusters represent path I and II respectively. The cluster analysis also shows that firms have a tendency to go to the middle, since this is the largest circle in the graph. These firms do not have the optimal position in terms of their innovation success; they can better make a choice between either following path I or path II. The worst choice position, however, is the bottom left cluster. Part of its low innovation success score can be explained by the low innovation structure and culture score, but not completely. These firms should both develop organize their structure and culture to better absorb innovation and start engaging in co-creation through either path I or path II.

FIGURE 27: RESULTS OF CLUSTER ANALYSIS ON LARGE SURVEY CASES



This research shows that there is much room for improvement. The cluster analysis shows that many firms are not making the optimal strategic choice in organizing organizational structure and culture for innovation and engaging in co-creation. The small survey shows that many firms feel constraint by a lack of skill to engage in co-creation. Both of these facets can be supported by consultants with expert knowledge in these areas. Depending on the progression of a firm's offerings and the closeness of the firm to its consumers, the optimal co-creation development path can be determined. Depending on the optimal path, a firm should either start developing a low level of co-creation in marketing/sales, service/support and NPD at the same time or engage in a high level of co-creation in one of these three organizational functions. There is no one single organizational function in which co-creation will work best; unfortunately, this research does not have the data to suggest the method with which this choice should be made.

5.3. ACADEMIC IMPLICATIONS

IMPLICATIONS FOR THE CO-CREATION CONCEPT

In 2004, Vargo and Lusch published an article in the Journal of Marketing (Vargo & Lusch, 2004) about a shift from a goods-dominant logic towards a service-dominant logic and formulated eight foundational premises for this new logic. This article caused a large academic debate and initiated commentaries (e.g. Bolton, 2004) and research on the premises (e.g. Payne, Storbacka, & Frow, 2008). Vargo and Lusch were even able to publish a book with dialogue, debate and directions about the S-D logic (Lusch & Vargo, 2006). This led to refinements and modifications of the foundational premises (Lusch & Vargo, 2006, 2008) and made it a more and more

accepted theory. The foundational premise most relevant to this research (FP6), 'the customer is always a co-producer' which has later been refined to 'the customer is always a co-creator of value' has been refined in such a way that it comes closer and closer to the way Prahalad and Ramaswamy (2004) developed the concept of experience co-creation. Vargo and Lusch later distinguished between co-creation of value (value-in-use) which is always happening and co-production which can happen in different extents. Both couples of authors now agree that the firm-customer relationship is not bilateral and that networks on both sides are always a factor. The difference is that Prahalad and Ramaswamy do not make a distinction between co-creation of value and co-production and go further in their co-creation concept; for Prahalad and Ramaswamy products and services are artifacts to the co-creation experience, whereas Vargo and Lusch see the service as the end-offering. Also, for Vargo and Lusch, the S-D logic is a matter of perspective (i.e. logic) and for that reason unconditional while Prahalad and Ramaswamy recognize a spectrum of co-creation experiences which have to be developed (Prahalad & Ramaswamy, 2004, p. 90).

This research can be used to reflect on both co-creation variants of foundational premise 6 of Vargo Lusch's S-D logic and the building blocks of Prahalad and Ramaswamy's experience co-creation. This research supports Vargo and Lusch's proposition that co-production can take place in different extents (Vargo & Lusch, 2008) and that more is not always better. Although repeatedly saying that the S-D logic is not only applicable to marketing, they do not indicate which other areas this can be. This research shows that co-production is most likely to take place in the organizational functions of marketing/sales, service/support and NPD. This research shows that the current managers do not support the notion that value is always co-created by customers in a unique combination of resources. Managers are heavily focused on physical products and are not ready for a paradigm shift. Vargo and Lusch do not indicate how this shift can be initiated and developed. Prahalad and Ramaswamy do present a path towards experience co-creation, which is supported by this research. Firms should first develop in the number of functions (Prahalad and Ramaswamy: expand DART building blocks and quality of interactions) and then increase the co-creation level (Prahalad and Ramaswamy: develop experience environment). Finally, this research suggests that firms should not act too quickly in their co-creation development, while both Vargo and Lusch and especially Prahalad and Ramaswamy do indicate that firms should start developing their co-creation activities as soon as possible.

IMPLICATIONS FOR THE OPEN INNOVATION MODEL

In his 2003 book 'Open Innovation', Chesbrough (2003) describes a shift from a closed to an open innovation paradigm. Since this time, many firms (e.g. Intel, IBM) have tried to adopt this new perspective on innovation success and academic research on the theme has greatly increased (e.g. Enkel, Gassmann, & Chesbrough, 2009; Dodgson, Gann, & Salter, 2006). Although the initial work (Chesbrough, 2003) mainly focused on the external knowledge contributions of academia, business ventures and competitors, later work of both Chesbrough (Chesbrough, Vanhaverbeke, & West, 2006) and other authors (e.g. Faems, Van Looy, & Debackere, 2005) refined this to include a range of parties, such as suppliers, customers, users, universities, research institutes and competitors. Several authors (e.g. Tsai, 2009; Tödtling, Lehner, & Kaufmann, 2009) point towards a relation between these types of alliance partners and types of innovation being affected and a positive effect of variety of these collaborations on innovation success. The importance of the absorptive capacity is always, sometimes implicitly, mentioned as having an important effect. This concept was first developed by Cohen and Levinthal (1990) and heavily used ever since (e.g. Lichtenthaler, 2009; Lane & Lubatkin, 1998). Zahra and George (2002) made a widely accepted reconceptualization in 2002, distinguishing between acquisition, assimilation, transformation and exploitation dimensions of absorptive capacity. The theory roughly states that these dimensions will improve the potential and realized absorptive capacity of firms, which subsequently improves competitive advantage.

This research can be used to reflect on the value of different collaboration partners and give direction to a beneficial variety of collaborations. This research shows that the involvement of knowledge partners such as universities and research institutes do not increase innovation success. This research also shows that the main effect of customer involvement does not improve innovation success and that this effect only becomes significantly positive when the negative moderation effect of the number of involved functions is included. The factors that mainly positively influence innovation success are part of the absorptive capacity of firms. This research found a very strong positive effect of exploitation absorptive capacity on innovation success, supporting proposition 4 of Zahra and George's (2002) paper. This research was not sufficiently able to test for the other absorptive capacity dimensions in order to formulate an implication for the absorptive capacity research stream. The non-significant effect of knowledge partner involvement, conditional effect of customer

involvement and very strong effect of exploitative absorptive capacity on innovation success challenge the urgency of firms to change to the open innovation paradigm. The improvement of the exploitative absorptive capacity of firms seems more valuable than the involvement of customers and much more valuable than the involvement of knowledge partners.

5.4. LIMITATIONS AND FUTURE RESEARCH

A first limitation of this research concerns the use of secondary analysis on survey data. The surveys used in this research were mostly designed and executed by consultants of Capgemini Consulting and are not fully adapted to the purposes of this research. Two important limitations result from this situation. Firstly, the variables measured are measured only qualitatively. This is especially the case for the dependent variable. This research uses two survey questions to score the responding firms on their innovation success. Both these questions are of qualitative nature and sensitive to the perspective of the particular manager who filled out the survey. Although the research controls for a number of factors that could lead to irrelevant variations in the dependent variable, a quantitative measure would have resulted in a higher reliability of the results. In future research, a mix of qualitative and quantitative measures for at least the dependent variable would be advisable. Secondly, the sampling method of the large survey is not completely known, making it difficult to determine the reliability of the observations. The large survey approached subscribers of HSM Americas, inc. and business contacts of Capgemini Consulting consultants. This second source consisted of a kind of snowball sampling, wherein involved consultants asked their colleagues to approach their contacts as well and so on. Because it is unknown who was selected to participate in the survey, it is impossible to determine whether there was a pattern between the response and non-response of the survey that could potentially explain the effects found in this research. Future research that applies sampling methods with higher reliability focusing at confirming the relations found in this research would, therefore, be helpful.

Although this research was able to measure the functions involved in the co-creation efforts of the participating firms, it was unable to measure the level of co-creation on the function-level. This research was also able to measure the level of co-creation in four categories, but a greater differentiation in co-creation forms might even better explain the variance in innovation success. This research indicates that it is very well possible that the effect of co-creation on innovation success can best be explained by these variations. Future research on a larger amount of co-creation levels on the function-level of firms might therefore be fruitful.

The surveys used for this research did not provide the opportunity to incorporate a potential time-delay of the effect of co-creation on innovation success. The research tests both variables on the same moment in time, while a time-delay between the effect of co-creation on innovation success seems to be likely. Although the assumption that co-creation and innovation success is measured in this research as an indicator of structural firm behavior is not unreasonable, it might be a too limited measure to fully grasp the effects of co-creation on innovation success. The addition of time-frames in future research will probably give valuable insights.

This research observed a gap between drivers of innovation and results for innovation, but was not able to empirically explain the reasons for this gap. The explanation seems to be in the amount of necessary urgency and skill associated with co-creation, but it is unclear in which situations this exactly has an influence on the effect of co-creation on innovation success and how this can be managed. Research on how motives for co-creation change while firms increase their co-creation level and the number of involved functions could greatly help understanding the value of co-creation.

The comparison the innovation success percentage, co-creation level and number of functions involved in co-creation between Dutch firms and firms in other countries showed no differences besides the considerably lower involvement of the NPD and service/support functions in the Netherlands. This research can, however, not empirically give an explanation for this. Future research on the international differences and similarities between co-creation activities may improve our understanding of the international value of different co-creation configurations.

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APPENDIX A: QUESTIONNAIRE

INTRODUCTION

- Goal of the research: Obtain insight in the effect of cooperation with consumers on innovation success.
- Goal of the interview: Obtain insight in the role of consumers in different firm processes in the context of innovation success.

BACKGROUND OF THE RESPONDENT

1. What is your function?
2. What is your role in innovation and consumer involvement?

Co-creation

3. What is the role of consumers in your firm?
4. What is the role of consumer knowledge in your firm?
5. What is the role of consumers in product development in your firm?
   - To what extent does your firm cooperate with consumers to come up with new ideas?
   - To what extent does your firm cooperate with consumers to further develop new ideas?
   - What are the most important factors for the success or failure of cooperation with consumers?
6. What is the role of consumers in production in your firm?
   - To what extent does your firm cooperate with consumers when adjusting individual products or services to consumer needs?
   - What are the most important factors for the success or failure of cooperation with consumers?
7. What is the role of consumers in marketing and sales in your firm?
   - To what extent does your firm cooperate with consumers when determining the market positioning of a new product or service?
   - To what extent does your firm cooperate with consumers when selling a new product or service?
   - What are the most important factors for the success or failure of cooperation with consumers?
8. What is the role of consumers in service and support in your firm?
   - To what extent does your firm cooperate with consumers during after-sales support to customers?
   - To what extent does your firm cooperate with consumers with the development of already sold products or services?
   - What are the most important factors for the success or failure of cooperation with consumers?
9. To what extent and in what way does your firm cooperate with knowledge partners?
   - What influence does this cooperation have on the cooperation with consumers in product development?
   - What influence does this cooperation have on the cooperation with consumers in production?
   - What influence does this cooperation have on the cooperation with consumers in marketing and sales?
   - What influence does this cooperation have on the cooperation with consumers in service and support?

APPENDIX B: INTERVIEW SUMMARIES

FIRM A

INTRODUCTION

The goal of the research is obtaining insight in the effect of cooperation with consumers on innovation success. The goal of the interview is obtaining insight in the role of consumers in different firm processes and with different knowledge partners in the context of innovation success. Data from the interviews is used in the research for the interpretation of the survey results.

BACKGROUND

The interviewee is a product manager in the Dutch part of the firm that mainly produces end-products (from here: the firm). The firm does not have any direct contact with the consumer and sells only through retailers. The retailer is considered to be the customer of the firm. The firm is active in de production of food. The interviewee is responsible for the interpretation of market needs for the product development function and the translation of product development ideas for the market.

INNOVATION

The innovation process takes place in a very flat organization. The interviewee is, together with the innovation manager, four product developers, the marketing manager and a trade marketer, responsible for the innovation within the firm.

CO-CREATION

Until recently, the firm involved consumers in two ways. Field employees gathered information about consumer needs and externally executed market research researched consumer needs. The market research focused both on product development and marketing and was executed on an ad hoc basis. Information from field employees and customer service was regularly shared with the rest of the firm. The firm is currently setting up a project in which consumers will be more actively involved through panels, discussions, focus groups, surveys etc. This project is the result of a need to be better informed about consumer needs.

The firm is dependent on the retailer for mass communication with consumers, the firm can independently interact with specific consumers. The consumer and the retailer have different needs. The firm would like to focus on the consumer, but feels forced to focus on the retailer, because the retailer has the direct contact with the consumer. The largest benefit of cooperating with consumers is to obtainment of more information about consumer needs. When consumer needs are better known and the firm can respond to this information effectively while taking the retailer's preferences into account, the firm will have guaranteed success. According to the firm, cooperating with consumers can be done independently of the product being produced; there will always be a sufficient number of consumers that are happy to cooperate with the producer of the product.

PRODUCT DEVELOPMENT

In the context of product development, the firm makes a difference between idea generation, idea development and idea testing. The firm thinks that consumers are well capable of adding value in idea generation and idea testing. Consumers should be involved in idea generation, because they can state from personal experience what is missing in the market. Consumers should be involved in idea testing, because this focuses on the actual use of products. In idea development, expert panels are best involved because of their knowledge of innovation paths and the market. Average consumers can only add little value here because they are not capable of imagining the possibilities. This is the case, because consumers have difficulties expressing themselves and have little market knowledge.

PRODUCTION

The firm does not cooperate with consumers in production. For the firm, the product is finished when it is sold to the consumer. The firm has this long perspective, because their field employees help the retailers on shop arrangement and other aspects.

MARKETING AND SALES

Product development and marketing is in the firm one function, which results in processes that lie very close together. The role of marketing depends on the retailer. Some retailers have very clear marketing preferences in their product development policy which the firm only needs to support with its marketing, while other retailers have this far less developed. In these cases, the firm can take a proactive role and determine large parts of product presentation and marketing. The firm and its retailers are mutually dependent, because the firm mainly produces private label products but is a large player as well. The firm does not cooperate with consumers in marketing and sales, because the firm has a preference to first start up cooperation with consumers in product development. Product development is given priority, because of practical reasons; the firm does not have the resources to develop consumer involvement in product development and marketing at the same time. In practice, marketing and sales will profit of consumer involvement in product development, because the departments lie very close together. A knowledge shortage of consumers would not be a limiting factor in cooperating with consumers in marketing and sales, as long as the consumer can imagine what the eventual marketing offering would look like. Increasing the success chance of new products would be the main advantage of involving consumers in marketing and sales; when the consumer need is known, the firm will be better able to address it.

SERVICE AND SUPPORT

Besides consumer feedback through customer service, the firm does not cooperate with consumers in service and support. The firm does see opportunities in the development of interactive platforms through which consumers can offer service and support to each other, but prefers to give priority to cooperating with consumers in product development. Product development is given here priority for the same reason as in marketing and sales; product development addresses the entire product range. An obstacle of involving consumers in service and support is the unfamiliarity with these kinds of cooperation. The main advantage would be obtaining early insight into consumer needs, which will enable the firm to be ahead of its competitors.

KNOWLEDGE PARTNERS

The firm cooperates very intensely with horizontal partners such as universities, research institutes and educational institutes. These partners mainly add to the fundamental research in future products and raw materials. The firm actively cooperates with these partners by, together with industry partners, cooperating with research programs. This improves both process and product development. The synergy effect of cooperating with knowledge partners and consumers is very clear to the firm. The knowledge partners can indicate technological opportunities and the consumers the market opportunities. Combining these perspectives will enable more focused innovations.

The firm also cooperates with knowledge partners in marketing. On an ad hoc basis, universities and market research firms are used to gain more insight in consumer needs. The synergy effect is here also very clear for the firm. Cooperating with consumers will enable better developed research needs, which can then be executed by research firms.

FIRM B

INTRODUCTION

The goal of the research is obtaining insight in the effect of cooperation with consumers on innovation success. The goal of the interview is obtaining insight in the role of consumers in different firm processes and with different knowledge partners in the context of innovation success. Data from the interviews is used in the research for the interpretation of the survey results.

BACKGROUND

The interviewee is responsible for the marketing of the Dutch part of the firm (from here: the firm). The interviewee is not directly responsible for the brand positioning of the brands of the firm, but does have knowledge about the approach of the different brands. The firm does not own production sites and outsources the production to several producers. The firm does not have any direct contact with the consumer, except through the service organization. The firm sells only via retailers. The retailers are seen as the customers of the firm and are divided into large retailers and family retailers. The firm is active in the delivery of large household equipment.

INNOVATION

Innovation happens in several ways at the firm. The firm has an own research facility, which researches, develops and tests new technologies and techniques. This results in designs for new products, which are subsequently produced somewhere in the world. The firm also tracks technologies and techniques at producers and in other industries and assesses whether those technologies and techniques can also be applied to their own products. Innovation is not just the development of new products for this firm, but also the communication with the customer and securing brand uniqueness. The partner concept of the firm enables cooperation with small family retailers on marketing and market research. Through this concept, the family retailers obtain scale advantages and the firm can improve their preferred supplier position.

The firm has shifted in their approach to innovation during the last few years. The firm no longer approaches innovation from 'why do we want to sell something', but from 'why do consumers want to buy something'. This shift has mainly been executed at the communications function and to a lesser extent at the product development function. The reason to start the shift has been an external research. The firm also notices a shift in the power position between the retailers and the consumers. Under influence of the internet and increasing price transparency, the power position has shifted in favor of the consumer.

CO-CREATION

The firm is highly dependent on the retailers for cooperation with consumers. The salesmen of retailers determine for about 80% the brand choice of consumers and consumers like to be led by salesmen in their brand choice. Almost all consumers have the same habits in buying products. Through the influence of the internet, the position of the consumer is starting to change. This will result in a better informed consumer and will change the roll of the salesman from someone who is selling something to someone who is helping a consumer to buy something.

To increase the brand attractiveness, the firm cooperates with retailers to improve the attractiveness of the offerings of the firm and to respond to societal trends. Direct cooperation with the consumer mainly takes place through the service organization of the firm. Consumer feedback is spread through the rest of the organization in this way.

PRODUCT DEVELOPMENT

In the context of product development, the firm makes a difference between idea generation, idea development and idea testing. In idea generation, the firm cooperates with consumers on ad hoc basis. Consumers are invited at the firm to discuss their needs. The firm does not cooperate with consumers in idea development. The firm intentionally works with the internal expertise only. In idea testing, the firm regularly cooperates with consumers. New products are tested on a small sample of consumers and external market research is performed with a focus on product orientation of consumers. The external market research consists of two phases; a survey is sent out first and a sample of consumers is subsequently interviewed.

In general, the firm is of the opinion that it should not let the consumer determine what the firm should produce. Considering big impact trends and letting consumers inspire you is good, but the internal expertise should determine what the firm develops and produces.

The firm applies this way of consumer cooperation with the goal to sell more products. Cooperating with consumers enables the firm to more effectively develop unique products with which the firm can distinguish it from competitors. Consumers are involved in product development when the firm is uncertain about the needs of specific groups of consumers. The largest advantages of cooperating with consumers in product development are to be a frontrunner with new products, the generation of new ideas and the testing of ideas.

PRODUCTION

Production is for the firm the manufacturing of the product up to logistics. Cooperating with consumers is not done and is not possible either. When the firm would interpret production as the process of manufacturing up to installation, the firm does not see any possibilities to cooperate with consumers either. The reason for this is the importance of a clear distinction between the firm and the retailers. The firm sees itself as a supplier of specific large domestic products. The consumer has the same perspective. Involving the consumer at production would cause competition between the firm and its customers, which would be undesirable.

MARKETING AND SALES

Consumers are involved with marketing on ad hoc basis through externally executed research. Surveys and interviews are used to obtain insight in the preferences and needs in the field of marketing materials. The same kind of research is also performed on retailers, but there is no research done in which the firm, its retailers and its consumers all partake in marketing. There is also no need for this, because of the high costs that would be associated with such an endeavor. Using the internal expertise is more effective. The advantage of cooperating with consumers would be to have more information about consumer needs. The firm cooperates with consumers in situations of increased risks and a need for more information.

SERVICE AND SUPPORT

Consumers are involved in service and support to develop tips and tricks. These are collected by field employees and shared with other consumers via the firm. Directly sharing tips and tricks between consumers would be much too expensive. The firm does not see a benefit from doing this either; there would be no increased sales as a result of this.

KNOWLEDGE PARTNERS

In the context of product development, the firm sees a synergy effect between the own research facility and cooperation with consumers, because this will result in a situations wherein consumers can test the technologies developed by the research facility. The firm does not see possible synergy effects in other areas.