THE EFFECT OF THE PRODUCT INNOVATION PROCESS IN NEW PRODUCT DEVELOPMENT WITH THE MODERATION EFFECT OF CUSTOMER PARTICIPATION IN THE FOOD INDUSTRY

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Abstract: New product development (NPD) success and product innovation have been a very important topic in management literature. New product development focuses on launching new products into the market, and product innovation is important for product growth and technological improvements. Over the last decades, new products have been launched to create a competitive advantage to companies and to satisfy customers' needs. However, new product development has been a challenge from new ideas to financial aspects. Despite constant searches for new products to satisfy customer needs, the low success in new product developments raises concerns and questions in companies. Companies invest a high amount of resources to develop new products and to improve their product innovation process. However, the constant lack of successful products that satisfy customers and solve customer problems have been the main issue. Many factors can affect new product development, such as the process of product innovation. The product innovation process is a key element for the success of new products. This study focuses on the effects of the product innovation process to successfully develop new products. Various indicators are used for new product development and the product innovation process to help increase the success of products. This research uses a specific population from the food industry, which was evaluated in a quantitative analysis format. A survey was adapted from past studies for the analysis. The results show that there is an important correlation between the production innovation process and new product development success. The regression analysis shows that the production innovation process and open product innovation is positively associated with new product development success. Substantively, this research builds on the growing stream of new product development and product innovation process literature. While previous research has shown that product innovation is an important outcome of NPD, this study explicated the different types of innovation processes on new product development success. Thus, this research extends the literature by showing that there is an extra benefit when the product innovation process meets NPD success.

TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

CHAPTER I

INTRODUCTION

For over 60 years, new product development success and product innovation have functioned as important topics in the management literature. The new product development concept focuses on the importance of launching new successful products into the market, and product innovation is an important factor for technological improvements and product growth. Companies have been introducing new products to increase competitive advantage through a market in constant evolution and satisfying customers' needs. Also, according to Schumpeter (1942), product innovation is studied in different areas such as marketing and management, producing as a consequence a critical key for company growth and success, which develops an added value and competitive advantage (Zahra & Covin, 1994).

Currently, companies are trying to develop new products with product innovation to satisfy customers' needs. Historically, many companies have been very successful in complying with customers' needs and demands. As a result, new product development and product innovation process have targeted customer needs. Many successful companies have gained their current positions and success due to new product development (Cooper, 1993). For example, in the 1980s, companies like Honda and

Toyota developed new products that managed to gain market share and enhance market trends to a greater degree than competing automobile manufacturers; in many ways, they did so by actually exceeding customer needs (Birou & Fawcett, 1994). These companies developed new and innovative products that fulfilled customers' expectations and provided an advantage against competitors. However, many companies suffered from constant failure in their attempts to satisfy customers. These types of companies did not reach success with their new products, thereby resulting in the ultimate failure of new product development.

Background of the Study

Recently, new product development (NPD) has increased as companies identify the importance of having a successful product in the market. However, the development of new products has been a challenging task, from new ideas to financial aspects. For example, according to Robert Adams (2007) and the Product Development and Management Association (PDMA, 2012), new products fail at a rate of approximately 65% and demonstrate an efficiency rate around merely 35%. It is important to mention that this statistic remained constant over the last 30 years. However, in more recent years, the new product failure rate is approaching 90% (Burkitt & Bruno, 2010) if leading market companies are taken into account.

Further, Adams (2010, p. 2) indicates that the 65% new product failure rate is associated with big companies, while the meaningfully higher 90% rate of new product failure is associated with new product development occurring at new companies. The increased failure rate of 90% in new companies refers to all instances of new product development, including apparent development efforts that involve nothing more than a mere product concept. Such a high failure rate is common to virtually every type of company and creates an atmosphere of

uncertainty and chaos. To elaborate, the following example involves the 2007 development and launch of Microsoft Vista. Microsoft is recognized as a top company that has been successful in many new products. However, Microsoft did not reach product expectations with its Microsoft Vista software. Microsoft reported that the Vista program was purportedly the most advanced and easiest user interface software, as well as the safest software that Microsoft had ever devised. However, the software was less efficient than the ones preceding it; and the unexpected results failed to meet the high expectations. As such, Microsoft's launch of this software prompted a drastic decline in quarterly revenue. Paliy (2012) investigated the $500 million marketing campaign that Microsoft had pursued with expectations of high returns and high customer usage. Ultimately, the results were never met, and the development of the new Vista software product represented a significant failure for Microsoft.

Despite constant searches for solutions to this problem, companies continue to develop new products that fail, showing that new product development is a risky business and a challenging adventure. Taking this into consideration, companies invest many resources often without achieving positive results; therefore, the pressure for return on investment increases. New product development success is not an easy task, and not many companies are willing to sacrifice a huge amount of resources for the ultimate goal.

New product development success (NPDS) refers to the process of generating new products aimed to launch into the market with customer acceptance. Success is the ultimate goal in the financial and performance aspects of a new product (Kahn, 2004). NPDS can have different meanings, depending on the context and industry. The success of new product developments can vary depending on the focus of the company. NPDS is composed of four

important characteristics: financial, customer, performance, and company success (Kahn, 2004, p. 610). According to Yli-Renko and Janakiraman (2008), new product developments are all the new tangible goods, technologies, and services that a company has developed. Success in new products helps companies to create a competitive advantage, opens new markets, and provides new revenues and profits (Chandy & Tellis, 1998; Chen, 2009; Cooper, 1993; Sheng, Zhou, & Lessassy, 2012; Wiklund & Shepherd, 2003).

Thus, NPDS plays a very important role inside companies for many reasons, such as focusing their success and growth to new products and targeting these new products to help satisfy customer demands. In past studies, companies agreed that success in a new product comes from the initial stages of the process. If the basis of the development is not strong enough for success, the product will not reach the market. According to Lagrosen (2005), to have success with a new product development, the company should know the importance of having an understanding of customers' needs and wants. Also, it is important to mention that in the last two decades, studies show that NPDS can be measured through different metrics. Many studies have been conducted to find the correct set of metrics to evaluate and analyze new product developments.

In this research, the metrics used for the analysis go from company growth to customer satisfaction. In reviewing the literature, seven success metrics are found that provide an overview of new product development. According to the Product Development and Management Association's handbook of new product development, success is defined as "a product that meets its goals and performance expectations" (Kahn, 2004, p. 610). In this research, the seven metrics are described, analyzed, and implemented for analysis. The seven metrics include several new products, the difference between new products and sales, the

number of new products in the making, revenue, sales growth, customer satisfaction, and product performance.

While new product development is a key component for company success, product innovation (PI) may also be a critical factor for achieving success with new products. Hauser, Tellis, and Griffin (2006, p. 687) point out that "innovation, the process of bringing new product and services to market, is one of the most important issues in business research today." Product innovation is the "degree of perceived newness, novelty, originality or uniqueness of a product" (Henard & Szymanski, 2001, p. 362). Companies that have succeeded in the market have a successful product innovation process and program (Cooper, Edgett, & Kleinschmidt, 2004a, 2004b; O'Connor, 2006). Hauser et al. (2006, p. 688) mention that "successful innovation rest first on understanding customer needs and then developing products that meet those needs." Companies that have an established product innovation program and process can create and maintain a competitive advantage in the market (Adams, Bessant, & Phelps, 2006). If the innovation is done correctly, companies can gain a competitive advantage in the market (Adams et al., 2006).

The purpose of the product innovation process is to change or modify the process of a new product to increase success (Ettlie & Reza, 1992) and obtain competitive advantage (Martinez Lorente, Dewhurst, & Dale, 1999). According to Lau, Tang, and Yam (2010), innovation is not only a new product or service, but can also be an old process or service that has been updated to have a benefit. Therefore, if a company complies and successfully changes the product innovation process for a better one, the new product may have better opportunities to satisfy the customers' needs and increase competitive advantage. For example, many of the changes in the process, such as the selection of new ideas and ways to

test the upcoming products, can increase success. The way of gathering ideas can be crucial in the product innovation process. There are two types of resources for collecting ideas—internal or external sources. An internal source is also called a closed innovation process in which a company gathers information and ideas for new product development from their own departments. An external source is also called an open innovation process, in which a company uses new ideas that come from external sources besides the company itself. In this case, closed and open product innovation plays a critical factor in the product innovation process. These resource types are used in this research as an important part of the construct to understand the effects of the product innovation process in new product development success.

Customer participation (CP) could be a key factor in the success of new products. However, there has been a debate in some studies where the customers have shown that they could improve the products (Al-zu'bi & Tsinopoulos, 2012; Mahr, Lievens, & Blazevic, 2014); in contrast, there are other studies that show that customers do not have an effect or impact on new product development (Menguc, Auh, & Yannopoulos, 2014; Ordanini & Parasuraman, 2011). There have been a lot of inconsistent and mixed opinions on the findings. Therefore, it has been recommended that researchers find a better understanding of customer participation.

Customer participation is defined as the collaboration of customers in new product development by creating new ideas to solve customer needs, new characteristics for new products, and working in conjunction with companies as developers (Fang, 2008; Hoyer, Chandy, Dorotic, Krafft, & Singh, 2010; Prahalad & Ramaswamy, 2004). According to Fang (2008), customer participation refers to an instance in which a customer contributes to a

firm's development of a new product. A customer can thus be defined as a person or business that purchases or receives goods, services, products, or even ideas from a seller or vendor (Kendall, 2007; Reizenstein, 2004). A customer can furnish a company with the information necessary for successful development of a new product by providing feedback that identifies potential solutions to problems that are representative of those experienced by typical customers in their daily lives (Gruner & Homburg, 2000; Kaulio, 1998; von Hippel, 1986). Many benefits can be brought to a company when customers are involved in the development of new products.

However, the needs of customers are increasing each time there are technology improvements, and companies are under more pressure to develop products that satisfy these needs (Westland, 2008). Customer participation can help in developing a competitive advantage by trying to satisfy customer needs. Customers can participate in new product development as contributors of new ideas and problem solving. For example, Ducati Motor relied on the customers to participate with a team of NPD professionals on the development of a new bike (Sawhney, Verona, & Prandelli, 2005). In effect, a key factor in customer participation can be the lead users. This type of user may provide a deeper knowledge of customer needs. The aid of lead users in developing new products successfully is of great importance to companies and for the future of new products. As such, customer participation is regarded as a resource that is ideally positioned to assist a firm with NPD to ascertain appropriate solutions to problems as described by customers. According to von Hippel (1988), when customers explicitly state their demands and problems about a product, they become essential to the informational database that NPD requires. Customers who participate in NPD become of great importance for the process and success of the new product.

Therefore, customer participation can increase knowledge in management literature between new product development and the product innovation process. In this research, customer participation is used to analyze the relationship between the two main constructs. Customer participation function as a moderator.

Problem Statement

The development of new products is a critical activity for company success. The percentage of new product development success has been as low as 25% (Evanschitzky, Eisend, Calantone, & Jiang, 2012). Companies are prioritizing new product failures as a major problem. The constant failure of new products means that there is an absence of any meaningful understanding of what customers actually want; the problem is that companies fail to account for the inherent value of customer's daily problems. For example, the failure of Corning's optical fiber NPD in the 2000s was due to a lack of understanding of customer needs (McGregor, Symonds, & Foust, 2006). This is a clear example in which Füller and Matzler (2007) are correct when listening to customer input can create a problem because sometimes customers have difficulty expressing their ideas and needs.

On the other hand, successful products tend to be unique or have attributes that customers need and provide a competitive advantage for a company. The problem of the low success of new products raises many concerns by showing that "developing successful new products and services is the lifeblood of today's acknowledged industry leaders" (Dorval & Lauer, 2004, p. 269). Companies that invest resources in developing new products can become frustrated in their search for innovative products. New products that are innovative create a competitive advantage (Porter, 1998). A large number of dollars are invested in new product development, so the pressure for a return on the investment increases (Bhuiyan, 2011).

Companies such as Ford and McDonalds have lost millions in failed products such as Edsel and the Arch Deluxe burger (Gilbert, 2018). Companies have issues in staying competitive through new products. Taking this into consideration, the resources used to satisfy customers and develop an advantage in the market are very high and expensive. New products fail for many reasons, but mainly because they do not meet customer needs. Despite many failing efforts to develop successful new products, companies are increasing research with customers to improve their success.

This kind of problem develops into a bigger concern when companies pursue NPD without attempting to generate a reliable index of customer needs; the result of failing to measure such demands is the development of a product that either fails to resolve a given customer problem or exacerbates customer complaints by furnishing an entirely new problem. For example, Google Glass represents one of the biggest product failures in the last several years (Doyle, 2016). Google developed this product to facilitate customer visualization, thereby promoting a better life via advancing further into the virtual world. According to Doyle (2016), this product was initially regarded as a breakthrough product innovation. However, it failed to satisfy customer needs, and the product lost the focus it would have required for success. This product might have provided short-term satisfaction to customers and acceptable sales, but the performance complications and lack of design yielded a failed effort to develop a new product. In this instance, the product created more problems than solutions. This exemplifies an instance where a company's failure to sufficiently attend to customer needs and increase competitive advantage resulted in consequent product failure. The understanding of customer needs and new product attributes are very important to new product development success (Cristiano, Liker, & White, 2000;

Hamilton, 2002). It also provides a clear example of a company's dynamic struggle to modify innovation processes and integrate customer participation in the development of a new product.

Further, the main problem is the constant lack of successful products in companies that satisfy customers and solve customer problems. In 2003, the American Productivity and Quality Center (APQC) showed that new products provide around 27% of company sales (Kahn, 2004). However, companies have a hard time keeping up with new developments and customer demands. To avoid failure, companies need to improve processes such as product innovation plus find a way of thinking that helps in developing new knowledge. Investment in different resources can be risky and costly, and the success of new products is not guaranteed (Ragatz, Handfield, & Petersen, 2002). This remarkably consistent pattern of failure is the reality for the majority of companies involved in developing new products.

According to Crawford (1997) and Cooper (2001), most new products never even make it to the market and those that do fail at rates ranging from 25% to 45%. For example, among seven new product ideas, only four enjoy success in the development stage, only two succeed in the launching stage, and only a single product enjoys actual market success (Booz, Allen, & Hamilton, 1982). Many new products are developed without any specific target and without even developing anything new. It follows that many organizations squander vast resources on efforts to encourage the success of new products and development teams, but they spend considerable resources on developing products that do not represent any actual breakthrough or advancement. The high amount of resources that are spent in NPD—an estimated 46% of the resources—are used in products that are canceled or do not have an optimal financial return (Bhuiyan, 2011). As statistics indicate, this is a constant problem for

many organizations, particularly those demonstrating a reduced usage of research and development centers, an inadequate budget for NPD, and no actual product innovation.

Von Hippel (1988) proposed that companies should research different types of product innovation sources such as the external source. There are two types of product innovation process sources: internal and external. There could be many benefits of using an external source, such as understanding customer needs, reducing the cost of development, and new product development success. However, the external source is not always the best answer to the problem. For example, according to Enkel, Kausche, and Gassmann (2005), SIG, a packing solution company, had an unsuccessful experience with external sources. This company joined forces with a customer at the early stage of the innovation process for the development of a new product. After developing the idea and concept together, the customer took advantage of the situation and went with a competitor and marketed the final product. This is a clear example that the customer does not always provide a better solution and advantage. A company needs to consider various factors when using this type of source. For example, companies need to identify the ideal users and the contribution of customer participation in the process. The identification of the ideal user could help to improve the product innovation process (Enkel et al., 2005). However, using the wrong type of user can develop a failure in the process and a lack of understanding of customers' needs (Enkel et al., 2005).

For example, in 2003, the car industry changed due to the Scion car brand. Toyota was looking to develop a new car model with a clear concept to attract new and young customers. Toyota had a vision of developing a new car concept in which customers would act as part of the developing process. Toyota's president's vision was to have a car that could be mass-

customized to customer specifications before delivery. After several models, Scion was in the path of success, and many players in the auto industry followed Toyota's idea. However, after a couple of years, the market changed and customers needed a different car due to various needs and wants. In 2017, Toyota decided that Scion was no longer a sustainable business, so they closed its operations. This was a clear example of a company supporting customers at the fullest, but the end result was different. Also, companies need to know when to use external or internal innovation processes because that decision can lead to failure. Studies show that using external sourcing in the early stages of new product development can increase the quality of the innovation (Gruner & Homburg, 2000; Handfield, Ragatz, Petersen, & Monczka, 1999; Petersen, Handfield, & Ragatz, 2005).

The information provided in this section shows the importance of the product innovation process for new product development success; that is why more research is needed. This study addresses the gap in research on the product innovation process in new product development success. Taking a process view, this study focuses on the role of the product innovation (PI) process in the improvement of new product development success (NPDS). Other studies have focused on NPDS and their metrics of measuring success.

As mentioned above, the problem is very clear for many companies. It does not matter whether the company is a large corporation or a startup company. However, companies continue to deliver unsuccessful products and risk investment when a new product is developed. As the investment of resources to this activity increases, the pressure for fast and positive returns increases. Statistics show that the problem of high NPD failure is constant. Thus companies are looking for successful and cost-effective new products. The challenge is to develop new products that satisfy customers and improve the product innovation process.

This study focused on seven success metrics gathered across the literature and provides a set of solutions to this problem. Also, many companies use a variety of factors (different types of product innovation processes and customer participation) to solve these problems that I use for analysis. Accordingly, there is a need for more research on new product development success and the product innovation process.

Purpose of the Study

The purpose of this study is to analyze the effect of product innovation processes in the success of new product developments. By investigating these factors, I hope to help increase success and find ways that companies can increase their competitive advantage through innovation and provide solutions to customer needs. Also, success factors play an important role in this study because they can show the attributes and characteristics of the development of successful new products that satisfy customers. The focus of this research is to develop a theoretical model and framework that companies can rely on for new product development. This study also describes the importance of relying on customer participation to determine new product development processes. The focus of the study is to find new product development success throughout customer participation as a moderator factor.

Research Question

How can companies increase new product development success through the product innovation process? For example, the product innovation process was crucial for the successful development of Google Glasses, but Google technologists failed to incorporate the potentially huge asset represented by customer input and market necessity. In this case, receiving a critique and corrective feedback during the product development cycle and product innovation process would have facilitated efforts to decrease the high rate of product

failure. Many companies confront the challenge of accurately identifying customer needs and fail to produce a successful new product.

Significance of the Study

According to Cooper, Edgett, and Kleinschmidt (2004a), more than 40% of projects that entered into the development stage failed to meet any company financial and market goals. To mitigate constant failure, companies focus on different types of strategies in marketing, operations, and R&D to increase the success rate (Dursun-Kilic, 2005). This study focuses on a different type of analysis and areas of new product development: success metrics, innovation processes, and customer participation. New product development success and the product innovation process are highly important to management, marketing, economics, and entrepreneurship.

The new product development literature has identified and analyzed different success factors, but companies have not fully applied these to their daily operations. This study includes a combination of new product success factors and product innovation processes that have not been previously analyzed. Also, the moderation factor of customer participation provides a new analysis. The combination of the constructs and the moderation factor presents new tools to increase success and solutions.

Contribution of the Study

In this research, I intend to expand new product development success and the product innovation process literature in different ways. I try to test a relationship between the different variables and find a possible solution to a constant problem. However, there is still much work to do by companies looking to develop successful products. This study provides new knowledge in many ways. First, the study shows the effect of product innovation

processes in new product development success. This relationship is important because companies and managers need to know the reason for the low success of new products. The objective of this study was to evaluate and analyze new product development to reduce the rate of failure and amplify the chances for success. Developing this success will help companies to better distribute resources across the organization and increase their competitive advantage in the market. This study is a building step for understanding how new products fail and which measures to use to analyze product failure.

Second, this research aids companies and managers to help increase their new product development success. Companies and managers can attain a better understanding of customer needs and the extent to which such input can facilitate successful new product development. Companies will also understand that product innovation and customer participation can create a competitive advantage in the marketplace and help new products succeed. One of the top benefits of this study for companies consists of explaining how to analyze the NPDS and how to make better use of company resources. Companies are hungry for enhanced knowledge about what customers want and need in order to increase their ability to develop products that may resolve daily problems that customers experience. Ultimately, companies in various industries can capitalize on the benefits to be derived from this research.

Third, this study shows the influence, either negative or positive, of customer participation in the development of new products. It shows the importance of lead users in the analysis of customer needs and a possible solution to reduce new product failure. Customer participation may help to increase the connection between the customer and the company. The goal of understanding customer needs can be accomplished with the correct

usage of a lead user and the involvement of customers in the new product development process.

Organization of the Study

This research is presented in six chapters. Chapter I provides an introduction to the study in which the constructs are presented and briefly explained. It introduces the problem that this research has identified in the literature review and explains the contribution of this research to the literature and practitioners. Chapter II presents a review of the literature and provides a complete analysis of new product development success, the product innovation process, and customer participation. The research constructs are explained and described. For example, Chapter II describes the new product development process and past success stories, product innovation process attributes and characteristics, and the customer participation description with its applications. Chapter III discusses the theoretical framework and hypothesis of this research. The theory behind the research is fully explained, and the relationships among the constructs are analyzed. Chapter IV is the methods and design section. It explains the methodology and measures used in this study. I provide a full description of the data sample and the analyzed population, the items and measures used to evaluate the constructs and moderators, and validation of the study. Chapter V explains the results of the survey, descriptive statistics, regression analysis, and hypothesis testing. Chapter VI explains the conclusions of the hypothesis testing and final results from the analysis, the limitations of the study, and possible future directions.

CHAPTER II

LITERATURE REVIEW

This section presents the necessary information to define my model and a literature review based on past studies. In this chapter, the different constructs in this study and the theoretical background of each of those constructs are explained.

First, the importance and definition of a new product and new product development are discussed. It starts with a definition and explains the stages of the new product development process (NPDS). Also, I provide an overview of NPDS and key metrics to measure the success of new products. Loch (2000) states that one measure does not fit all companies to determine success. Second, I analyze innovation and the key aspects of innovation to reach NPDS. In the innovation section, I explain the different types of innovations that are in a company and market. Also, the different product innovation process (PIP) characteristics are analyzed and described in this section. Open and closed innovation, such as advantages and disadvantages, are part of this analysis. Third, I explain customer participation, differences between open innovation, and the different types of customers a company can pursue for feedback. In the description of customer participation, I emphasize the lead user as an influencer.

New Product Development Definition and Process

In every company, new product development (NPD) is a critical attribute and key element for success. NPD success can be defined in many ways depending on the product type and industry. This section provides a review and definition of NPDS and a review of the different metrics that create and define success in NPD.

There are several definitions of "new product" in the literature: a product that has not been produced before, a product new to the market, or a product that has been launched to a new market. Booz, Allen, and Hamilton (1982) were the first researchers to define new products. In a survey of 700 U.S. companies, they found that a new product was determined by six aspects. First, only 10% of new products were defined as "new-to-the-world products." Second, 20% of new products were considered new to new markets. (A product that is introduced for the first time is called a "new product line.") Third, 52% of new product introductions were extensions of existing products. Fourth, a product that had been introduced to a new market was called "repositioning" and accounted for only 7% of new products. Fifth, a product that had been created in a cheaper version was called "cost reduction" and represented 11% of new products. All of these definitions have been followed by researchers in different contexts.

For example, Fuller (1994) provides a definition of a new product that is very similar to the previous authors. For this author, new products are categorized in different aspects such as an extension of an existing product, the repositioning of a product in a new market, or an upgrade of the existing products. Overall, different authors use similar concepts of new product definitions and apply them to their research. In different studies, NPD has been established as an important asset to companies to develop a competitive advantage as well a

positive impact on sales and revenue (Ayers, Dahlstrom, & Skinner, 1997; Chen, Damanpour, & Reilly, 2010; Cooper, 2001; Hamilton, 1968; Ziger & Maidique, 1990).

*Stages of the NPD Process***.** A new product development (NPD) represents a very complex intrafirm enterprise that has an enormously significant influence on the company as a whole (Clark & Wheelwright, 1995). NPD refers to the process of generating a new product aimed for launch into the market. A new product goes through different stages before hitting the market. The NPD process contains many challenges and risks. Researchers have found that a company that has an established and proven NPD process can reduce the risks and challenges. Many NPD process models have been developed over the years, but the best model is the Booz, Allen, and Hamilton (1982) model. The first NPD model was introduced by Booz, Allen, and Hamilton (BAH) in 1969 and has been updated and modified into better versions. The BAH model can be seen in Figure 1. The NPD stages include new product strategy, idea generation, evaluation, business analysis, development, testing, and market launch (Booz et al., 1982).

The new product strategy stage is when company objectives are aligned with the purpose of the new product. In this stage, companies set long- and short-term goals, so their new product strategy is aligned and serves as a guide for the NPD (Wind, 1982). The critical factor of this stage is to clearly communicate the strategy to the organization and the developers, which is fundamental for new product success. According to Cooper and Kleinschmidt (1995), companies that transmit the new product strategy to their employees have a 32% chance of success in NPD, a 42% chance of meeting sales goals, and a 39% chance of making a profit.

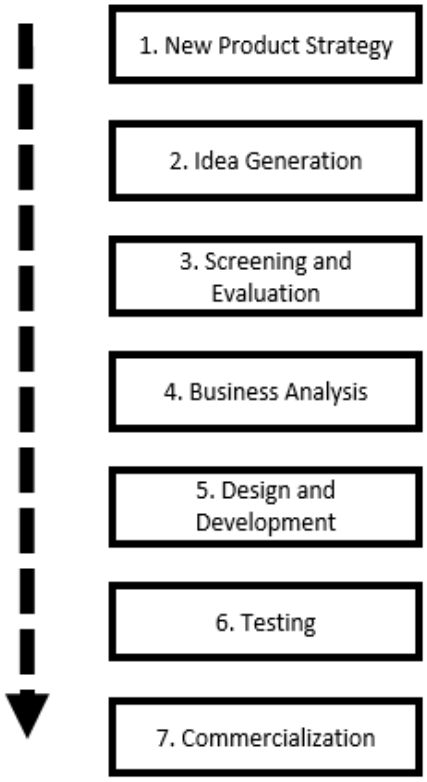

Figure 1. Stages of New Product Development (Booz, Allen, & Hamilton, 1982).

The idea generation stage is when the brainstorming of different idea types comes into play. In this stage, the company looks for ideas that can be translated into successful products. According to Booz and colleagues (1982), the company needs to develop at least seven ideas in order to have an opportunity for one successful idea. According to Crawford (1997), companies need to gather ideas from different sources, any source that can suggest a potentially successful product. In any company, there are different sources from which to gather ideas, both internal and external. Internal sources are all the personnel inside the company: employees, engineers, and managers. External sources are individuals outside the company: customers, suppliers, and distributors. According to Souder (1987), the most common sources that create successful products are customers and marketers. Souder (1987)

also point out that external sources may develop more successful products than internal sources. Idea generation can be measured with different outputs, such as the number of new ideas and the number of ideas in a specific period. Cooper (1999) mentions that an idea can be generated through focus groups, interviews, reviews, and lead users.

The evaluation of the project stage is when the ideas are deeply analyzed to see whether they have a possibility of success. In this stage, the selection of ideas from the previous stage becomes critical. According to Booz et al. (1982), as time passes, the cost of development increases in every stage. This stage is critical because new ideas need to be aligned with company objectives and visions. According to Cooper (1999), an incorrect analysis can result in a high failure percentage.

The business analysis stage is when the ideas of NPD are analyzed from an economic and financial aspect. Rosenau, Griffin, Castellion, and Anschuetz (1996) state that many companies do not perform the right type of analysis and jump from one stage to another with a negative result. Companies spend, on average, 7% on project funding and 16% on analyzing the financial aspect, which creates a lack of understanding and product failure (Cooper, 1999). Business analysis can be measured with financial and economic models for the NPD such as net present value (NPV), internal rate of return (IRR), and profitability index.

The development stage is when the ideas change from the state of a possible product to a product to be manufactured. This is the stage where a company starts to develop a prototype for development. According to Cooper (1999), 40% of the total time in NPD is done in this stage. This stage functions as the development of an idea to satisfy customer needs into a prototype and a final design capable of commercialization. Customer feedback and input is

very important at this stage because it will show whether the prototype is on the right path and will target what customers are looking for. The time to develop a product can vary and can change if a similar product is in the market or customers' needs change. As a tool, customer feedback plays a very important role in this development stage.

In the testing stage, the idea has become a product that is ready to be used by a select group of customers for their initial feedback. According to Cooper and Kleinschmidt (1987), this stage is when there is a total validation of the project, the production schedule is determined, and a marketing campaign becomes a priority. The development and testing stages have a very close relationship because they will determine whether the product has a chance of success. According to Urban and Hauser (1993), this stage can show the negative aspects of the product before the launching stage. However, a company should not wait to test the product until this stage; testing should be during the whole process (Ulrich & Eppinger, 2011). Customer acceptance is a very important indicator in this stage because it will show interest level, possible purchasing, positive and negative aspects of the product, and functionality to the customer.

Finally, the market launch stage is when the new product is placed in the market for general customers. Different marketing campaigns are performed depending on the function of the new product. Advertising and distribution channels are the main attributes in this stage for a new product.

New Product Development Success (NPDS)

Every company that starts new product development wants to have a successful product in the market. According to Kahn (2004), success is defined as reaching financial and performance goals. However, NPDS is not determined by only one characteristic; it is

determined by a combination of characteristics and events. NPDS is composed of four main characteristics: financial, customer, performance, and company success (Kahn, 2004, p. 610). Many of the characteristics are influenced by the company's goals, vision, and mission. NPDS creates many positive attributes in a company: better employment, financial growth, market position, and positive customer perception.

For many companies, successfully launching and developing new products is the main objective of the firm. Also, developing successful products is critical for many organizations from the aspects of growth and survival. Many recent studies analyze the key components or factors for successful NPD and also identify critical errors that many companies make during NPD. Companies understand that new product success comes from the NPD process. The process creates an opportunity to improve the product at each stage. However, many factors determine success. For example, a company that is successful in a new product has aligned the development with corporate strategy and customer needs. According to Soldatos and Hardy (2007, p. 62), "the overall success of a company depends on how the new product is developed and how well it fits into the company's objectives and direction."

Companies may have to make sacrifices in order to achieve positive NPD success. For example, some companies sacrifice product quality and uniqueness in exchange for mass production and productivity. Although more than one factor can measure success, companies may have a difficult task in measuring the success of new products. Griffin and Page (1993) find that most success factors are surrounded by project-level successes that depend on the strategy of the project. For example, the strategies used in an existing product may be very different from new product strategies. Also, they find that the success of the NPD may depend on the company's innovation strategy. For example, companies that target the overall

market at first will have a different success measure than those who target only a secure market.

Many researchers, such as Cooper and Kleinschmidt (1995) examined the variables of NPDS by prioritizing the importance of customer needs and wants (cf. Cooper, 1988; Cooper & Kleinschmidt, 1987; Cooper & Kleinschmidt, 1994). According to Hoyer et al. (2010), NPD depends on the understanding of customers' needs in such a way that meets those needs.

Many companies increase the productivity of new products by showing customers new alternatives in the market. However, the probabilities of failure are very high in every NPD. According to Hopkins (1980), two-thirds of new product success is seen by the company as "disappointing" or "unacceptable." Cooper and Kleinschmidt (1987) show that the main reason for disappointing or unacceptable product success is the low contribution of customer participation. In more recent years, the new product failure rate approaches 90% (Burkitt & Bruno, 2010) when leader market companies are taken into account.

Further, Adams (2010, p. 2) indicates that "65% of new product failures are associated with big companies, while a much higher 90% rate of new product failures is associated with new product development occurring at new companies." This increased failure rate in new companies refers to all instances of NPD, including apparent development efforts that involve nothing more than a mere product concept. This high failure rate is common to virtually every type of company, creating an atmosphere of uncertainty and chaos. Failure is a possible event for every NPD, although success can be achieved. NPD success is not an easy task, but companies take the risk in both the short and the long terms despite the odds of success being very low. Still, if one product is placed in the market, a company's future can

be very prosperous. The pressure for companies to develop successful new products often occurs because upper management wants immediate returns after investing time, dollars, and personnel.

After much research, Cooper (1976) found five specific reasons for new product failure: "inadequate market size, distribution problems, internal conflicts, impatience and resistance, and bad marketing research." Also, Cooper provides results from 114 new products that failed; these results are closely related to the other study results. Cooper finds that sales and profit margins were below target, the NPD cost was elevated, and the funding for the new product was above expectations. From all these causes, sales and profit margins were the highest variable for product failure at 63.2%. For Cooper, the sales and profit margins caused failure because companies set new product prices too high, competitors were stronger than expected, market studies of new customers was set higher than the original number, the product had very weak attributes that did not attract customers, the company misunderstood what customers wanted, and the launch of the product was not appropriate for the market. In conclusion, Cooper (1976, p. 307) defined the causes of new product failure as "elements of the product development process which precede the specific causes of failure."

To elaborate on the problem of the constant failure of NPDS, the following example involves the 2007 development and launch of Microsoft Vista software. Microsoft Vista was purportedly the most advanced and easiest user interface software, as well as the safest software that Microsoft had ever devised. However, the software was less efficient than the ones preceding it, and the unexpected results failed to meet the high expectations. Thus, Microsoft's launch of this software prompted a drastic decline in quarterly revenue. Paliy (2012) found that the $500 million marketing campaign that Microsoft had pursued created

expectations of high returns and high customer usage. Ultimately, the results were never met, and the development of the new product represented a significant failure for Microsoft. This example shows how established, strong companies can develop failed products. Also, a product that may be a great idea does not guarantee success in the marketplace.

NPD Success Metrics. Product development is very difficult to measure compared with other business areas. Many of the metrics used in past research are questioned by other authors who provide different kinds of metrics for NPDS. As mentioned earlier, NPDS can vary among industries. Still, research indicates seven overall helpful metrics. There are two overall, general success measurements in every company: the project and the individual level. In this study, the focus is on the project level rather than the individual level.

A metric is a way to measure the development of a new product. Metrics have a critical role in NPDS by keeping track of the performance of the NPD. However, there are three important reasons for a company to use a metric measure. First, the metric can help create value for the NPD and help to invest more resources if the NPD follows a successful path. Second, metrics can give another point of view to senior management for investment purposes. Third, metrics can help the NPD teams to be evaluated in the correct format and provide the best decisions during the process. The metrics' function is to measure the effectiveness of the NPD and create an evaluation format to know whether the NPD is successful.

The metrics used in this research are: 1) number of new products, 2) difference between the new products and total of sales (percentage), 3) number of NPDs in the making, 4) revenue, 5) sales growth, 6) customer satisfaction, and 7) product performance. These metrics are taken from the Product Development and Management Association's (2012)

Handbook of New Product Development, which explains the three major characteristics of NPDS. The financial characteristic is covered by revenue and sales growth; performance is covered by product performance; company success is covered by the number of new product developments in the making, number of new products, and the difference between new products and total sales. All of the metrics in this research come from the Griffin and Page (1996) recommended measures for product development success and failure and the Cooper and Kleinschmidt (2007) critical success factors.

The metrics used in this research are described as follows.

1) *Number of new products* is when a new product is developed successfully and launched to the market. Also, this is the number of new products in the market throughout a specific period. The number of products is used as a survey metric to show the specific quantity of new products.
2) *Difference between the new products and total of sales (percentage)* is the most used metric to measure NPDS. This metric was identified by Griffin and Page (1993). It is very special because it can vary among industries. The NPD can vary in time. For example, in the automotive industry, a car can take several years to be developed from the initial stage to commercialization; however, a new computer can be developed in a matter of months. So time can be a crucial factor between the new product and total sales.
3) *Number of new product developments in the making* shows the number of new products that are in the development stage of the process. This information can help to identify products that are being terminated or have been discontinued.
4) *Revenue* shows profits from sales and the success of the new product.

5) *Sales growth* can be determined by the position in market share or the amount of sales of a company. A company can decide which of those two measures to set as a priority. Sales growth is an important measure for market forecasting and projects possible new product success.
6) *Customer satisfaction* is a common measure of the success of new products in the market. If customers are satisfied with a product, it can be considered a success. This metric can help to determine the future success of new and actual products.
7) *Product performance* feedback comes from different sources such as customer feedback. Product performance has a close relationship with the initial stages of the new product such as design specifications. Performance is a key factor for new products and helps to determine their success.

Cooper (2000) identified some characteristics of NPDS benchmarks. He found that the NPDS benchmarks had to be part of the company strategy, develop an advantage, and satisfy customer needs. For example, the market needs to be a platform to launch a successful product. The product needs to be achievable and develop a financial gain at the end. The factors of NPDS come in different versions; however, companies adopt these factors to gain a better perspective on their new product development.

I use the chosen metrics of NPDS to help analyze the effect of the product innovation process (PIP). According to Griffin and Page (1996), NPDS is hard to establish because of the variety of measures used. However, this compilation of metrics can help to describe the effect and relationship of product innovation in NPD.

I describe these metrics of NPDS as influencers in the PIP. For example, innovation can dictate whether new products can increase customer attention and be successful in the

market. Also, innovation can contribute to the difference between the new product and total sales. Innovation assists in knowing how long the new product will take for development. Is it even possible? Innovation also plays an important role in the number of new products in the making because without innovation, products remain the same and will not create an impact on the market and customers. Every company searches for a new product to produce revenue. Innovation in a new product can develop profits, which is the main objective of companies. Every company develops new products to increase sales. Innovation is also a factor in customer satisfaction: will customers accept or reject the new product? Thus, innovation may be a very attractive attribute for customers.

Product Innovation (PI)

This section describes what product innovation means, the different forms of PI processes, and the relationship of NPDS to the PIP. It is important to specify the importance of PI from other kinds of innovation. PI is the "degree of perceived newness, novelty, originality, or uniqueness of a product" (Henard & Szymanski, 2001). According to Adams et al. (2006), PI's main purpose is to make a financial profit. Also, PI plays a key element for many companies. Companies that have succeeded in the market normally have a higher PI program and process than companies that do not innovate (Cooper et al., 2004a, 2004b; O'Connor, 2006). Companies that keep up with PI maintain a competitive advantage and can increase their presence in the market (Adams et al., 2006). The objectives of PI are to create value, obtain a competitive advantage, and achieve long-term success through the development and commercialization of new products (Rainey, 2005).

Innovations are normally created in research and development departments whose main function is to develop new products or modify existing ones (Nijssen, Hillebrand,

Vermeulen, & Kemp, 2006). The newness of a product can help to determine how the product will rate in the market. Newness is very tight to a new product (Song & Montoya-Weiss, 1998), which shows how innovative the new product is.

There are two types of PI: incremental and radical products. Incremental PI occurs when a product has only minor changes in the product's characteristics (Chandy & Tellis, 1998). These minor changes represent only small changes in market advantage or benefits to the customer (Gatignon & Xuereb, 1997). On the other hand, radical PI represents a major change in the product that provides greater benefits to customers and therefore companies (Chandy & Tellis 1998; Wind & Mahajan, 1997). According to Bessant and Tidd (2007, p. 15), the difference between incremental and radical PI is defined as "doing what we do better" versus "new to the world." To Makrides and Geroski (2005), the "new to the world product" has two important conditions: the new value that the product offers to customers and the market that is created by radical innovations. Radical innovations can constitute macro and micro levels, whereas incremental innovations are only used in a micro-level context (Garcia & Calantone, 2002). Radical innovations represent greater challenges and risks than incremental innovations. Radical product innovations constitute a major change in a product, not a continuity of the previous version. The profitability of these radical PIs increases the company's position of advantage in the market (Chandy & Tellis 1998; Wind & Mahajan 1997).

The success of PI is determined by the company's ability to change the market and affect customer satisfaction (Grossi, 1990). Thus, companies need to be on top of the market and ready to make changes according to customer requirements. Companies should never stay in their comfort zones; they must understand the challenges of the market (Chia, 1995).

According to Brown and Eisenhardt (1995), many factors affect PI in new product success; one of those factors is the PIP. In this study, the PIP is used to analyze and evaluate the effect on NPDS.

Product Innovation Process (PIP). Innovation is a very hot topic for researchers who focus on all kinds of innovations (Wang & Ahmed, 2004). Innovation can be described as ideas, objects, or processes (Rogers, 1983). Also, innovation is considered a critical component in company growth and success (Andrews & Smith, 1996; Cohen, Eliashberg, & Ho, 2000; Rogers, 1983). Innovation can take different meanings depending on what topic is used. The PIP can change the process through different innovations due to changes in technology, customers, and markets (Damanpour, Walker, & Avellaneda, 2009; Teece, Pisano, & Shuen, 1997). For example, Hurley and Hult (1998) point out that innovation can be openness to new ideas. For Hult and Ketchen (2001), innovation is the company' ability to develop new ideas, products, or processes. Many researchers use innovation as a process, a market, or even a strategy. In this study, innovation is used to describe a process. The process of innovation can be shaped and characterized in many ways.

The PIP is used as a key component in this study. "Successful innovation rests first on understanding customer needs and then developing products that meet those needs" (Hauser et al., 2006, p. 688). The PIP is used as a dependent construct for the success of new product developments. This type of innovation, seen as a process, is the adoption of new methods and new behaviors (Hurley & Hult, 1998; Lee & Grewal, 2004). The purpose of a PIP is to change or modify the process of producing a new product (Ettlie & Reza, 1992). The aim of a PIP is to improve effectiveness and efficiency in processes, especially inside the company (Damanpour et al., 2009; Ettlie & Reza, 1992). These changes can include the way of

obtaining ideas, production of products, and methods to launch a product to the market. Also, this new process is considered an organizational innovation in which an organization's culture changes to accommodate new ideas and processes (Hurley & Hult, 1998). It also has different phases of innovation, such as products, markets, processes, behaviors, and strategies (Wang & Ahmed, 2004). Whatever the type of innovation, the main goal is to make a profit (Martinez Lorente et al., 1999). This study focused on the process and outcomes for new product development success.

In a new PIP, creativity plays a very important role. According to Im and Workman (2004), creativity is the key to creating many important ideas. Creativity can be developed to help a company achieve a competitive advantage in the market (Hunt & Morgan, 1995). Creativity is crucial in bringing out new ideas for a successful PIP (Sheremata, 2000). Im and Workman (2004) discuss three types of approaches to creativity and innovation. The first approach is an effect of the people in an organization. The second is the process of developing new ideas. The third is when there is a difference of ideas from company management. When these approaches are highlighted in a company, the creative process can help to develop many ideas that can provide a market advantage. Whenever companies try to develop a competitive advantage in any form, NPD is in progress. New ideas can come from any source, inside or outside the company.

Closed Innovation (CI) and Open Innovation (OI). Product innovation is defined as the "degree to which the product being developed is new to the company and new to the market" (Olson, Walker, & Ruekert, 1995, p. 48). According to von Hippel (1988), PI occurs not only within a company, but can also be done outside the company. Von Hippel (1988) mentions that research findings show the importance of external sourcing, which is critical to

understanding the origin of an idea to provide better innovation. There are two key sources of ideas in the PIP: closed and open innovation.

Closed innovation (CI) is when the only process a company uses is the gathering of information and ideas for new product developments from within itself and is the more traditional way. Open innovation (OI) is when a company uses a process of new ideas that come from external sources. In open innovation, customers and suppliers are the main resources of information from which knowledge is developed. Customers provide help in OI, and their inputs help with the evolution of ideas to improve the success of NPD.

Chesbrough (2003c) notes that CI is the process whereby a company develops their own ideas without the help of any external sources. With CI, the company needs to have strict and detailed control of sources. Companies are also responsible for building overall support of the new product in distribution, production, and financials. For a company to develop internal ideas, they need the support of many departments but mainly the R&D division. The company needs to make sure to have the best individuals to develop the best ideas. The research and development department is considered a critical asset for new product innovations.

According to Chesbrough (2006b), companies have many reasons to keep their in-house innovation format. Some companies prefer to develop innovations in their own departments rather than searching an external source. Their reasons include the fact that technology is changing very fast and product life is very short. The R&D teams thus have little time to develop new products or innovations successfully, so all of the information needs to travel very quickly. Having outsider ideas can decrease the success window. Finally, the most

important reason is that employees are very jealous of their ideas. They resist innovation that is not made inside the company.

According to Chesbrough (2006b), CI has long been a topic of research explaining why it is important to companies. However, companies also realize that many potential ideas are not considered correctly and thus are disqualified. According to Joshi and Sharma (2004), many studies argue that internal knowledge is not enough to provide a competitive advantage in the market. However, companies are always being challenged, so leaving ideas unused is a waste of resources. The demand for new and great ideas is a constant reminder from the market and customers. From a company perspective, Chesbrough (2003c) shows that employee satisfaction is decreased when new product ideas are not used. CI may be a correct way to develop new products, but since the world is developing new products at a high pace, companies need to evaluate their procedures and processes for innovation.

CI is not a negative attribute in a company. However, there are many reasons for companies to consider changing their processes of innovation. According to Chesbrough (2003c), those reasons include financial aspects, employees, and opportunities for new ideas. OI has become a very important topic in new product development and innovation management (Huizingh, 2011). Research shows that companies open to new innovation processes are more successful in NPD than companies that have been working with the same innovation process for many years (Cooper & Kleinschmidt, 1995). OI has also been an important strategy for developing ideas from an external source (Dodgson, Gann, & Salter, 2006). In OI, customers play a crucial role in developing new ideas and providing feedback on new products. According to Chesbrough (2003b, 2003c), OI is a way of receiving inputs and ideas from places other than the company itself. Chesbrough (2006a, p. 1) defines OI as

a “paradigm that assumes that firms can and should use external ideas as internal ideas, and internal and external paths to market, as they advance their technology.”. More recently Chesbrough and Bogers (2014, p. 17) define OI as “a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and nonpecuniary mechanisms in line with the organizations’ business models.” OI has been related to companies in fast-paced markets such as the technology and pharmaceutical industries (Bigliardi & Galati, 2013; Huizingh, 2011; Morcillo, 2007; Sarkar & Costa, 2008; Theyel, 2012; West, Salter, Vanhaverbeke, & Chesbrough, 2014; Wynarczyk, Piperopoulos, & McAdam, 2003).

With OI, different methods boost the generation of ideas, creativity, and inputs to companies. These methods are fast-pace processes, and many researchers find interesting results regarding this new era in which customers become major components in OI. Chesbrough (2003a, 2003b, 2003c) suggests that OI will be key for different industries for a long time. The OI methods’ goals are to use customer inputs to create new ideas. The first method is to have a group of customers from whom new ideas are developed from scratch or to improve a current product and as a result provide a level of idea satisfaction (Jeppesen & Frederiksen, 2006).

The second method is the development of “toolkits” throughout an internet company platform (Sawhney et al., 2005). These toolkits will help customers to provide solutions and answers regarding product innovation (Piller, Ihl, & Vossen, 2010). This method is getting more attention in many companies because the interaction between manufacturer and customer is increasing. A clear example is Dell’s IdeaStorn, which is an online user innovation community whose customers post their ideas (Di Gangi & Wasko, 2009). Open-

source software online communities are among the most common types to promote product innovation (Dahlander, Frederiksen, & Rullani, 2008).

Finally, the third most common method is when a company requests ideas from customers through a contest or platform that helps to collect ideas. The interaction between customers and the company is less common, but the goal is to take the most ideas possible from different customers (Sawhney et al., 2005).

OI methods can be a good way to connect with customers and provide a viable solution to everyday problems. However, these methods can challenge companies in properly organizing customer inputs (Hoyer et al., 2010). Cooper and Edgett (2008) suggest that many companies will have issues with these methods due to an increase in costs and programs to organize customer ideas. Many of the ideas are not placed in a real context and may be less feasible to accomplish. Also, companies may face property rights with customers when they use these types of innovation methods. Overall, companies are trying to use these methods despite the challenges, but they must be applied carefully (Cooper & Edgett, 2008). Ideas can come from customers, competitors, or even unused company ideas. OI uses not only customers' and suppliers' ideas but any external information that is used for research applications (West & Gallagher, 2006). Companies that follow OI have seen added value in the success of their new product development.

Customers are considered a good starting point with which to generate ideas (Crawford, 1997). Many worldwide companies have adopted OI methods. Procter and Gamble developed a program called Connect Develop Strategy (Schumacher, Germann, Trill, & Gassmann, 2013). In this program, the company searches for connections in the information that positively affects its new products (Huston & Sakkab, 2006). Von Hippel (1988) found

that customers have become critical of the product innovation process. According to Antikainen, Mäkipää, and Ahonen (2010), the use of customers in the product innovation process can help companies to increase knowledge through a low-cost method. Many companies with successful new products pay special attention to customers' perspectives and ideas. According to Souder (1987), an idea that comes from an external source leads to better and more successful products than other ideas.

Customer Participation (CP)

New product development provides competitive advantages to meet customer needs and market demands (Athuahene-Gima & Ko, 2001; Yli-Renko & Janakiraman, 2008). Customers are becoming a key tool in the integration of many NPD activities. Customer participation (CP) occurs when customers help in the development of new products with new ideas and new characteristics; they play the role of codevelopers (Fang, 2008; Hoyer et al., 2010; Prahalad & Ramaswamy, 2004). In other words, customers help in creating new inputs and knowledge in a new product development process (Blazevic & Lievens, 2008). CP brings benefits in different areas such as understanding customer needs and wants and reducing failure of new products. CP and new product development have a close relationship that can be used for problem-solving in new products (Coviello & Joseph, 2012; Gerwin, 2004). For example, Nike and Proctor & Gamble are two companies that successfully use CP in their programs of new product development success (Prahalad & Ramaswamy, 2004; Ramaswamy, 2008).

Customers represent the front line of any product. Customers can give unlimited responses to different aspects of the product such as attributes, aspects, and acceptance. In research, customers are considered external sources of information that can help to develop

new products successfully, providing a competitive advantage in markets (Berthon, Hulbert, & Pitt, 1999). As companies use CP in the idea process of a product, they can understand customer needs in more depth. Second, CP is a key element in the NPD process, providing collaboration between the company's departments (Chesbrough 2003a; von Hippel, 1988; Yli-Renko & Janakiraman, 2008). Research shows that customers can bring many benefits as sources regarding investments and attributes of new products (Coviello & Joseph, 2012). Also, customers can lower the expenses for development (Lettl, Herstatt, & Gemuenden, 2006), assist with better efficiency in manufacturing (Griffin & Hauser, 1996), and lower managerial stress (Yli-Renko & Janakiraman, 2008). Third, customers play a key role in the initial stages of NPD as testers and critics of new products. They can help as a screening tool before the product is launched to the market. According to Griffin and Hauser (1996), customers can provide feedback from the market regarding needs and wants for possible successful development. Customer participation is, in many ways, a tool of early stages. Customers can help with the specifics of the product, testing of the new products, and support in future stages (Nambisan, 2002). This customer benefit can help companies avoid possible market failure and delay of products.

Overall, CP has been studied for a long time, and many researchers find outstanding benefits when participation is used in the NPD process. For example, Fang, Pamaltier, and Evans (2008) show that customers can increase ideas and support for new products. Cooper and Kleinschmidt (1988) and Griffin and Hauser (1996) prove that NPD efficiency can be increased when customers are involved in the development of products, and von Hippel (1988) points out that new ideas can help in the innovation process.

The Difference Between Customer Participation and Open Innovation. Customer participation (CP) and open innovation (OI) are different approaches with different definitions. According to Fang (2008), CP is used in different parts of the NPD process (resource) and idea development and testing of the product. On the other hand, OI is a source of NPD in innovation for new products and services (Prahalad & Ramaswamy, 2004). OI is viewed as an external source as opposed to a CI company's philosophy. According to Lichtenthaler (2008) and Ulrich (2007), OI develops the power of ideas in a company that inspires knowledge to develop full-scale new products. To show the difference between these two concepts, OI is used by the Lego Company. They have a site called "Create and Share" in which community members provide ideas such as designs, constructions, and worlds that are used to help launch new products (Morikawa, 2016). Yoplait used CP in developing a program called "Save Lids to Save Lives." In this case, Yoplait donated a dollar amount to a breast cancer foundation for every pink lid that was mailed back to the company. In this campaign, Yoplait encourage customers to participate in a cause (Stocker, 2014).

Customer Participation in NPDS and the Product Innovation Process. Coviello and Joseph (2012) conclude that CP can help in NPDS by, for example, lowering the cost of development and suggesting new technologies and new networks. Researchers also show that CP can bring many benefits to the innovation of new products (Fang, 2008; von Hippel, 1986, 1988). According to Cohen, Nelson, and Walsh (2002), 90% of companies use customer knowledge to start new product projects. Customer information and knowledge provide important value for the PIP. Companies are starting to increase their CP in the OI process to bring competitive advantages, new ideas, and technology (Bendapudi & Leone, 2003; Chen et al., 2010; Prahalad & Ramaswamy, 2004). Customers want to be part of OI

programs, which are rapidly increasing (Hoyer et al., 2010; Schreier, Fuchs, & Dahl, 2012). As innovation increases, studies find that sometimes very new products can create negative attributes because the innovation can be too radical and can take time to enter the market and be accepted by customers (Sood & Tellis, 2005). Product newness is defined as "the extent to which an innovation is compatible with experiences and consumption patterns of customers" (Atuahene-Gima, 1996, p. 278). When a product is too radical, it can fail because it can be considered too risky; it needs adaptation time.

CP can be a key element in the different processes of NPD. First, if customers are used properly during the product strategy and idea generation stages, they can develop and help with understanding what customer needs are, they can identify problems and provide solutions. Customers can provide great inputs for new products and pursue the market to accept the product in future stages. In the next stage, customers can provide great input in the concept development stage. In this stage, customers can help by providing new investments and technology (Coviello & Joseph, 2012; Yli-Renko & Janakiraman 2008). They are of great advantage because their input can reduce development time and therefore costs (Lettl et al., 2006). In later stages such as product testing, customers can provide feedback on the positive and negative attributes of new products (Griffin & Hauser, 1996). Also, as customers participate in the NPD process, they can test the market for responses such as acceptance or denial. This is of great help to many companies because it can minimize launching and marketing costs for modified products. For example, Proctor and Gamble's advisors program brings customers in to participate in their NPD.

Overall, CP can increase new product development success and help during the process to avoid potential failure. Also, the PIP can benefit from CP in many ways, such as being a

resource for new product ideas. Von Hippel (1988, 2005) points out that not all customers can be good sources of knowledge in the PIP and NPD.

According to von Hippel (1988), a special type of customer called a "lead user" has better knowledge of innovations and NPDS. This type of customer is very important to companies because they have better input and output than common customers. This concept started as von Hippel (1986) searched for reliable information or sources to determine the constant changes in the market and customer needs. Companies need more dependable information to keep up with changes in the market (Lilien et al., 2002; Morrison, Roberts, & Midgley, 2004). Lead users thus provide better feedback and input for future products and services (Munksgaard & Freytag, 2011; von Hippel, 1986). The lead user is considered an individual with some level of technical knowledge and experience in the product field. This type of user has experience based on extensive use of a particular product. Only a small and select group will have an in-depth understanding of a new product. Figure 2 provides an example of how lead users can be represented by a small group of people with the skills to provide the necessary feedback on a product.

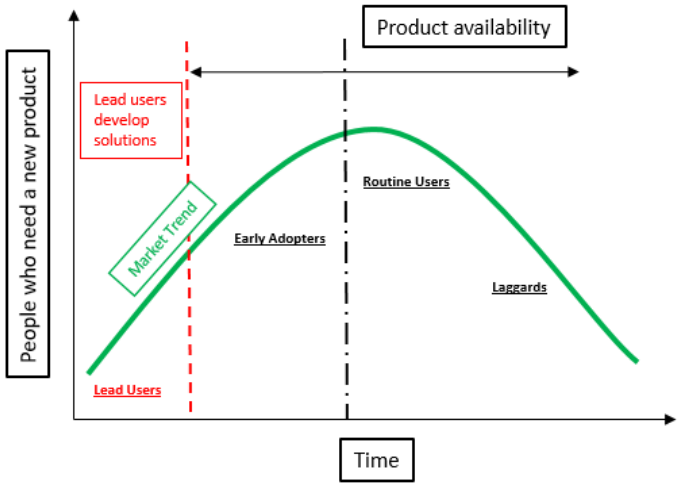

Figure 2. Lead Users Select Group (von Hippel, Thomke, & Sonnack, 1999).

Even though lead users can provide many benefits to a company, they do have some limitations. First, according to von Hippel (1986, 2006), lead users only contribute ideas in the initial stage of the new product development process. Though they provide a good starting point, their experience and knowledge can be even more beneficial across all stages of the NPD. Second, lead users are difficult to find. Identifying this type of user requires resources from companies.

*Lead Users in NPDS***.** Lead users are of great help in new product development success. Lead users can help improve coordination inside a company (Herstatt & von Hippel, 1992) and can increase product success (Lilien et al., 2002; Morrison et al., 2004; Thompke & von Hippel, 2002). The participation of lead users can bring new ideas and different points of view to the product development process. Successful companies rely not only on traditional users, but they also look for other ways to satisfy customer needs, such as lead users. These lead users are experts on similar problems in the market and can help companies obtain real solutions (Lilien et al., 2002). Many studies show that when companies let lead users participate in idea generation in NPD, success is higher than for companies that use only their R&D departments (Lilien et al., 2002). Ideas from lead users tend to have a bigger impact because they provide another point of view (Lilien et al., 2002). Lead users need to have the right tools from the company by which they can provide better contributions with sufficient knowledge.

Lead users provide two differences from common users in the market. First, lead users help to develop new ideas that can be used in the market quickly. Second, lead users can provide important solutions to problems in the market (Franke, von Hippel, & Schreier, 2006; von Hippel, 1986). These two important differences help lead users to increase their

importance in NPDS. Lead user participation can have a major influence when the quality of their ideas and opinions are used correctly. The quality of lead user ideas depends not only on the number of ideas thrown at the company, but when the ideas can be converted to reality.

Lead Users in the Product Innovation Process. In the product innovation process, lead users can help to produce better products with better attributes and new concepts (Franke et al., 2006; Lilien et al. 2002). Lead users can help the company innovation process to develop successful new products by providing ideas and opinions that are also in the interest of common customers, thereby increasing sales. Lilien et al. (2002) show that the 3M Company uses innovation projects that are developed by lead users. These have increased sales growth by eight times and doubled market share distribution. Another example of lead users in the PIP is shown in the Herstatt and von Hippel (1992) study, which finds that costs of development at Hilti AG was decreased by 50%.

On the other hand, lead users are not easy to locate: they are rare and hard to find. However, once they have been identified, they want to provide information for innovation without expecting anything in return for two reasons. First, lead users do not hide their knowledge from companies because they have other duties to perform. Second, lead users do not see any rewards; they simply have the will power to provide what is needed (von Hippel et al., 1999). According to Franke and Shah (2003), innovation communities do not want a benefit; they just want to communicate information to other members to expand knowledge. Many researchers have shown that lead users can often provide more knowledge and information to companies than professionals (Kristensson, Magnusson, & Matthing, 2002). Users and customers can be great sources of innovation, depending on how companies

manage the information. Companies can identify lead users in a market by creating programs for which the end reward will be a market advantage. Overall, when companies learn to manage and understand the lead user concept, they will increase their value and provide better successful new product development processes.

CHAPTER III

RESEARCH MODEL AND HYPOTHESES

To represent my theoretical framework and research hypothesis, I propose a model showing the product innovation process and new product development success using customer participation as a moderator. The proposed model describes the variables and constructs in the literature review and the connection between them (see Figure 3).

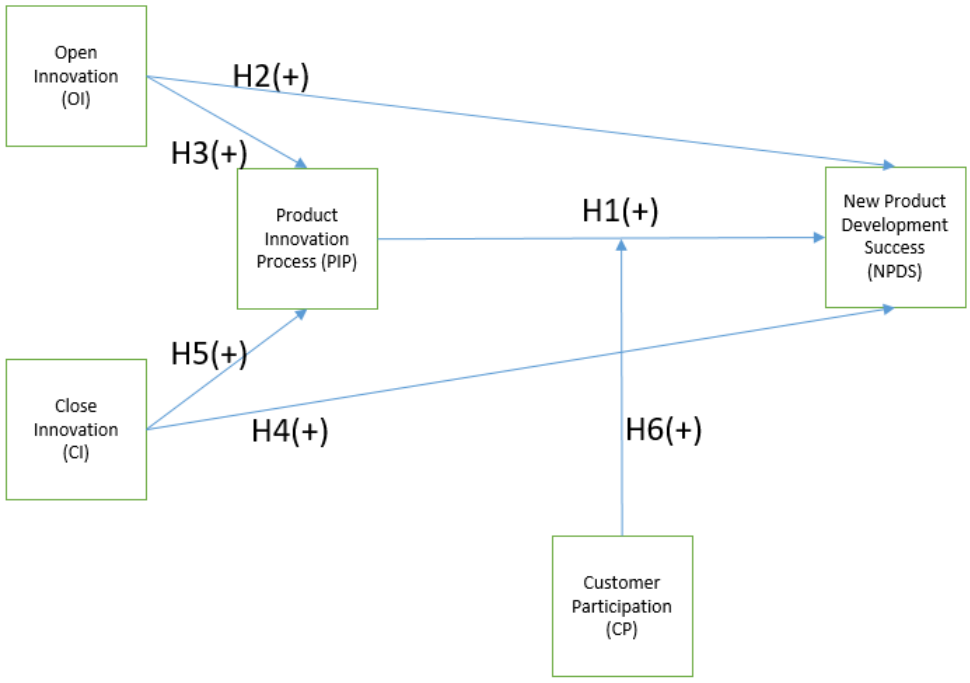

Figure 3. Theoretical Model

The literature provides evidence of how the product innovation process (PIP) can help to increase new product development success (NPDS) and result in a competitive advantage. In the literature review section, I highlighted the importance of NPDS and how the PIP can affect outcomes. Vast numbers of programs in different companies have been applied and modified in the PIP to increase their success in new products and achieve sales growth. However, there is more research to do in this area as it is still unclear how the PIP can influence new product development (NPD) in a negative or positive way. In this chapter, I provide a series of hypotheses to test the model.

In this study, I use the resource-based view (RBV) theory of the firm and lead user theory to develop my conceptual and theoretical framework. The RBV theory has been one of the most important and often-cited theories in management. From the perspective of RBV, companies do not use their resources for a competitive advantage and therefore do not create value in a strategy for success (Barney, 1991). Many authors argue that competitive advantage is closely related to company resources (Barney, 1986; Conner, 1991; Peteraf, 1993; Prahalad & Hamel, 1990; Wernerfelt, 1984). Also, many articles use the RBV as part of the NPD idea (de Brentani, Kleinschmidt, & Salomo, 2010; Madhavaram & Hunt, 2008; Ngo & O'Cass, 2008; Olavarrieta & Friedman, 2007). However, in more recent studies, the RBV is used in the context of NPDS (Kleinschmidt, de Bretani, & Salomo, 2007; Paladino, 2007, 2008). According to Barney (1991) and Daft (1983), resources are the base of the RBV and include assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness.

The RBV refers to the ability to manage the competitive advantage resources in a company that is one of a kind, different, and unique (Barney, 1991; Smith, Vasudevan, & Tanniru, 1996). Also, the RBV shows that resources and capabilities can influence competitive advantage (Day, 1994; Penrose, 1959; Peteraf, 1993). The RBV is a good fit for the PIP, providing a competitive advantage for companies. RBV researchers know that the different types of resources can be obtained both as internal and external formats (Tanriverdi & Venkatraman, 2005). RBV focuses on the effect of companies' strategies and processes (Gatignon & Xuereb, 1997; Gupta & Wilemon, 1986; Hurley & Hult, 1998).

From the product innovation aspect, Rigby and Zook (2002) indicate that when a company combines internal and external resources, competitive advantage can increase and be a key element. Companies have many types of customers as resources for feedback and knowledge, but they may not be using them in the right way to gain an advantage for the success of NPD and PI. This is why the resource-based view can help in this research study regarding the influence of the PIP and NPDS. The resources for product development and product innovation are very important and can determine a product's overall success.

The lead-user theory, developed by Eric von Hippel, is used in this study as a complement to the RBV. A lead user is defined as a special and unique user who understands what customers want and need in the market (von Hippel et al., 1999). A lead user can be used as a resource to provide a company with a competitive advantage. If the lead user is adequately used, success of the PIP can be achievable. Once a lead user is used properly, the increase of NPDS is possible, and product innovation can provide the tools for success.

Product Innovation Process (PIP) and NPDS

According to the literature review, NPDS is a top objective for companies. A company that is successful in new products in coordination with the NPD process deeply understands its customer needs and knows how to solve new product problems (Ziger & Maidique, 1990). According to the RBV, a company that has a successful NPD program will develop a competitive advantage and increase its revenues and profits. However, success is not easy to obtain; many things need to happen. No one factor can measure success, and many factors can be critical. The identified success factors for this study are taken from several studies and include the number of new products, the difference between the new products and total sales, the number of NPDs in the making, revenue, sales growth, customer satisfaction, and product performance. These measures can help to reduce the failure of new products and provide an advantage for the company. Failure in NPD is a constant fear in companies with a high percentage of failed products.

Product innovation is a key element in the NPD process and success. PI can help to provide a successful product with some changes in the development process and provide an advantage in the market. Researchers define PI in various ways. Henard and Szymanski (2001) define it as the degree of perceived newness, novelty, originality or uniqueness of a product. Research shows that innovative products can produce up to 30% of a company's sales (Cooper, 2001). Also, new successful products can provide up to 90% of return on investment, with a very low payback period and 40% of market share (Cooper, 2001). The PI process also has a strong relationship with NPD and success. All companies that develop a successful PIP have an advantage against competitors. It does not matter whether the advantage is big or small; having an extra edge in the market is what matters. For example,

companies that are successful in a particular market normally have a high PI program and process (Cooper et al., 2004a, 2004b; O'Connor, 2006). Successful PI starts when a company develops the ability to change the market and satisfy customers (Grossi, 1990). A competitive advantage can be developed by many resources. The RBV suggests that when there is a recombination of resources and activities, a lead in revenue and new business models can help the company (Mathews, 2006).

Many researchers have studied the RBV in the role of competitive advantage through PI (Knight & Cavusgil, 2004; Zou & Cavusgil, 2002). PI is a driver helping companies gain an advantage in the market with a combination of different resources. Theoretically, the RBV uses intangible and tangible resources for company success (Amit & Schoemaker, 1993; Barney, 1991; Conner, 2002; Hall, 1993; Michalisin, Smith, & Kline, 1997). Paladino (2007) found that there is a relationship between resources in new product success and performance.

According to Brown and Eisenhardt (1995), many factors influence PI success. One of those factors is the PIP, which is very important in the developmental stages of a product. The PIP can be seen as a resource for competitive advantage and also a factor for new product success. If the resources used in this process are adequate and positive, successful new products can be achieved. In past studies, researchers applied the RBV in a more strategic concept to gain a competitive advantage and success (Ferreira & Azevedo, 2007). Helfat and Raubitschek (2000) show how companies think about new product activity with a RBV and the many advantages of the RBV in product innovation. First, they show the resources that are important for PI. Second, they discuss how PI can be used as a driver of company resources. To have a successful product, the company needs to have a successful PIP, so the metrics of NPDS may be an appropriate metric type. Success factors such as the

number of new products, the difference between new product and total of sales, number of new product developments in the making, revenue, sales growth, and customer satisfaction can help to measure the success of a PIP.

According to the RBV literature in innovation and marketing, many researchers focus on profit from a new product (Atuahene-Gima 1996, 2005; Cooper & Kleinschmidt, 1995; Gatignon & Xuereb, 1997; Griffin & Page, 1996; Montoya-Weis & Calantone, 1994). If a PIP is successful and develops a competitive advantage, sales will grow, revenue will increase, customers will be satisfied, new products will be in constant development, and new products will be launched to the market more often. These two constructs have been analyzed and investigated before, but researchers choose specific success metrics to analyze the possible success of a PIP. Therefore, this study investigates the relationship between PIP and NPDS.

H1: The product innovation process is positively associated with the success of NPD.

Open and Closed Product Innovation (OI-CP) with NPD Success (NPDS)

According to Hauser et al. (2006, p. 688), "Successful innovation rests first on understanding customer needs and then developing a product that meets those needs." The PIP is a tool that can help in understanding those customer needs by applying new methods and new behaviors. The purpose of PIP is to modify the process of development of new products (Ettlie & Reza, 1992). PI can take different forms such as the way the company gathers information, the sources of new ideas, production of products, and even how new products are launched in the market. There are two ways of gathering and sourcing important ideas to develop a new product to create a competitive advantage: closed innovation (CI) and open innovation (OI) are types of PIPs.

Closed innovation is when a company only uses resources and ideas from within for new product development and is the traditional method for developing new products. Many companies use this type of innovation because internal ideas come from their R&D departments. Internal ideas and resources may help in developing an important advantage against competitors and markets. For example, companies such as AT&T and IBM have become leaders in CI (Chesbrough, 2003a) and have developed very important products for customers. The Berthon et al. (1999) research suggests that customers are not always the best sources of innovative ideas and will not create a competitive advantage. CI provides a strategy that does not use customer feedback (Bennett & Cooper, 1981).

In contrast, open innovation is when new ideas come from external resources instead of from inside the company. When companies use the OI process, they have a higher probability of success. According to Schreier et al. (2012), OI is about regularly obtaining resources and knowledge from the outside. Their research shows that having information from the outside world can generate better ideas with more potential for a successful product (Lichtenthaler, 2008; Ulrich, 2007). A relationship with customers can result in ideas that are not easy to duplicate (Madhok & Tallman, 1998; Ward, Duray, Leong, & Sum, 1995) and therefore provide an important advantage. Also, companies can create ideas from relationships with suppliers (Gerwin, 1993). All these ideas meet the RBV concept in which external knowledge and ideas can be of great help in NPD and PI.

An example is Threadless.com. They engage customers to participate in t-shirt designs. According to the Threadless CEO, the company does not engage in any internal R&D or NPD; instead, they use customer feedback to develop their products (Bogers, Afuah, & Bastian, 2010; Schreier et al., 2012). This company searches throughout their different

resources for better ideas to change market trends. Their model type has helped the company to create successful designs and products. The impact of an OI process in this company creates higher levels of NPDS. Customer input helps with the transformation of ideas to improve the constant failure of NPD. The ultimate goal of innovation is to develop a successful product; thus, having help from different resources is always an advantage. Changing from CI to OI could create a competitive advantage (Huston & Sakkab, 2006). Idea generation from customers and OI fulfills the customers' needs and creates a higher level of customer adaptation (Chesbrough, 2003b; Gruner & Homburg, 2000; von Hippel, 1988). Having an open product innovation process may provide a chance for companies to succeed in NPD.

The different types of innovation processes have a close relationship with NPDS factors that can create a competitive advantage. Applying the RBV, a company can use OI or CI to develop a significant competitive advantage in the market. The RBV helps to differentiate the internal and external resources of a company. For a company to have a competitive advantage, the resources should be unique and difficult to replicate and provide a positive outcome (Barney, 1991). This study investigates the relationship between the open and closed product innovation processes with NPDS.

H2: Open product innovation is positively associated with new product development success.

H3: Open product innovation is positively associated with the product innovation process.

H4: Closed product innovation is positively associated with new product development success.

H5: Closed product innovation is positively associated with the product innovation process.

Customer Participation (CP) and the Product Innovation Process/NPDS

In this study, customer participation is used as a moderator between the two main constructs. I analyzed the influence of customers on the PIP and NPDS. The effect of this moderator helps to increase knowledge in NPD and verify whether it helps to increase product success. CP occurs when customers help in the development of new products with new ideas and new attributes. Customers are situated as codevelopers in the company (Fang, 2008; Hoyer et al., 2010; Prahalad & Ramaswamy, 2004). According to the RBV, CP can help in the development of resources for a specific goal. It develops a close relationship between customers and the company for a long period (Bendapudi & Leone, 2003; Payne, Storbacka, Frow, & Knox, 2009), which can increase productivity (Lovelock & Young, 1979) and help companies to gain a competitive advantage (Prahalad & Ramaswamy, 2004). CP is not a new topic; what is new is how CP helps to provide a competitive advantage in the market and against competitors (Bendapudi & Leone, 2003). Customers can provide input for developing new ideas, market analysis, and problem-solving for successful new products.

According to Levitt (1981, p. 102), "a customer is an asset usually more precious than the tangible assets on the balance sheet. Balance sheet assets can generally be bought… customers cannot so easily be bought." Customers are an important value to the company and a special type of resource (Srivastava, Fahey, & Christensen, 2001). Benefits and advantages of successful new products can be greater profits, new market share, and competitive advantage (Chandy & Tellis, 1998; Chen, 2009; Cooper, 1993; Sheng et al., 2012).

Company objectives can be reached with the participation of customers. The successful use of human and organizational factors may affect innovations (Hayes & Wheelwright, 1984). Customers can be involved in many stages of the NPD process and can bring the benefit of increasing sources of new ideas and providing solutions to the daily problems encountered in products (Yli-Renko & Janakiraman, 2008). Increasing the resources of new ideas and brainstorming can increase the advantages of a company in the market. The expansion of idea development is a useful resource in PIP and NPDS. For example, Evans (1996) notes that companies such as Ames Rubber Corporation that use CP have developed successful products. Great benefits can be obtained when companies accept input and provide direction for these new ideas. CP has a close and tight relationship with NPDS. Millson and Wilemon (2002) find that CP in the early stages of NPD correlates with sales and profit. Gales and Mansour-Cole (1995) find that CP in late stages of NPD can help to decrease uncertainty, which helps to guide NPDS.

While there is reason to believe that CP may positively affect NPDS, studies show greater levels of PI in new products (Fang, 2008; von Hippel, 1986, 1988). Some studies suggest that CP provides a negative impact on NPD because sometimes customers are not prepared or do not understand new technologies (Christensen & Bower, 1996). Some studies also challenge and question the importance of CP in successfully developing new products (Christensen, 1997; Hamel & Prahalad, 1994; Leonard, 1995; Martin, 1995; Veryzer, 1998). Thus, there is some level of controversy on whether CP helps the NPD process.

This study attempts to clarify the question. In this study, strong CP with NPDS is encountered with customer satisfaction and performance of the product. Customers can be involved in the OI process as a source to measure customer satisfaction. According to Cooper

(1993) and Cooper and Kleinschmidt (1996), customers are considered the most important source in NPDS. The success of a NPD is measured by various items, and customer participation and customer satisfaction are among them.

In the past, CP has been used as the main variable rather than as a moderator, so the effect may be different in the relationship. Treating CP as a moderator is something new. In this study, CP is used as a moderator to see whether the effect is negative or positive. Therefore, I provided the next hypothesis to measure this effect.

H6: Customer participation has a moderation effect between the PIP and the success of NPD.

Past studies have concluded that customers wish to be more involved with companies and that they wish for companies to take their opinions into account so that they have more control of products (Fuchs, Prandelli, & Schreier, 2010; Hoyer et al., 2010). Companies that provide engagement with customers can develop better communication and relationships.

CHAPTER IV

METHODS AND DESIGN

This chapter presents the methodology and design of my research and describes the population size and sample characteristics used. Also, the measures used in this study are described and different constructs are analyzed as well as the study's validity and reliability.

Population and Sample

In this research, new product development practitioners from the U.S. food industry are chosen as the sample and data source. These practitioners are professionals in the NPD area and include customers, engineers, development scientists, R&D managers, technical directors, marketing managers, executives, and owners of companies who have been involved in the development of new products. The individuals in the population are from companies that produce and commercialize products in a business-to-business market.

A questionnaire or field survey was used rather than personal interviews. Although personal interviews provide more in-depth qualitative data, quantitative research provides a better scope from a larger population and better data collection. The quantitative research goal is to find data that can be applied to a large and varying population. This

type of research can be generalized and applied to different areas. According to Bryman and Bell (2011), when data is collected in a quantitative study, the data needs to be measured and presented numerically. Quantitative data should be presented in a statistical format so that the data can be summarized for conclusions (Bryman & Bell, 2011). This type of research is empirical data collection with a structured method, which is the most common method for a large population (Bryman & Bell, 2011; Neuman, 2003).

Data Sources

There are two types of data: primary and secondary data. Primary data is that which is collected with a research objective (Hox & Boeiji, 2005). This study uses primary data that is collected with an objective and hypotheses to be proved. According to Yin (1994) and Bryman and Bell (2011), primary data takes more time to collect and usually is more expensive to collect than other types. Primary data is collected without the influence of any analysis and is gathered with a research strategy that allows the collection of the most important information for the study. This type of data allows the study to be updated more easily and is more relevant since the data is recent. I did not use secondary data.

Data Collection

There are many methods to gather quantitative data: experiments, observations, and surveys. In primary data, experiments have a very important role in providing very useful insights (Hox & Boeije, 2005). The experimental method is used to verify the hypotheses and to analyze changes in the results (Malhotra, 2010). In this method, researchers can select the participants and suggest which participants were part of the analysis (Berg, 2001) depending on the characteristics and goals of the study. In this case, the researcher helps the participants

to modify the variables, especially the independent variables. With this method, the researcher has more control over the study and process.

On the other hand, surveys are a very important method. In this case, I used a survey with a structured questionnaire to collect the data, which is the most common method. A survey can be done in different ways: through interviews, by telephone, and by questionnaires (Hox & Boeije, 2005). Interview surveys can be used for large sets of respondents. The interviews are coded in such a way that respondents can answer in different steps and categories (Berg, 2001). Surveys can be easily distributed for data collection and can be used in a large population. A questionnaire or survey can provide great data quality and more efficient collection, and the respondents will not be affected by the interviewer. Also, survey questions can provide researchers with more information of interest and comments from respondents. This method can help to reach more respondents faster to collect data from large population samples (Bryman & Bell, 2011). When a researcher uses a survey, the purpose is to analyze different feelings and experiences from the respondents. A survey with a structured questionnaire provided better analysis for this study. The questions are organized in such a way as to create relationships among the variables. There are many computer programs that can provide an ideal format to distribute the surveys through email or social networks.

In this research, the survey was sent to the participants through Qualtrics software and via email through a hyperlink. The main focus of Qualtrics software is on research and surveys. The survey had a hyperlink to help the participants forward the survey to colleagues. Also, different hyperlinks and surveys were posted in LinkedIn groups. The responses were anonymous, which helped in receiving more honest responses to yield better results (Bryman & Bell, 2011).

I used different kinds of practitioners/professionals from a portfolio of customers. The population is around 1,000 practitioners to whom I sent a survey to be completed. The survey was sent to professional organizations such as the Institute of Food Technology and the Tortilla Industry Association. To be considered in the sample data, the participants needed to have been involved in at least one new product development in the last year This was the only limitation of the study since the aim was to maximize the response rate. Also, the population included male and female practitioners of different ages.

To be able to participate in this survey and research, individuals needed to provide voluntary consent. They responded to yes-or-no questions such as "Do you have any experience in new product development?" After the system accepted the participants' responses, different actions were available to maximize the time and responses to the survey.

1) The primary goal for the survey's front page was to provide the explanation and purposes of this survey. The participants were told that the survey responses would be confidential and anonymous. Also, they were told that there is no intent to commercialize their responses.
2) The survey instructions were provided at the beginning of every section so that there was no confusion about the subject.
3) After the survey was answered, a follow-up message was sent to the participants for completion and participation in the questionnaire. Also, my contact information was provided for future reference.

Design

In order to understand the effect of the PIP for NPDS in a business-to-business concept with a moderating factor of customer participation, I chose to use a quantitative method for

this research study. This experiment involves a correlational design to find the relationship between the PIP and NPD. Also, I analyzed the moderating factor as part of the relationship. The participants were contacted and the information was obtained through online surveys. First, an email survey was sent to the participants, and they had four weeks to complete the survey on the website. After two weeks, a reminder email was sent. Then when the four weeks concluded, the website portal was automatically closed. The survey had 43 questions for the participants to fill out. Through this survey process, I avoided any repeat customers in my data set.

Questionnaire Design

In this study, the source of the primary data was a survey with a structured questionnaire (Appendix A). The survey was distributed via email and social networks, making the collection of data easy and inexpensive. According to Johnson and Christensen (2012), researchers use this method to find out the feelings and observations of the participants. For example, researchers use answers already chosen by individuals and companies. Questionnaires can be used in quantitative and qualitative experiments (Anderson & Morgan, 2008; Johnson & Christensen, 2012). Also, questionnaires help to answer questions of variables (Anderson & Morgan, 2008).

There are two types of questionnaires: “self-administrated” and “interviewer administrated” (Connaway & Powell, 2010). Nowadays, the format most frequently used in questionnaires is through the internet, which provides benefits such as a fast collection of results and feedback (Katsiriku & Skiadas, 2010). Also, the low cost and reduction of processing time can provide researchers with faster data. Researchers can reduce travel costs, team distribution, and paper usage (Katsiriku & Skiadas, 2010). Online questionnaires are

easy to distribute without the hazard of paper formats and costs (Hussey & Hussey, 1997; Katsiriku & Skiadas, 2010; Saunders, Lewis, & Thornhill, 2009). This format can reach larger populations and audiences for better analysis (Saunders et al., 2009). However, there are some disadvantages when using this format type. First, many participants cannot be reached through this format, so useful information cannot be analyzed (Katsiriku & Skiadas, 2010). The limitations of the online questionnaire can lower the participant response rate (Connaway & Powell, 2010). For example, if Google Docs is used, the questionnaire will be limited to simple, noncomplex questions (Saunders et al., 2009).

When a survey is designed, there are many options to consider, the most important of which is the quality of the questions that will provide useful data for analysis. The quality of the data will depend on the survey; if the questions are good, the data will be good. The wording of the questions has great relevance to obtain great data (Bryman & Bell, 2011). However, no exact formula or successful procedure exists to guarantee good quality data (Aaker, Kumar, Day, & Leone, 2010; Bryman & Bell, 2011; Malhotra, 2010). Researchers follow the main principle in developing surveys: to make the questions as understandable as possible for the participants. The questions should be practical and concise so that respondents will not be discouraged from continuing with the survey. According to Bryman and Bell (2011), the structure and wording of each question is very important to catch the participants' attention and provide continuity. In this research, Qualtrics was used for the survey form, and it was distributed through the Internet.

Operationalization and Measurements

The measures of this study were developed from existing literature and past researchers. To test the hypotheses, the research constructs needed to be changed to items that could be

measured. The items used to develop the questionnaire and the survey were measured with Likert scales, which is the most commonly used in perception studies and questions (Bryman & Bell, 2011). To increase the validity and reliability of the items, I used Likert measures that have been tested before by other researchers (Abidin, Mokhtar, & bin Yusoff, 2013; Cooper & Kleinschmidt, 2007; Fang, 2008; Griffin & Page, 1996; Gruner & Homburg, 2000; Sisodiya, 2008; Zhang & Yang, 2016). Reusing items from different studies helps to duplicate and compare the results (Bryman & Bell, 2011) so that reliability is increased. I used multiple items for every construct, which helped to reduce mistakes and increase accuracy (Bearden & Netemeyer, 1999; Bryman & Bell, 2011). The validity of the study increases by using a survey since the rate of questions being wrong is reduced (Bearden & Netemeyer, 1999; Bryman & Bell, 2011).

NPDS was measured by 21 items taken from the PDMA Handbook (Kahn, 2004, p. 610), and especially from the studies of Griffin and Page (1996) and Cooper and Kleinschmidt (2007). Three basic areas were covered: customer, financial, and performance success (Griffin & Page, 1996). Seven NPD success metrics were analyzed to determine a relationship with product innovation. The measures were used as a self-evaluation with a five-point Likert scale of 1 = never, 2 = occasionally, 3 = sometimes, 4 = frequently, and 5 = always. The seven NPDS used in this study included the following: 1) number of new products, 2) difference between the new products and total sales, 3) number of new product developments in the making, 4) revenue, 5) sales growth, 6) customer satisfaction, and 7) product performance.

The product innovation process (PIP) is a tool that can help in understanding customer needs by applying new methods and new behaviors. Process innovation can take different

forms, such as the way the company gathers the information, the sources of new ideas, production of products, and even how the new product is launched to the market. There are a couple of ways that companies can gather and source important ideas to develop new products. There is closed and open innovation, which helps to measure the importance of these processes of gathering ideas. Both of the innovation process types helped to prove or disprove the hypotheses. The hypotheses were measured by 16 items on the survey. The measurements were measured with a Likert-type scale of 1= strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. These measures were taken from Abidin, Mokhtar, and bin Yusoff (2013) and Sisodiya (2008).

Customer participation is defined as customer involvement in the company's NPD process. Customer participation is key to the development of new products and the PIP. I used six items in the survey taken from Fang (2008) as references. The measurements were Likert-type scales of 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. These items were used to measure the participation of customers in NPD as a source of information.

I needed to change the measurements to help in analyzing the numbers. The data were collected with different types of measurements for which a proper statistical method was applied. According to Nolan and Heinzen (2007) and Malhotra (2010), different levels of measurements can be divided into different types, such as nominal, ordinal, interval, and ratio. The nominal scale is the most basic type of measurement and is used when the variables do not have a numeric value and cannot be ranked. This type of measurement is done rarely since it does not give rank or a position. The ordinal is a scale when the variables contain an order; it is more commonly used. The interval scale is when the variables are in a

specific order and have meaning. I used this measurement to help compare differences among items (Bryman & Bell, 2011; Malhotra, 2010). Finally, the ratio scale is the same as the interval scale but with a difference of meaning in zero.

In this research, I used Likert-type scales in the analysis because it helps participants to show agreement or disagreement on the measure or item (Aaker et al., 2010; Trost & Hultåker, 2007). The scale can use five or seven measurement points (Aaker et al., 2010). Likert scales are divided into two categories: one that locates the item and one involving analysis or evaluation of the item. An item is a statement that helps to connect a construct and is then evaluated with a list of possible answers. Aaker et al. (2010) point out that it is important to measure every item of the survey as a single factor. In this study, the research was evaluated and analyzed using a five-point Likert-type scale. In all of the measured items, the scale responses range from 1) strongly disagree to 5) strongly agree. Also, there was a section in which the company and participant information is needed. There are variables such as the period of time in developing new products, the period of time in the food industry, and period of time working in the most recent company.

Table 1 shows all of the items, measurements, and questions used in the survey. Answering the survey took no more than five minutes. It is important to have no time limit for completing the survey, but once the survey is downloaded and started, it needs to be finished. The survey can only be downloaded to one computer, which helps to prevent multiple responses and prevents answers from being altered. The surveys were confidential and anonymous, and no personal information was required to complete the task. The survey included a nondisclosure agreement indicating that the respondents' answers were confidential and used only for this research and for data purposes.

Table 1. Operationalization

Construct	Type of Scale	Items	Questions
New Product Development Success (NPDS)	21 items 5-point Likert scale 1: Never – 5: Always	NPDS1 – Number of new products NPDS2 – Difference between the new products and total of sales NPDS3 – Number of new product developments in the making NPDS4 – Revenue NPDS5 – Sales growth NPDS6 – Customer satisfaction NPDS7 – Product performance	- How frequently does your company determine new product development success? -How frequently does your company set up objectives according to? -How often does your company provide incentives to each NPDS metric? Adapted from Griffin & Page (1996) and Cooper & Kleinschmidt (2007)
Product Innovation Process (PIP)	8 items 5-point Likert scale 1: Strongly disagree to 5: Strongly agree	PIP1 – All significant innovations must conform to company objectives. PIP2 – All affected departments participate in the innovation process. PIP3 – Individual employee input is important PIP4 – Customer input is considered important. PIP5 – Business partners input is considered important. PIP6 – Ability to balance risk-taking with cost/benefit. PIP7 – Clearly define measures to monitor progress. PIP8 – Innovation objectives and progress are clearly communicated.	- In the product innovation process, to what extent do you agree with each statement below: Adapted from Abidin, Mokhtar & Yusoff (2013)
Open Innovation (OI)	4 items 5-point Likert scale 1: Strongly disagree to 5: Strongly agree	OI1 – Constantly looking for new ways of information such as ideas, technology, market, etc. for the improvement of your new product success. OI2 – Constantly searching for information outside of your company such as with customers, suppliers, and competitors for increased success in your new product, OI3 – Properly find the use of external sources (such as customers, suppliers, market, competitors, etcetera) to help in the development of NPD. OI4 – Provide external knowledge and information to use with the R&D group in the company.	- In the new product development process to what extent do you agree with each statement below*:* Adapted from Sisodiya (2008)
Closed Innovation (CI)	4 items 5-point Likert scale 1: Strongly disagree to 5: Strongly agree	CI1 - Fully depend on your R&D department. CI2 - Think that the information and knowledge for a new product are better taken from your own company than from other sources.	- In the new product development process to what extent do you agree with each statement below: Adapted from Sisodiya (2008)

Construct	Type of Scale	Items	Questions
		CI3 - Work with any other information type besides your R&D department such as customers, suppliers, or competitors. CI4 - Think that your company is the best source of information in the market for new product developments and for increasing the success of new products.	
Customer Participation (CP)	6 items 5-point Likert scale 1: Strongly disagree to 5: Strongly agree	CP1 - Collect information from customers to the R&D groups to increase the success of the new product. CP2 - Share information collected from customers with the R&D department. CP3 - Provide information to comply with the customer needs and wants of new product development. CP4 - Key customers provide information to improve our process and new products. CP5 - Include customers in the early phases of the development. CP6 - Take into consideration the customers' opinion about their involvement in the new product development process.	- In the new product development product to what extent do you agree with each statement below: Adapted from Fang (2008); Zhang & Yang (2016)

Data Analysis Method

According to Malhotra (2010) and Ghauri and Gronhaug (2005), data preparation is a process that divides the quality of the data. This process helps to filter out the data that is useful for the research. The process has five stages: verifying the questions, revising, coding, filtering the data, and analysis. The first step of verifying the questions allows me to determine whether all of the questions were answered in a correct manner (Ghauri & Gronhaug, 2005). In this step, I verified that the participants completed the questionnaire. I left out the incomplete questionnaires that did not fully comply. Second, revising or editing the questionnaire was useful to identify whether the responses were consistent and clear (Malhotra, 2010) or were inconsistent with similar questions. If not, the questionnaire was deleted from the data analysis. Third, the coding stage a code is selected for a specific question and is used for statistical purposes when the analysis is performed. Fourth, filtering of data identifies missing information or low-quality responses. When there is missing information, a mean of the responses was used as a valid value (Malhotra, 2010). Finally, in the analysis of the data, I looked for the best method to make the statistical analysis. In this case, there are two types of methods: univariate and multivariate. Univariate is used when a variable can be analyzed independently and has more than one measurement. Multivariate is used in the case of a combination of relationships among variables (Hair et al., 2006). In this case, I used multivariate research on the relationships among different variables.

I used a regression analysis as my main method of analyzing the data. Multiple regression analysis was used in this part of the model as a key component. Multiple regression analysis can be used to describe the variance of the variables (Aaker et al., 2010). First, I evaluated the model fit and evaluated the parameter estimates; this helped me to better understand the

model. The significance value was crucial for the model and hypothesis testing. Second, regression analysis was used for the relationship of the main constructs of OI, CI, PIP, and NPDS. Also, regression was used to evaluate the interaction of CP between PIP and NPDS. The computer software used to perform the analysis was JMP. According to Aaker et al. (2010), regression analysis is the method used to find the relationship between two main constructs. Regression analysis can be used to describe the variance of the variables (Aaker et al., 2010). Different authors (Nolan & Heinzen, 2007; Aaker et al., 2010) explain that regression analysis is described by a range of -1 to 1. When the results of the regression shows a negative value of 1, it means that when an independent variable increases, the dependent variable decreases. In addition, when there is a result of 0, the relationship between the dependent and independent variables is nonexistent. Finally, when the regression shows a positive value of 1, it means that when an independent variable increases, the dependent variable also increases.

The calculation of correlations was a priority in the analysis because highly correlated constructs can create a problem. The correlations help with the verification and testing of items and constructs for reliability. I payed close attention to this analysis for multicollinearity issues on the model.

Validity

In this study, validity was an important factor for measurement and data collection. Validity helps to determine how good the collected data is by using the measures proposed and helps to ensure more accurate data collection. There are three kinds of validity: content, construct, and criterion. The three types and how they apply to this research is discussed next.

First, content validity is a tool used to help replicate a study's concept for better understanding. According to Bryman and Bell (2011), to ensure content validity, there should be a pretest to analyze the respondents and population to see whether the questions are fully understandable and will provide the data needed for the analysis. In this case, the measures have been validated by other researchers, but the content validity can be lowered when it is applied to food industry research. Since the questions were sent electronically, content validity can decrease because the questions will not be answered directly. To help improve the content validity in this research, a pretest on a smaller scale was made beforehand. Once the pretest concluded, a discussion with the respondent followed for better input.

Second, criterion validity is a tool that helps to predict relationships among constructs (Bryman & Bell, 2011). I used hypothesis testing to determine criterion validity (Nolan & Heinzen, 2007). Since the population and sample are limited to a certain area, validity was controlled to avoid any excess (Gibbert, Ruigrok, & Wicki, 2008).

Third, construct validity is a tool that helps to measure what is meant to be measured. Construct validity is a priority in the validity of any research (Carmines & Zeller, 1979). In many cases, construct validity can be affected by how the measures were developed and what words were used. Having this in mind, discriminant validity helped to measure construct validity. To test discriminant validity, I used the Pearson correlation statistical test, which helps to show that the measures test different things (Bryman & Bell, 2011; Saunders et al., 2009). For the Pearson correlation, the range is between 0 and 1; a value higher than 0.9 will be discarded due to a lack of discriminant validity (Bryman & Bell, 2011).

Reliability

Reliability is very important to a research study as it shows the repeatability of the data. Repeatability of research must exist to show the consistency of the results when the measures are tested at different times or in other studies. According to Bryman and Bell (2011), a study is reliable when the measures are constant and practical. It is said that when a study is highly reliable, it means that if the study is repeated by other researchers, the results will not change or vary (Bryman & Bell, 2011; Gibbert et al., 2008).

There are two methods for analyzing the reliability of the results. In this study, I used the analysis of Cronbach's alpha. Validity was satisfied since the measures are from other key studies in which the measures did not suffer any problems. I used Cronbach's alpha to determine the internal consistency in correlations among the different items. The use of Cronbach's alpha is a way to measure the relationships among the variables. According to Muijs (2004), this method shows how close the variables are in a scale of alpha coefficients of 0 to 1. To have acceptable reliability, Cronbach's alpha needs to be higher than 0.5 (Hair et al., 2006). The higher the Cronbach's alpha, the better the correlation among measures and results. If by any chance the study shows poor reliability, the measures need to be revised and modified.

CHAPTER V

RESULTS

In this research, the effect of new product development success on product innovation with the moderating effect of customer participation was examined. While the majority of literature focuses on new product success and metrics, the goal of this research was to explain how the product innovation process impacted new product development success. Invitations were sent to participants through an online survey using Qualtrics, and survey links were posted on professional media websites such as LinkedIn. The data was collected from the respondents who agreed to take and complete the survey. The respondents' data was analyzed for reliability and validity, and the research hypotheses were tested by using a regression analysis statistical method.

Descriptive Statistics in Demographics of the Sample

Table 2 presents the results of the descriptive statistics of the study, including the mean, standard deviation, and sample size. The total number of respondents was 116; each respondent had a completed survey. Five different constructs were analyzed. First, new product development success (NPDS) had a mean of 3.63 and a standard deviation of 0.76. In the product innovation process (PIP), the mean was 4.00, with a standard deviation of 0.64. In open innovation (OI), the mean was 4.10, with a

standard deviation of 0.55. For closed innovation (CI), the mean was 3.45, with a standard deviation of 0.64. For customer participation (CP), the mean was 3.78, with a standard deviation of 0.78.

Table 2. Descriptive Statistics/Correlation/Cronbach's Alpha

Variable	M	SD	1	2	3	4	5
1. New Product Development Success (NPDS)	3.63	0.76	*0.75*				
2. Product Innovation Process (PIP)	4.00	0.64	0.56	*0.73*			
3. Open Innovation (OI)	4.10	0.55	0.47	0.56	*0.76*		
4. Closed Innovation (CI)	3.45	0.64	0.38	0.38	0.25	*0.80*	
5. Customer Participation (CP)	3.78	0.78	0.43	0.50	0.48	0.39	*0.75*

Note: Internal consistency values are in italics on the diagonal.

There were different types of respondents and demographics in which number of years in NPD, number of years in the food industry, number of years working in the actual company, gender, firm size, and education level were recorded. Table 3 shows the different types of respondents and corresponding values.

Correlations

I conducted a correlation analysis to verify the discriminant validity of the different constructs used in the survey and to determine that the independent variable did not correlate too highly with other constructs that can measure the same idea. The correlations significant level was at 95% of significance ($p < 0.05$). The correlations coefficients should be between -1.0 to 1.0; zero means there is no correlation. According to Hemphill (2003), when the correlation coefficient has a range of 0.2 to 0.3, there is a low correlation; when the coefficient range is 0.3 to 0.5, there is a medium correlation; and when the coefficient is above 0.5, there is a high correlation. However, if the correlation is too high, the risk of the items measuring the same idea or question increases. A potential problem of multicollinearity may occur. Therefore, I did a correlation analysis among the five constructs to see if there

Table 3. Demographics

Characteristics	Number	%
Sample	116	100
Years in NPD		
1-5	42	
5-10		27
10-15	22	19
15-20	33	
20 or More	18	15
Years in Food Industry		
1-5	32	28
5-10	34	29
10-15	18	16
15-20	9	8
20 or More	23	18
Years Working at Company		
1-5	61	53
5-10	24	21
10-15	13	11
15-20	6	5
20 or More	12	10
Gender		
Male	90	78
Female	26	22
Firm Size		
Micro (1-6 Employees)	8	7
Small (< 250 Employees)	43	37
Medium (< 500 Employees)	22	19
Large (< 1,000 Employees)	11	9
Enterprise (1,001 or More)	32	28
School Level		
Less than High School	2	2
High School	4	3
Bachelor's Degree	54	47
Master’s Degree	47	41
Doctorate Degree	9	8

were any problems among them. Also, the purpose of this analysis was to find out if the moderator would create a problem of multicollinearity with a high correlation. Table 2 shows the correlation between the variables or constructs.

The correlation analysis shows that neither of the constructs is highly correlated. The highest correlated variables are NPDS and PIP, with a value of 0.56. The lowest values on the correlation are OI and CI, which had a value of 0.25. These two variables should have a

very low correlation. These results show that all variables are acceptable and within the minimum range of correlation acceptance, according to Hemphill (2003). As the analysis was made, the results showed that CP variable has a low correlation among the other variables.

Reliability and Validity

I performed a reliability test on the constructs to see whether the items used in the survey were measuring the concept and idea of the research. This study had many challenges, but one of the most critical was the complexity to measure the NPD success since there are many factors and variables that can help to determine success. According to Loch (2000), most companies do not use the same NPDS benchmarks, which can create difficulties. In this dissertation, a five-point Likert scale was used to measure NPDS. To measure the psychometric properties, I used the different Likert scale items and Cronbach's Alpha to analyze the reliability and consistency of the study. According to Bryman and Bell (2005), the results of the Cronbach Alpha should oscillate between 0.60 and 0.80 to be considered acceptable and reliable. A higher Cronbach Alpha will represent a high respondent consistency in the answers given in the survey. In this research, the Cronbach's Alpha was calculated using the JMP statistical program. The survey has at least four items per construct to be used to analyze reliability. Table 2 shows the reliability of the different constructs of the research. As shown, all Cronbach's Alpha values are above 0.6. After making the overall analysis, I found out that the model has a good and acceptable reliability. The constructs were used in prior research, which showed that they have acceptable reliability.

I decided to average the items of each construct since the sample size and other issues prevented a full SEM analysis. Instead, I used the approach of running different and multiple regression models with the constructs to determine the relationship among them. I did

multiple regression models in which the variables were modified and analyzed. Table 4 shows the mean and standard deviation of every item of the survey. This helps to better visualize each variable and understand the purposes of averaging the items.

Regression Analysis and Hypothesis Testing with Centered Variables

To help develop the analysis and determine the relationship between the independent and dependent variables, I performed multiple regressions using the JMP program. I analyzed the five different constructs from the model plus an interaction in which the moderator plays an important role. In this case, I centered the variables of each construct; therefore, the results are with this modification.

Multicollinearity

I tested for multicollinearity issues to see whether there is a problem with the model and variables. Multicollinearity happens in the regression analysis when the independent variables are highly correlated among them; if so, there is a large standard error in the estimate of the regression coefficients (Daoud, 2017). Table 2 shows the correlation analysis among variables, which indicates that the correlations are not large enough to provide a multicollinearity issue. However, I took a second approach to test multicollinearity of the model with the variance inflation factors (VIF) method, which is obtained in the regression analysis. According to Kutner, Nachtsheim, Neter, and Li (2005), the VIF method is used to determine the degree to which the regression coefficient is increased compared to the predictor variables. The method provides a maximum value of 10. If the value of VIF surpasses this number, there is a problem and an action measure should be applied. Table 5 shows that the VIF of every variable is under the maximum value. After analyzing the

Table 4. Survey Items Statistics

Survey Items	Mean	SD
New Product Development Success (NPDS)		
Frequency in Company to Determine NPDS		
Number of New Products	3.12	1.20
Difference Between the New Products and Total of Sales	3.20	1.27
Number of New Product Developments in the Making	3.12	1.15
Revenue	3.84	1.14
Sales Growth	4.03	1.04
Customer Satisfaction	4.11	0.98
Product Performance	3.91	1.07
Frequency in Company to Set Up Objectives		
Number of New Products	2.91	1.43
Difference Between the New Products and Total of Sales	3.16	1.36
Number of New Product Developments in the Making	3.09	1.26
Revenue	3.89	1.15
Sales Growth	4.05	1.10
Customer Satisfaction	4.01	1.15
Product Performance	3.91	1.17
Company Provide Incentives to Each NPDS Metric		
Number of New Products	2.95	1.39
Difference Between the New Products and Total of Sales	3.41	1.29
Number of New Product Developments in the Making	3.21	1.26
Revenue	3.91	1.14
Sales Growth	4.16	1.10
Customer Satisfaction	4.24	0.93
Product Performance	4.05	1.05
Product Innovation Process (PIP)		
All Significant Innovations Must Conform to Company Objectives.	3.84	0.98
All Affected Departments Participate in the Innovation Process.	3.78	1.11
Individual Employee Input is Important	3.99	0.97
Customer Input is Considered Important.	4.41	0.79
Business Partners Input is Considered Important.	4.02	0.85
Ability to Balance Risk-Taking with Cost/Benefit.	3.99	0.97
Clearly Define Measures to Monitor Progress.	4.00	1.06
Innovation Objectives and Progress are Clearly Communicated.	3.95	0.97
Open Innovation (OI)		
New Ways of Information such as Ideas, Technology, Market, etc. for the Improvement.	4.11	0.73
Searching for Information Outside of Your Company.	4.31	0.69
Properly Find the Use of External Sources.	4.07	0.74
External Knowledge and Information to Use with the R&D Group.	3.92	0.87
Closed Innovation (CI)		
Fully Depend on Your R&D Department.	3.30	1.15
Information and Knowledge for a New Product is Better Taken from Your Own Company.	3.40	1.01
Work with Any Other Information Type Besides Your R&D.	3.94	0.96
Company is the Best Source of Information in the Market.	3.16	1.08
Customer Participation (CP)		
Collect Information from Customers to the R&D Groups.	3.73	0.90
Share Information Collected from Customers with the R&D.	3.81	1.01
Provide Information to Comply with the Customer Needs and Wants	3.91	0.95
Key Customers Provide Information to Improve Process and New Products.	3.82	1.09
Include Customers in the Early Phases of the Development.	3.51	1.15
Take into Consideration the Customers' Opinion for Their Involvement.	3.93	0.98

values, the VIF method shows that there is no multicollinearity problem within the model and serious multicollinearity does not exist.

Table 5. Multicollinearity/VIF

Construct	VIF
Product Innovation Process	1.98
Open Innovation	1.58
Closed Innovation	1.24
Customer Participation	1.56
INT (CP*PIP)	1.33

The regression analysis was made using all of the constructs, including the interaction of the moderator. Table 6 shows the results of the regression analysis of the model.

Table 6. Regression Analysis of the Model (Centered Variables)

Construct	Estimate	Std. Error	T Ratio	Prob > |t|	Lower 95%	Upper 95%	Std. Beta
Product Innovation Process	0.44	0.12	3.57	0.00	0.20	0.69	0.37
Open Innovation	0.27	0.13	2.06	0.04	0.01	0.52	0.19
Closed Innovation	0.19	0.10	1.91	0.06	-0.01	0.38	0.16
Customer Participation	0.11	0.09	1.24	0.22	-0.07	0.29	0.12
INT (CP*PIP)	0.10	0.10	0.94	0.35	-0.11	0.30	0.08

The result from 116 survey respondents shows that the model is significant since the overall *p*-value is less than 0.0001. (The minimum requirement for significance is 0.005.) The root mean square error (RMSE) is 0.61 or 61%. The R^2 is 0.39, and the Adjusted R^2 is 0.36. Thus value could be interpreted as the variance of the dependent construct (PIP, OI, CI, CP, and CP*PIP) could be explained by the independent construct (NPDS). In this case, Adjusted R^2 is 36% of the explanation from one variable to the others and represents a moderate measure of uncertainty. In the overall regression model, all of the estimates on the parameters are positive. The confidence interval level varies across the constructs.

Hypothesis Testing Results (Centered Variables)

H1: Product innovation process is positively associated with the success of NPD.

To investigate the relationship between PIP and NPDS, I performed multiple regression analysis. The independent variable was NPDS, thus leaving the PIP as the dependent variable. Looking at the overall model in Table 6, we can determine that the model has a positive effect of 0.44, it is the most important relationship in the model with a standardized beta of 0.37, and is statistical significant ($p < 0.05$). The parameter estimate of the PIP means that if the PIP increases by 1 unit, the NPDS increases by 0.44. This means that the PIP has a positive influence on the NPDS, which indicates that the relationship is acceptable and significant. Therefore, the hypothesis is proven. The results also show that the confidence interval for the PIP is 0.20 – 0.69.

H2: Open product innovation is positively associated with new product development success.

The regression analysis to test this hypothesis is shown in Table 6. The model has a positive effect of 0.27, OI is the second most important construct in the relationship with a standardized beta of 0.19, and is statistical significant ($p = 0.04$). The parameter estimate of OI means that if OI increases by 1 unit, NPDS increases by 0.27. This means that OI has a positive influence on NPDS, which indicates that the relationship is acceptable and significant. Therefore the hypothesis is proven. The results also show that the confidence interval for OI is 0.01 – 0.52.

H3: Open product innovation is positively associated with the product innovation process.

In this hypothesis, I developed a regression analysis between the PIP, OI, and CI (see Table 7). The relationship between PIP and OI has a positive effect of 0.58, the standardized beta shows that OI is more important that CI when the PIP is analyzed, and

it is statistical significant ($p < 0.0001$). The R^2 value is 0.37, and the Adjusted R^2 value is 0.36; this means that 36% of the variance is explained in the model. Also, there is a positive effect between these two constructs. The parameter estimate means that if OI increases by 1 unit, PIP increases by 0.58. The results show that the confidence interval for OI is 0.40 – 0.76.

Table 7. Regression Analysis of CI and OI (Both Centered Variables)

Construct	Estimate	Std. Error	T Ratio	Prob > |t|	Lower 95%	Upper 95%	Std. Beta
Open Innovation	0.58	0.09	6.46	<.0001	0.40	0.76	0.50
Closed Innovation	0.25	0.08	3.26	0.00	0.10	0.41	0.25

H4: Closed product innovation is positively associated with new product development success.

To test this hypothesis, I used the overall regression analysis in which CI and NPDS can be seen in Table 6. The relationship between these two constructs have a positive effect of 0.19; however, it is not statistical significant ($p > 0.06$).

H5: Closed product innovation is positively associated with the product innovation process.

To test this hypothesis, I used regression analysis with two constructs, PIP and CI. Table 7 shows the result of the regression between these two constructs. The results show a positive effect of 0.25 in the relationship of these two constructs and is statistically significant ($p < 0.05$). This means that if CI increases by 1 unit, PIP increases by 0.25. The results show that the confidence interval for OI is 0.10 – 0.41.

H6: Customer participation has a moderation effect between the product innovation process and the success of NPD.

To test this hypothesis, I used the overall regression analysis of the model from Table 6. The moderation effect of CP has a positive moderation effect on the relationship of 0.10; however, the model is not statistically significant (p = 0.35). Therefore, the interaction between CP and PIP yields a nonsignificant effect. The results show that there is an effect in the model, but it is not significant. Furthermore, there should be a deeper analysis with the other constructs with different models.

Regression Analysis and Hypothesis Testing From the Original Model (Without Centered Variables)

As noted in the previous analysis, the moderation effect and interaction is not significant (H6 is not supported). Therefore I needed to take a step back and provide a regression analysis with the original model without centered variables. Table 8 shows the results of the regression analysis between NPDS on PIP, OI, and CI.

Table 8. Regression Analysis with the Original Model

Construct	Estimate	Std. Error	T Ratio	Prob > |t|	Lower 95%	Upper 95%	Std. Beta
Product Innovation Process	0.43	0.11	3.89	0.00	0.21	0.66	0.37
Open Innovation	0.31	0.12	2.49	0.01	0.06	0.56	0.22
Closed Innovation	0.22	0.10	2.26	0.03	0.03	0.41	0.18

The result from 116 survey respondents shows that the model is significant since the overall p-value is less than 0.0001. (The minimum requirement to be significant is 0.005.) The RMSE is 0.61 or 61%. The R^2 is 0.38, and the Adjusted R^2 is 0.36. In this case, Adjusted R^2 is 36% of the explanation from one variable to the others and represents a moderate measure of uncertainty. In this regression model, all of the estimates of the parameters are positive.

Hypothesis Testing Results (Without Centered Variables)

H1: Product innovation process is positively associated with the success of NPD.

After analyzing the regression of H1 with the centered variables, the new model shows that PIP has a positive effect on NPDS of 0.43, the PIP construct shows major importance in the model, and it is statistically significant ($p < 0.05$). The parameter estimate shows positively associated PIP with NPDS. In this case, the relationship between these two constructs with either analysis type is significant and is positively associated.

H2: Open product innovation is positively associated with new product development success.

I analyzed this hypothesis by the regression of the new model, which showed that OI is positively associated with NPDS with a positive effect value of 0.31. It is also statistically significant ($p = 0.01$). The parameter estimate value indicates that as OI increases by 1 unit, NPDS increases by 0.31 units. The parameter estimate shows the positive relationship between these two constructs as the same as the centered variable model.

H3: Open product innovation is positively associated with the product innovation process.

In this hypothesis, I made a regression model with only the PIP, OI, and CI constructs. The results show that the overall model is significant ($p < 0.05$). The R^2 is 0.37, and the Adjusted R^2 is 0.36. The RMSE has a value of 0.51. The regression analysis is shown in Table 9, which indicates that OI has a positive effect with PIP of 0.58 and it is statistically significant ($p < 0.05$). The parameter estimate means that for every unit in OI, NPDS increases by 0.58. This analysis confirmed the hypothesis of OI having a positive association with PIP.

Table 9. Regression Analysis Among PIP, CI, and OI

Construct	Estimate	Std. Error	T Ratio	Prob > |t|	Lower 95%	Upper 95%	Std. Beta
Open Innovation	0.58	0.09	6.46	< .0001	0.40	0.76	0.50
Closed Innovation	0.25	0.08	3.26	0.00	0.10	0.41	0.25

H4: Closed product innovation is positively associated with new product development success.

This hypothesis shows a difference between both models (centered and not centered). Table 8 shows that there is a positive association between CI and NPDS with a positive effect of 0.22 and the model is statistical significant ($p = 0.03$). Also, the parameter estimate indicates the association in which CI increases by 1 unit, NPDS increases by 0.22. If we compare both models, we see that there is a difference in being significant or not significant. For example, the previous model tried to prove this hypothesis, but the analysis yields a nonstatistical significance value, even though it had a positive effect on the model. The comparison is important between the models because it can be seen how a construct affects being significant or not.

H5: Closed product innovation is positively associated with the product innovation process.

The regression analysis is shown in Table 9. The CI has a positive effect of 0.25 on PIP; and the relationship between PIP and CI is statistical significant ($p = 0.00$), the same as the regression with the centered variables. Also, the parameter estimate means that for every unit that CI increases, PIP increases by 0.25.

CHAPTER VI

DISCUSSION AND IMPLICATIONS

Discussion

New product success is a very important and challenging subject to most companies. The high failure rate is a daily problem when new product development is in progress. For example, according to Evanschitzky et al. (2012), NPDS is below 25% worldwide. Many companies have deep knowledge and have been pioneers in developing new products; however, the high failure rate makes for an uncertain future. Companies search for competitive advantage in markets by constantly seeking ways to improve, increase, and redesign new product developments. The product innovation process and customer participation can provide a better outlook for better results.

In this research, the effect of the PIP on NPDS was examined to understand and analyze potential competitive advantages. A good set of success metrics is necessary for the evaluation and analysis of new product development. The moderating effect of customer participation was also examined within the two constructs. This study was designed to evaluate and analyze the independent and dependent variables with a moderation variable, in this case customer participation.

Several regression analyses showed the different outcomes within the constructs. In the regression analysis, I used the method of centering the variables because it provided more accurate results. By centering the variables, the analysis can show a better understanding and enhance the interpretation of the constructs and data points. However, when I performed a centered and non-centered regression analysis as shown in the model, a difference in the constructs such as CI variable. I chose to follow this method because full structural equation modeling provided untrustworthy results and analysis. For example, the centered regression analysis was made with all the variables of the model, and the results were positive. In the other case, the non-centered regression analysis was done with all of the variables except the interaction between PIP and CP. The interaction was not included because the analysis yielded a nonsignificant statistical result. However, the comparison was necessary to explain the significance, the effect the interaction variable produced in the model, and how the CI variable is statistical significant.

The overall results of this research show that the product innovation process is positively associated with NPD success in either model. The hypothesis was statistically validated as well as the effect on NPDS. The product innovation process was the most important construct in relation to NPDS. It showed that no matter what model I chose, the significance and effect was very important. In all of the regression model analyses, the PIP performance was the best construct. The PIP provided to NPDS the main element for increasing success and competitive advantage. The correlation and reliability were acceptable and of great importance.

My results show that the PIP affects NPDS. The effect on NPD is positive and provides higher knowledge of the development of new products. As companies search for higher

competitive advantage and success in NPD, they need to understand the different impacts on the NPD attributes. Companies can benefit from the PIP while having success in NPD, but managers need to understand that different types of innovation may contribute to a positive competitive advantage and success with new product developments.

Open innovation provided great knowledge in this research by being the second most important construct. OI provides a significant and positive association with PIP and NPDS. As a result, the hypothesis has been statistically validated and achieved. As the results yield, OI can be a great tool for the development of new products and help companies to increase their competitive advantage and success. OI also shows that companies that bring external knowledge and resources can help in the development of successful products. As shown in the analysis, OI can provide companies with better insight and more information about the path for success in NPD. Due to the OI process, a company should be able to acquire and explore knowledge to gain maximum competitive advantage.

On the other hand, CI played a different role among the models. First, CI had a positive effect on the model, but it was not statistically significant. In the second model, CI provided a different picture of being significant and with a positive effect. It is important to mention that when customer participation is in effect and is included in the model, CI does not affect NPDS. However, when CI is around PIP and OI, the significance level increases and provides a positive association and effect with NPDS. CI is important to companies depending on the context and the model placed. CI is a type of innovation on which companies rely for several reasons; it does not mean that it is the best option or that it can provide the best results.

In this research, customer participation played the role of a moderator factor between PIP and NPDS. However, after different model types, the effect of the moderator was not statistically significant. Since it was nonsignificant, any possible effect is not important. The results yield a much unexpected outcome with the customer participation construct. In the past, NPD and customer participation literature showed the importance of this relationship in different studies by explained many factors with positive results. However, this time, the role of customer participation was very different compare to other studies and what the literature shows. For example, when I started doing the several regression analyses, I noticed that CP was affecting the model by lowering and making the other constructs insignificant. CP was the variable affecting the model and the explanation of the results. After a deep investigation, CP showed no positive input and results within the model. The same happened when the interaction effect between PIP and CP was used. The interaction effect yielded a positive but statistically insignificant effect. This could be an area of opportunity and future research. Therefore, the hypothesis that included customer participation was not met and could not be statistically validated.

There could be many possible causes for the issue of customer participation not being a significant result. Customer participation might have developed a conflict in the moderator effect with PIP. This could be an interesting area for deeper research and investigation. For example, the items in the survey might have caused confusion for the participants, mainly when OI and CP are within the similar context. CP could produce a conflict within the respondent's interpretation and therefore the answers did not provide the intended outcomes. Different items need to be explored and developed to target the CP construct with more precision and accuracy.

Substantively, this research builds on the growing stream of new product development and product innovation process literature. While previous research shows that product innovation is an important outcome of new product development, this study explicated the different types of innovation processes on new product development success. Thus, this research extends the literature by showing that there is an extra benefit when the product innovation process meets new product development success.

Limitations of the Study and Future Research

The results found in this study need to be managed and interpreted considering the study's limitations. First, a possible limitation is the number of responses to the survey since it is focused on the food industry and NPD-related professionals. Thus the population and sample are in a specific target industry; the results could vary within other industries. The data was collected from two different associations, which limited the research. Therefore, it is possible to collect secondary information in other industry types to determine more data and whether there is a different effect on the NPD success and other values. This study was targeted to professionals; however, the questionnaires could be answered by companies instead of individuals. In future research, different industries and companies as a whole should be examined and analyzed.

The second limitation is the number of responses. Having a larger number of survey responses and more data points could change and improve the results. In this research, the collected responses were very useful for conducting my study; however, a higher response rate could provide greater benefits. The higher the response rates, the more creditability of the research. I had a sample limitation due to the low number of professional responses, which could be improved in future studies.

Third, another limitation of this research is the different new product development success metrics. In this study, the metrics used had a base of different studies; however, a huge variety of success metrics could be applied. In this research, the survey had seven different NPD success metrics. These could vary depending on the application and extent to which NPD is perceived. Many companies have their own success metrics. Future researchers should explore the notion of the financial aspects metrics affecting the success of NPD and product innovation.

Fourth, another limitation is the moderator factor and constructs of the study. For example, customer participation and product innovation process can be used to play different roles. Different moderators could have been used in this study and might have yielded different results. For example, customer participation could be used as a different variable type such as mediator or antecedent. My use of customer participation as a moderator had a limiting role.

Fifth, most of the population had at the most 10 years of experience, so the responses were from professionals who had some years of experience in the industry. Thus the sample population may not represent the full potential of respondents with fewer or more experience in NPD. A future study could be based on professionals who have more experience and greater knowledge and interest to complete the survey.

Sixth, the survey was made with a single source type, which means that the respondent types were very similar: engineers, scientists, food industry professionals, and R&D specialists. The results could change if the respondents were from other types, especially end consumers. End consumers could provide a different approach and knowledge in new

product development success. Therefore, an area of opportunity for future research could help to understand better the different constructs in the model and their results.

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APPENDICES

APPENDIX A: QUESTIONNAIRE

	Never	*Occasionally*	*Sometimes*	*Frequently*	*Always*
New Product Development Success (NPDS)					
How do your company describe new product development success?					
- Number of new products.	1	2	3	4	5
- Difference between the new product and total of sales.	1	2	3	4	5
- Number of new product development in the making.	1	2	3	4	5
- Revenue (monthly or annually).	1	2	3	4	5
- Sales growth (monthly or annually).	1	2	3	4	5
- Customer satisfaction.	1	2	3	4	5
- Product performance.	1	2	3	4	5
Do your company set up objectives according to the following metrics?					
- Number of new products.	1	2	3	4	5
- Difference between the new product and total sales.	1	2	3	4	5
- Number of new product development in the making.	1	2	3	4	5
- Revenue (monthly or annually).	1	2	3	4	5
- Sales growth (monthly or annually).	1	2	3	4	5
- Customer satisfaction.	1	2	3	4	5
- Product performance.	1	2	3	4	5
How important are these attributes for your company in the development of new products?					
- Number of new products.	1	2	3	4	5
- Difference between the new product and total of sales.	1	2	3	4	5
- Number of new product development in the making.	1	2	3	4	5
- Revenue (monthly or annually).	1	2	3	4	5
- Sales growth (monthly or annually).	1	2	3	4	5
- Customer satisfaction.	1	2	3	4	5
- Product performance.	1	2	3	4	5
Product Innovation Process (PIP)					
In the product innovation process, to what extent do you agree with each statement below:					
- All significant innovation must conform to company objectives.	1	2	3	4	5
- All affected departments participate in the innovation process.	1	2	3	4	5
- Individual employee input is important.	1	2	3	4	5

	Never	*Occasionally*	*Sometimes*	*Frequently*	*Always*
- Customer input is considered important.	1	2	3	4	5
- Business partners input is considered important.	1	2	3	4	5
- Ability to balance risk taking with cost/benefit.	1	2	3	4	5
- Clearly define measures to monitor progress.	1	2	3	4	5
- Innovation objectives and progress are clearly communicated.	1	2	3	4	5
Open Innovation (OI)					
In the new product development process:					
- Are you constantly looking for new ways of information such as ideas, technology, market, etc. for the improvement of your new product success.	1	2	3	4	5
- Are you constantly searching for information outside of your company such as with customer, suppliers, or competitors for the increase in success in your new product.	1	2	3	4	5
- Do you find properly the use of external sources (such as customers, suppliers, market, competitors, etc.) to help in the development of NPD.	1	2	3	4	5
- Do you provide external knowledge and information to be used with the R&D group in the company?	1	2	3	4	5
Closed Innovation (CI)					
In the new product development process:					
- Do you fully depend on your R&D department?	1	2	3	4	5
- Do you think that the information and knowledge for a new product is better taken from your own company than from other source.	1	2	3	4	5
- Do you work with any other information type besides your R&D department such as customers, suppliers or competitors	1	2	3	4	5
- Do you think that your company is the best source of information in the market for new product developments and for increasing the success of new products.	1	2	3	4	5

	Strongly Disagree	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
Customer Participation (CP)					
During the new product development, your company					
- Collect information from customers to the R&D groups to increase the success of the new product	1	2	3	4	5
- Share information collected from customers to the R&D department.	1	2	3	4	5
- Provide information to comply with the customer needs and wants of new product development.	1	2	3	4	5
- Key customers provide information to improve our process and new products.	1	2	3	4	5
- Include customers in the early phases of the development.	1	2	3	4	5
- Take into consideration the customers opinion for the involvement in the new product development process.	1	2	3	4	5
Respondent's Background					
- Number of years in NPD	1-5	5-10	10-15	15-20	20 or more
- Number of years working in the food industry	1-5	5-10	10-15	15-20	20 or more
- Number of years working for your recent company	1-5	5-10	10-15	15-20	20 or more
- Gender	Male	Female			
- Firm Size	Micro (1-6 employees)	Small (< 250 employees)	Medium (< 500 employees)	Large (< 1000 employees)	Enterprise (1,001 or more)
- Highest degree or level of school you have completed	Less than high school	High School	Bachelor's degree	Masters degree	Doctorate degree

APPENDIX B: CONSENT FORM

Information Participant Sheet

PARTICIPANT INFORMATION

Oklahoma State University

Title: Product Innovation Process and New Product Development Success.

Investigator: Alfredo Perez Salinas, Oklahoma State University.

Purpose: The purpose of this study is to understand the effect of the product innovation process in the development of new products successfully in the food industry.

Procedure: This survey will be administrated online. If you agree to participate, you will complete a series of questions related to your experience in the product innovation process and new product developments. You must have at least one year of experience in new product development (NPD) and participate in NPD in your company to be part of the study. All information will be anonymous. It should take less than 10 minutes to complete the survey.

Risks: There are no known risks associated with this project, which are greater than those ordinarily encountered in daily life.

Confidentiality: All the information gathered, including yours, in this study, will be anonymous. Once the data is collected and analyzed, all names and email addresses will be deleted permanently. Research records will be stored in a secure place, and only the researcher will have access to the records. The computer program will be used in the survey to collect data is Qualtrics™. The data will be destroyed two years after the research has been completed. The data will be reported for research purposes in a professional journal or professional meeting.

Compensation: At the end of the survey, there will be a link where you will have the opportunity to participate in a drawing to win one electronic tablet. Participants that do no complete the entire survey will not be able to register for the drawing. You do not

have to provide your contact information if you are not interested in the drawing. If the participant decides to enter the drawing, the contact information provided will not be used for any other purpose, and there will be no connection with the survey data.

Contacts: You may contact the researcher at any time at the following address and phone number, Dursun Delen, Ph.D., Department of Management Science and Information Systems, Spears School of Business, Oklahoma State University, Stillwater, OK, 74078, (918) 594-8283 or Alfredo Perez Salinas, Dept. of Management, Spears School of Business, Oklahoma State University, Stillwater, OK, 74078, alfredo.perez_salinas@okstate.edu. If you have questions about your rights as a research volunteer, you may contact the IRB Office at 223 Scott Hall, Stillwater, OK 74078, 405-744-3377 or irb@okstate.edu.

Participant Rights: Your participation in this study is voluntary, and you can discontinue the research activity at any time without penalty. You are free to withdraw at any time from this study.

In order to participate in this survey, you must click NEXT. If you do not agree, you will not be allowed to continue the survey. By clicking NEXT, you are telling that you agree to participate in the research freely and voluntarily, and you are at least 18 years of age.

APPENDIX C: PARTICIPANT EMAIL

Participation solicitation email to participants

Dear Professional,

My name is Alfredo Perez, and I am a Ph.D. candidate in Spears School of Business at Oklahoma State University. My area of research relates to product innovation and new product development success. I am conducting a study to gather data for my dissertation about the effects of the product innovation process in new product development. Because you have experience in this area, I am asking for your help in sharing your experience and knowledge for this research. The survey will take approximately 10 minutes of your time, and it will provide valuable and important data for the study. All of you answers will be anonymous. In return and if you want, I can share with you an executive summary of the results.

Once the survey is completed, you will have the opportunity to enter to win an electronic tablet. To participate, you will be redirected to a link to add your contact information. The contact information will be used to select the winner of the tablet. Your contact information will not be connected to the survey responses you provide as it will be a separate survey. If you have any question, please feel free to contact me at alfredo.perez_salinas@okstate.edu.

Thank you for your support

Kind regards

Alfredo Perez

VITA

Alfredo Felipe Perez Salinas

Candidate for the Degree of

Doctor of Philosophy

Dissertation: THE EFFECT OF THE PRODUCT INNOVATION PROCESS IN NEW PRODUCT DEVELOPMENT WITH THE MODERATION EFFECT OF CUSTOMER PARTICIPATION IN THE FOOD INDUSTRY

Major Field: Business Administration

Biographical:

Education:

Completed the requirements for the Doctor of Philosophy in Business Administration at Oklahoma State University, Stillwater, Oklahoma in December, 2019.

Completed the requirements for the Master of Science in Engineering Management at The University of Texas at Austin, Austin, Texas in 2013.

Completed the requirements for the Bachelor of Science in Manufacturing Engineering at The University of Texas – Pan American, Edinburg, Texas in 2007.

Experience:

Corporate Account Sales Manager, Azteca Milling LP, 2017-Present
Technical Sales/ Support National Manager, Azteca Milling LP, 2015-2017
Technical Sales/ Support Manager, Azteca Milling LP, 2010-2015
Technical Support Engineer, Azteca Milling LP, 2008-2010

Professional Memberships:

Member of the Institute of Food Technologist, 2017-Present
Member of Tortilla Industry Association, 2010-Present